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ABSTRACT

War and Peace: How Economic Prospects Drive Conflictuality

We experimentally study how economic prospects and power shifts affect the risk of conflict through a dynamic power rivalry game. Players decide whether to maintain the status quo or challenge a rival under declining, constant, or growing economic prospects. We find that conflict rates are highest when economic prospects decline and lowest when they improve. A behavioral model incorporating psychological costs and reciprocity can explain these differences. A survey on U.S.-China relations supports the real-world relevance of these findings. Inspired by the Thucydides's Trap, this study highlights how economic expectations shape conflict dynamics, offering key insights into geopolitical stability.

JEL Classification: C83, C91, D74, D91, F51

Keywords: conflict, economic prospects, Thucydides's Trap, power shift, experiment

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"When the hay rack runs out, the horses fight."

— French proverb

1 Introduction

Although peace and development are central themes of our time, various forms of conflict – between nations, ethnic groups, organizations, and individuals– remain pervasive. High-profile geopolitical tensions, such as the ongoing conflicts between Russia and Ukraine and in the Middle East, serve as stark reminders of the preciousness of peace. The shifting global landscape and power struggles among major nations are particularly concerning. Thucydides's Trap, a concept popularized by political scientist Graham T. Allison (Allison, 2015, 2017), draws from the ancient Greek historian Thucydides, who noted that the rise of a new power often led to conflict with an established one. The idea has gained significant attention in contemporary international relations, particularly in the context of the perceived rivalry between the United States and China.

Historical accounts underscore the recurring nature of power transitions leading to conflict. For example, the rise and fall of British naval mastery, as discussed by Kennedy (2017), and broader analyses of war and change in world politics by Gilpin (1981) illustrate the Thucydides Trap.[1] Allison (2015) refers to 16 historical cases over the past 500 years where a rising power challenged an established power, finding that 12 resulted in war. The two World Wars are also prominent historical cases. These historical perspectives highlight the potential for instability and conflict during significant power shifts.

This deterministic view has been challenged by scholars like Lee (2019) and Chan (2020) who argue that conflict is not inevitable and that other factors, particularly economic conditions, can influence the trajectory. This argument is further supported by analyses of historical power shifts, such as Britain's response to its relative decline (Friedberg, 2021) and the dynamics of power transitions in Asia (Shambaugh, 2005).[2] This opens the door to investigating whether economic

[1] Kennedy (2017) offers an in-depth historical analysis of British naval power from the 16th to the 20th century, providing detailed accounts where the rise or decline of British naval power corresponded with significant geopolitical shifts and subsequent conflicts. Gilpin (1981)'s work provides a theoretical foundation that aligns with the idea that the rise of a new power and the fear it instills in an established hegemony can result in war.

[2] Friedberg (2021) provides an in-depth look at how Britain managed its relative decline as a global power amid the rise of the United States and Germany. Although Friedberg does not

conditions can alter the course toward conflict or cooperation in power dynamics.

Economic conditions are undeniably crucial in determining international conflicts. World War II, for example, was significantly influenced by the Great Depression. Economic prospects also influence domestic politics and conflicts. Collier and Hoeffler (2004) suggest that economic conditions largely determine the opportunity for rebellion in civil conflicts, while Blattman and Miguel (2010) and Ray and Esteban (2017) identify lower income levels and weak economic growth as strong predictors of civil wars. Gartzke (2007) and Mitra and Ray (2014) highlight the role of economic development in reducing war and mitigating communal violence. The role of economic factors in power transitions is more complex. Gilpin (1981) and Kennedy (2017) argue that disparities in economic growth can disrupt the balance of power, potentially leading to instability and conflict.

Building on this, we explore how economic prospects affect the likelihood of cooperation and conflict between rising and established powers. We hypothesize that growth prospects encourage cooperative strategies, as both parties stand to benefit from mutual gains. Economic interdependence driven by positive economic prospects can foster stronger trade relations, investment, and collaboration in technology and infrastructure, creating a stabilizing effect where both powers have a vested interest in maintaining peace. Conversely, bleak economic prospects can intensify competition over limited resources. An established power may perceive the rising power's growth as a threat to its dominance, prompting preemptive actions. Similarly, a rising power facing economic difficulties may adopt aggressive strategies to secure resources and markets, escalating tensions.

Better understanding the interactions between the dynamics of power and economic trajectories provides valuable insights into the potential for cooperation or conflict on the global stage.[3] However, numerous confounding factors make it difficult to isolate the causal effect of economic prospects on the natural occurrence of conflicts. It is also impractical to create real conflict scenarios in the real world to test these hypotheses. Therefore, we used a laboratory experiment to simulate interactions between two entities undergoing a power shift under varying

explicitly use the notion of Thucydides Trap, his analysis offers insights into how established powers can navigate decline and avoid conflict with rising powers.

[3] A similar logic can also characterize competition among individuals, communities, and businesses. Positive economic prospects encourage collaboration, with shared prosperity fostering cooperation. For businesses, this can lead to partnerships, joint ventures, and joint investment in innovation. Conversely, poor or uncertain prospects intensify competition for limited resources, leading individuals to compete for scarce jobs, communities to struggle over funding, and businesses to engage in aggressive mergers or hostile takeovers.

economic prospects. While this experiment cannot capture the full complexity of international or commercial relations, it does allow us to study the causal relationship between economic prospects and conflict in a power-dynamic context under controlled conditions.

To achieve this, we designed a dynamic power rivalry game where two players in fixed pairs, A and B, simultaneously decide how to allocate a pie in each period by either choosing to "Maintain Status Quo" or "Challenge". If both maintain the status quo, the pie is shared equally. If one or both challenge, the pie size shrinks by a social loss coefficient, and the remaining pie is distributed according to the players' relative strength, which shifts over time. Player A represents the rising power, starting with low relative strength, which increases each period. Player B, the established power, starts with high relative strength, which declines over time. Across the 21 periods of the game, their strengths undergo a symmetrical reversal, with Player A starting at 0.2 and Player B at 0.8, each shifting by 0.03 per period. Players incur a cost when choosing to challenge.

We compared three economic prospect conditions across between-subjects treatments, independent from the players' actions: in the Constant treatment, the pie size remains constant across periods at 20,000 tokens; in the Decline treatment, the pie size starts at 30,000 tokens and decreases by 1,000 tokens per period; and in the Growth treatment, the pie starts at 10,000 tokens and increases by 1,000 tokens per period.

The Nash equilibrium of the game predicts that Player B will challenge in the first eight periods, while Player A will challenge in the last eight, with both players maintaining the status quo in the remaining periods. Notably, the different economic prospects do not alter this equilibrium. In contrast, our results show that the proportion of challenges from both players, as well as the overall conflict incidence rate, is highest in the Decline treatment and lowest in the Growth treatment. The differences between these treatments are significant across various metrics. Only the Growth treatment reaches a conflict rate significantly lower than the Nash equilibrium. Specifically, Player A (the rising power) challenges significantly more than the equilibrium in both the Decline and Constant treatments but challenges insignificantly less than the equilibrium in the Growth treatment. Player B (the established power) challenges less than the equilibrium in all treatments but only significantly so in the Growth treatment.

Further analyses of the behavior of different types of players with absolute

advantage, characterized notably as "money maximizers" who always challenge or "peace lovers" who never challenge, support the robust pattern that growth prospects reduce conflict. We also show that the initial action is crucial in determining subsequent behaviors. Though triggering a conflict is socially inefficient, growth prospects help enhance social welfare. Exploring the mechanisms driving the different impacts of decline and growth prospects, we reject potential explanations in terms of differences in wealth accumulation. A behavioral model with psychological costs for challenging and reciprocity helps rationalize why different economic prospects lead to divergent routes in terms of conflict and cooperation when relative powers shift. This model shows that an established power is less likely to challenge when expecting its rival's reciprocity. Given its expectations of the rival's psychological costs, an established power is less likely to initiate a challenge in the Growth treatment than in the other treatments.

To test the real-world relevance of the dynamics observed in our experiment, we conducted a preregistered online survey experiment in the United States with a representative sample of 813 individuals. After presenting each of two scenarios describing long-term global economic prospects –one optimistic and the other pessimistic –, respondents reported their beliefs about the probability that tensions between China and the United States would escalate into conflict over the next decade. In line with our laboratory experiment findings, respondents perceived a significantly higher likelihood of conflict in the slow-down scenario than in the growth scenario. Moreover, most respondents believed that major powers are most likely to engage in conflict when global economic prospects are declining and least likely under global economic prosperity and growth trends.

Our study contributes to the theoretical and experimental literature on conflict in the context of power shifts. Fearon (1995), Powell (1999, 2006, 2012), and Baliga and Sjöström (2020) discuss the strategic aspects of conflict with power asymmetries, emphasizing how shifts in relative power can lead to conflict despite both parties preferring peace. Similarly, Sieberg et al. (2013), Kimbrough et al. (2014), Herbst et al. (2017), and Schaller and Skaperdas (2020) explore how the balance of power influences conflict propensity. To our knowledge, only Tingley (2011), Abbink et al. (2023), and Comola et al. (2024) have conducted experimental studies on dynamic power shifts. Tingley (2011) examine a resource division game with infinitely repeated interactions and changing bargaining strength, while Abbink et al. (2023) provide a framework for understanding how perceived threats and power imbalances can provoke preemptive actions in a two-stage bargaining

game with power shifts. Comola et al. (2024) study how power shifts between competitors modify which nodes to target in a network to maximize influence. Our study extends this line of research by explicitly incorporating economic prospects through the mechanism of a growing or shrinking pie within a new game that captures symmetric power shifts in a finitely repeated context.

We also contribute to the empirical literature on the role of economic conditions in conflicts. Studies by Hegre and Sambanis (2006), Blattman and Miguel (2010), and Ray and Esteban (2017) on the causes of civil wars suggest that low-income levels and slow economic growth are robust predictors of civil war onset. Martin et al. (2008) and McGuirk and Burke (2020) illustrate how economic variables can either exacerbate tensions or promote peace, depending on the context.[4] The only experiment we are aware of that studied resource scarcity's effects on inter-group conflict is Safarzynska and Sylwestrzak (2021) but this study does not consider future prospects and power shifts as we do. While much empirical research has explored economic factors in civil conflicts, fewer studies have examined these dynamics in the context of power transitions. By incorporating dynamic economic prospects into our design, we explore how future economic conditions influence the pathways toward conflict or cooperation between rising and established powers.

Finally, our study contributes to the literature on expectations and cooperation. The maintenance of cooperation through history-dependent strategies like tit-for-tat is well-documented (Dal Bó and Fréchette, 2018). The concept of the "shadow of the future", introduced by Axelrod and Hamilton (1981), emphasizes how anticipated future interactions encourage cooperation. Kreps et al. (1982) suggest forward-looking agents can sustain cooperation even in finitely repeated prisoner's dilemma games. However, in conflict games, Tingley (2011) demonstrates that a longer shadow of the future can exacerbate commitment problems when bargaining strength shifts. Based on historical case studies, the theory of trade expectations of Copeland (2014) suggests that positive expectations of the future trade environment trigger motives for peace while negative expectations

[4]Some studies show that negative economic shocks increase conflict (Miguel et al., 2004; McGuirk and Burke, 2020), while others suggest that positive economic shocks (Angrist and Kugler, 2008; Nunn and Qian, 2014) can also increase tensions. Dube and Vargas (2013) and Bazzi and Blattman (2014) find that the effects of price shocks on conflict depend on specific contexts, and Becker and Pascali (2019) reveal how economic downturns intensified anti-Semitic sentiments in Germany over 600 years. Conversely, Martin et al. (2008) suggest that cooperation through trade deters conflict and Cao and Chen (2022) highlight how trade disruptions escalate tensions. Acemoglu et al. (2020) discuss how resource scarcity due to population growth can lead to conflict, while Berman et al. (2017) study how mineral abundance fuels conflicts in Africa.

promote motives for conflict. Though these studies did not examine conflict during dynamic power shifts as we do, they provide valuable insights into the importance of expectations on challenging behavior.

The remainder of this article is organized as follows. Section 2 outlines the theoretical framework. Section 3 details the experimental design and hypotheses. Section 4 reports the experimental results. Section 5 develops a behavioral extension of the model to rationalize the experimental findings. Section 6 reports the results of the supplementary survey experiment to support the real-world relevance of our laboratory findings. Section 7 briefly concludes.

2 Theoretical Framework

We model the dynamic interplay between a rising power and an established power as a dynamic power rivalry game, inspired by the conflict bargaining game developed by Baliga and Sjöström (2020). While our model greatly simplifies the baseline structure of their game, we extend it into a dynamic setting to better fit the context of power transition over time.

The game is played over T periods. In each period ($t = 1, \ldots, T$), two players, A and B, decide how to divide a pie of size R_t. By default, the pie is equally shared, with each player receiving $0.5R_t$.[5] Both players simultaneously choose between two actions: "Maintain Status Quo" or "Challenge". If both players choose "Maintain Status Quo", the pie is equally shared, each receiving $0.5R_t$. However, if either player chooses "Challenge", a conflict arises, reducing the pie's size to kR_t (where $0 < k < 1$), representing the social inefficiency of conflict.[6] The player initiating the challenge incurs an additional cost of cR_t (where $0 < c < 1$), reflecting the extra effort or resources required to engage in conflict.[7]

In the model of Baliga and Sjöström (2020) or similar games like in Abbink et al. (2023), which use a winner-takes-all approach where the probability of winning depends on relative strength, the players' risk attitudes may have an impact

[5] We chose equal sharing as a reference for peace because equality is considered a strong social norm in many settings, morally justified by the egalitarian fairness principle.

[6] In the real world, k could represent losses due to social, economic and operational inefficiencies that arise when a conflict occurs, such as losses in human capital or in trade, and destruction of infrastructure.

[7] The cost of initiating a conflict, c, represents a fixed proportion of the pie size to capture the idea that the economic and military resources engaged in a conflict depend on the size of the target or territory to conquer.

on their decisions. In contrast, we simplify the conflict outcome by assuming that relative strength determines the share each player receives, rather than the probability of winning outright. In reality, conflicts rarely result in one side claiming all the resources or territory; rather, the victor typically secures a larger share.[8]

Let $s_{A,t}$ and $s_{B,t}$ be the parameters that represent the relative strengths of Players A and B at period t, where $s_{A,t} + s_{B,t} = 1$. The payoff of Player i (where $i \in \{A, B\}$) in period t is given by:

- if both players maintain the status quo (M, M):

$$\pi_{i,t}(M, M) = 0.5R_t \tag{1}$$

- if one player (*e.g.*, Player A) challenges (C) and the other player (Player B) maintains (M):

$$\pi_{A,t}(C, M) = (s_{A,t}k - c)R_t \tag{2}$$

$$\pi_{B,t}(C, M) = s_{B,t}kR_t \tag{3}$$

- if both challenge (C, C):

$$\pi_{A,t}(C, C) = s_{A,t}kR_t - cR_t \tag{4}$$

$$\pi_{B,t}(C, C) = s_{B,t}kR_t - cR_t \tag{5}$$

Table 1 shows the payoff matrix for the game. According to this payoff structure, we derive the equilibrium condition for a single period, as shown in Table 2. This condition indicates that when one player holds a significant strength advantage over the other player, she will always choose to challenge, while the weaker player will choose to maintain the status quo. When the relative strengths of both players are more balanced, both tend to favor peace, preferring to maintain the status quo.

In the finitely repeated game, we assume that Player A starts with a relatively low strength, $s_{A,1} < 0.5$, while Player B starts with a relatively high strength,

[8] This adjustment aligns more closely with real-world scenarios, where a fighting power impacts the allocation of property rights, as discussed in Umbeck (1981) about the Californian gold rush. Several more recent studies incorporate similar considerations (Skaperdas, 1992; Konrad and Skaperdas, 1998; Grossman, 2002; Besley and Ghatak, 2010).

Table 1: Payoff matrix for the game

	Player A	Player B
Both maintain	$0.5R_t$	$0.5R_t$
Both challenge	$(s_{A,t}k - c)R_t$	$(s_{B,t}k - c)R_t$
Only A challenges	$(s_{A,t}k - c)R_t$	$s_{B,t}kR_t$
Only B challenges	$s_{A,t}kR_t$	$(s_{B,t}k - c)R_t$

$s_{B,1} > 0.5$. Over periods, Player A's relative strength increases at a constant rate β, while Player B's relative strength decreases by the same rate β, maintaining symmetry in the power shift for simplicity. The changes in relative strengths over time are given by:

$$s_{A,t} = s_{A,1} + \beta(t-1) \quad \text{and} \quad s_{B,t} = s_{B,1} - \beta(t-1)$$

for $t = 1, \ldots, T$. By the final period, $t = T$, the relative strengths will have completely reversed such that:

$$s_{A,T} = s_{B,1} \quad \text{and} \quad s_{B,T} = s_{A,1}$$[9]

Table 2: Characterization of the equilibrium of a single period

Condition	Equilibrium
$s_{A,t} > \frac{0.5+c}{k}$	A challenges, B maintains
$s_{A,t} = \frac{0.5+c}{k}$	A is indifferent, B maintains
$s_{A,t} > \frac{k-0.5-c}{k}$ and $s_{A,t} < \frac{0.5+c}{k}$	A maintains, B maintains
$s_{A,t} = \frac{k-0.5-c}{k}$	A maintains, B is indifferent
$s_{A,t} < \frac{k-0.5-c}{k}$	A maintains, B challenges

Under standard preferences and complete rationality, the Subgame Perfect Equilibrium of the dynamic game can be calculated using backward induction. This analysis reveals that the equilibrium outcome in each period mirrors the equilibrium condition of a single-period game. Both players should behave in each period based on their relative strengths at that time, with the stronger player tending to challenge and the weaker player preferring to maintain the status quo, following the same logic as in the single-period game.

[9] This requires that $\beta = \frac{1-2s_{A,1}}{T}$.

Define $t_L \equiv \frac{k-0.5-c-ks_{A,1}}{k(1-2s_{A,1})}T$ and $t_H \equiv \frac{0.5+c-ks_{A,1}}{k(1-2s_{A,1})}T$. The following proposition characterizes the equilibrium of this dynamic game.

Proposition 1. (*Equilibrium under standard preferences) The following strategy profile is the unique Subgame Perfect Equilibrium of the dynamic game: Regardless of the history, if* $t < t_L$*, Player A maintains and Player B challenges; if* $t_L < t < t_H$*, both players maintain; if* $t > t_H$*, Player A challenges and Player B maintains.*

Based on this proposition, t_L and t_H are two thresholds that determine the evolution of the game over time. First, notice that $t_L + t_H = T$, which is due to the time-symmetric feature of the game. Second, if the two players' initial relative strengths are close, such that $\frac{k-0.5-c}{k} < s_{A,1} < 0.5$, we have $t_L < 0$ and $t_H > T$, meaning that there is no period in which a player challenges. Third, if t_L and t_H are integers, at period t_L, Player B is indifferent between challenging and maintaining, and at period t_H, it is Player A who is indifferent.

3 Experimental Design and Hypotheses

3.1 Experimental Design

Baseline. To identify the causal impact of future economic prospects on the occurrence of conflicts, we further simplified the above model for our experimental setting. In the experiment, participants were randomly paired, with one designated as Player A and the other as Player B. These roles and pairings remained fixed for 21 periods. At the start of the first period, Player A had a relative strength of 0.2, while Player B's relative strength was 0.8. Player A's strength increased by 0.03 each period, while Player B's strength decreased by 0.03. In the last period, Player A had a relative strength of 0.8, while Player B's relative strength was 0.2.

At the beginning of each period, both players were informed of the pie size and their relative strength in the period. Then, they had to simultaneously and independently choose between "Maintain Status Quo" (in which case the pie was shared equally if the other player did not challenge either) and "Challenge". If at least one player chose to challenge, the pie size was reduced to 90% of its initial value of the period (*i.e.*, $k = 0.9$), and the challenger(s) incurred a cost equivalent to 1% of the pie size of the period (*i.e.*, $c = 0.01$). Then, this reduced pie was divided between the two players based on their relative strengths. Assuming Player

A's strength in a given period was $s_{A,t}$ and Player B's was $s_{B,t}$, A received a share $s_{A,t}$ of 90% of the pie, while B received a share $s_{B,t}$ of 90% of the pie, from which the challenger(s) had to deduct the challenging costs. After both players made their choices, they received feedback on the decisions and earnings of both for that period. Participants were paid the sum of their earnings across all periods.

Treatments. Three between-subject treatments varied how the size of the pie evolved over time, allowing us to explore how economic prospects influence challenge behavior and conflict rate. In the *Constant treatment*, the pie size remained fixed at 20,000 tokens at the start of each period. In the *Growth treatment*, the initial pie size was 10,000 tokens in the first period, increasing by 1,000 tokens per period. In the *Decline treatment*, the initial pie size was 30,000 tokens in the first period, decreasing by 1,000 tokens per period. This setup ensures that the total sum of initial pie sizes across all periods is the same across treatments – 420,000 tokens – with an average initial pie size of 20,000 tokens per period.

3.2 Procedures

The experiment, programmed in z-Tree (Fischbacher, 2007), was run in the computer laboratory of Shandong University, Jinan, China, in November and December 2023. A total of 296 undergraduate and graduate students were recruited from the local subject pool. 15 sessions were conducted (five per treatment), with 18-24 participants in each session.[10]

Upon arrival, participants were randomly assigned to a terminal and given a set of instructions (see sections A.1 and A.2 in Appendix A). An experimenter read the instructions aloud and answered questions privately. Participants had to complete control questions (see section A.3 in Appendix A) after reading the instructions, and the experiment did not proceed until all participants answered correctly. Participants then performed the dynamic power rivalry game. At the end of each session, socio-demographic characteristics were recorded (see section

[10]The SDU-CER-LAB Research Ethics Review Board approved the experimental design (#1016CER2023). We pre-registered the experiment on the AEA RCT Registry (#12539, Jiang et al. (2023)). As pre-registered, we aimed to collect 300 individual observations, with 100 observations per treatment. Indeed, pilot data suggested a medium effect size (Cohen's $d = 0.68$). To detect this effect size with 80% power and a Type-I error rate of $\alpha = 0.05$, a minimum of 24 pairs per treatment was required. Ultimately, we secured the collection of 100 individual observations per treatment, which allows us to detect a minimum effect size of 0.46 with 80% power and $\alpha = 0.05$.

A.4 in Appendix A). Most survey questions on preferences were adopted from Falk et al. (2023) and intended to measure trust, altruism, negative and positive reciprocity, and risk attitudes. We also elicited inequality aversion with a hypothetical questionnaire, following the procedure of Balafoutas et al. (2014). Table D2 in Appendix D presents the average characteristics of the participants in our three treatments and shows almost no significant differences across treatments.[11]

Each session lasted approximately 60 min. Transactions were conducted in tokens, which were converted to Yuan at a rate of 4,500 tokens per 1 Yuan. On average, participants earned 48.21 Yuan (Std. Dev. = 4.11, Max = 57.36, Min = 40.23), equivalent to about 11 US Dollars in purchasing power parity, which included a show-up fee of 5 Yuan. Earnings were paid privately via a third-party mobile or online payment platform by an assistant who was not aware of the experiment's content, as outlined in the instructions.

3.3 Hypotheses

The model's equilibrium predictions under standard selfish preferences depend on the parameters s_A, s_B, k, and c, and are independent of the pie size. Given the specific parameter settings in our experiment, it is rational for Player B to choose Challenge in the first eight periods and Maintain in the later periods, regardless of Player A's decisions.[12] Symmetrically, Player A is predicted to choose Challenge in the last eight periods and Maintain in the earlier periods, regardless of Player B's decisions. This predicts an 8/21 probability of challenge for both types of players, leading to a 16/21 overall incidence of conflict. Due to the challenging costs and the fact that conflict is a negative-sum game, the total social loss is predicted to be 8.38% of the total pie size.[13] This gives our first hypothesis:

Hypothesis 1. (*Standard preferences) In periods 1-8, Player A chooses Maintain while Player B chooses Challenge. In periods 9-13, both players choose Maintain.*

[11] We found a significant age difference between the Decline and Growth treatments using a two-sample Mann-Whitney rank-sum test ($p = 0.046$), while the t-test result was insignificant ($p = 0.142$). We also observed significant differences in trust and disadvantaged inequality aversion between the Decline and Control treatments. Regressions control for these variables.

[12] Player B's relative strength at period 8 is 0.59, which is larger than $(0.5 + c)/k = (0.5 + 0.01)/0.9$. However, by period 9, Player B's relative strength drops to 0.56, which is smaller than $(0.5 + 0.01)/0.9$. Thus, Player B should choose Challenge from period 1 to period 8 and Maintain from period 9 to period 21. This reasoning is symmetric for player A.

[13] $0.1 * 16/21 + 0.01 * 16/21 = 8.38\%$.

In periods 14-21, Player A chooses Challenge, and Player B chooses Maintain. This results in a 76.2% conflict rate across all periods and leads to an 8.38% social loss.

Since the equilibrium predictions are independent of the pie size and its changes, no differences in challenge behaviors or conflict incidence are expected across treatments. This leads to our second hypothesis:

Hypothesis 2. (*Standard preferences) There are no differences in the choices of Player A and Player B or in the total conflict rate across treatments.*

However, if preferences deviate from standard preferences, we may observe fewer challenges than Hypothesis 1 predicts. Since conflict leads to social inefficiency, the psychological costs associated with social losses could discourage challenging behavior, even when players are in an advantaged position. Furthermore, if the stronger player at the beginning of the game anticipates that the currently weaker player will reciprocate in the future based on his or her decision to challenge or maintain, we could observe treatment differences, contrary to Hypothesis 2. This could result from the lower relative gain for Player B to challenge in the Growth treatment when he or she is stronger than in the decline treatment. We therefore formulate the following conjecture:

Conjecture 1. (*Non-standard preferences). There are differences in the choices of Player A and Player B or in the total conflict rate across treatments.*

4 Results

We start by reporting aggregate descriptive statistics on players' challenge decisions and the incidence of conflicts within pairs across treatments. Next, we examine the evolution of challenge behavior over time. We then provide a regression analysis to identify the mechanism behind the decision to challenge. We conclude with an analysis of social efficiency.

4.1 Incidence of Challenges and Conflicts

We first compare our data with the equilibrium predictions. Table 3 reports the average challenge rate for both Players A and B across all periods, as well as the overall incidence of conflicts. If players follow the equilibrium strategy, they are expected to challenge in 38.1% (8/21) of the periods. We find that Player A challenged significantly more often than predicted in both the Decline treatment (43.8%; Wilcoxon signed-rank test based on average individual-level data, $p = 0.003$)[14] and the Constant treatment (39.4%; $p = 0.001$). In the Growth treatment, Player A's overall challenge rate is slightly below the equilibrium, with no significant difference (37.3%, $p = 0.563$). In contrast, Player B challenged less frequently than predicted in all treatments (35.5% in the Decline treatment, 31.5% in the Constant treatment, and 25.6% in the Growth treatment), though only in the Growth treatment was the rate significantly lower than expected ($p < 0.001$).

Table 3: Incidence of challenges and conflicts compared to the Nash equilibrium

	A challenges	*p*-value	B challenges	*p*-value	Conflict	p-value
	(1)	(2)	(3)	(4)	(5)	(6)
Decline treatment	43.8%	0.003***	35.5%	0.591	73.7%	0.191
	(0.183)		(0.159)		(0.247)	
Constant treatment	39.4%	0.001***	31.5%	0.401	67.8%	0.435
	(0.133)		(0.177)		(0.241)	
Growth treatment	37.3%	0.563	25.6%	< 0.001***	58.4%	0.012**
	(0.228)		(0.176)		(0.322)	
Decline vs. Constant		0.082*		0.290		0.050*
Decline vs. Growth		0.063*		0.005***		0.011**
Growth vs. Constant		0.484		0.105		0.333

Notes: Column (1) and Column (3) represent the average proportion of challenges for Player A and Player B over the 21 periods, with standard deviations in parentheses. Column (5) reports the average proportion of conflicts across the 21 periods, also with standard deviations in parentheses. Columns (2) and (4) present the *p*-value from two-tailed Wilcoxon signed-rank tests assessing the differences between the incidence of challenges for each player and the expected proportion of 8/21 (approximately 38.1%) corresponding to the Nash equilibrium. Finally, column (6) reports the *p*-value from Wilcoxon signed-rank tests comparing the incidence of conflicts within the pairs to the expected 16/21 (76.2%) in the Nash equilibrium. The bottom rows report *p*-values from two-tailed Mann-Whitney rank-sum test between treatments. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

As a result, the conflict rate is 73.7% in the Decline treatment, 67.8% in the Constant treatment, and 58.4% in the Growth treatment. While the incidence of conflicts is lower than predicted in all treatments, only the difference in the

[14] In this article, all non-parametric tests are two-tailed.

Growth treatment reaches statistical significance (58.4%, $p = 0.012$). This leads to our first result, which does not support Hypothesis 1:

Result 1. *Player A's overall challenge rate in both the Constant and Decline treatments is significantly higher than the equilibrium prediction, while Player B's challenge rate in the Growth treatment is significantly lower than the equilibrium prediction. The overall conflict rate is significantly lower than the equilibrium prediction in the Growth treatment.*

Next, we compare the data across treatments. Table 3 shows a consistent pattern: Player A's and Player B's challenge rates, and the overall incidence of conflicts are highest in the Decline treatment and lowest in the Growth treatment. Mann-Whitney rank-sum tests, based on average individual-level data, show that Player A's challenge rate in the Decline treatment (43.8%) is higher than in both the Constant treatment (39.4%; $p = 0.082$) and the Growth treatment (37.3%; $p = 0.063$), but not significantly so. Player B's challenge rate in the Decline treatment (35.5%) is significantly higher than in the Growth treatment (25.6%; $p = 0.005$). In the Constant treatment, this rate (31.5%) is intermediate between the two, with no significant differences from either. The overall conflict rate in the Decline treatment (73.7%) is significantly higher than in both the Constant (67.8%; $p = 0.050$) and the Growth treatment (58.4%; $p = 0.011$), while the difference between the Constant and Growth treatments is not significant ($p = 0.333$).

So far, we have not considered the relative strength of each player. Now, we focus exclusively on cases where players hold an absolute advantage, meaning that challenging is their rational choice. We define an absolute advantaged position as one in which a player's strength is strictly higher than that of the other player and the return of challenging exceeds its cost. At equilibrium, Player B should challenge in all of the first 8 periods, and Player A in all of the last 8 periods. Figure 1 illustrates that the actual challenge rates for both players are significantly lower than the equilibrium prediction of 100% across all three treatments. Player B's challenge rate during the first 8 periods is highest in the Decline treatment (77.9%) and lowest in the Growth treatment (55.0%), with a significant difference between them (Mann-Whitney rank-sum test, $p = 0.001$). In the Constant treatment, it is 67.8%, which is marginally higher than in the Growth treatment ($p = 0.058$). Player A's challenge rate during the last 8 periods is lowest in the

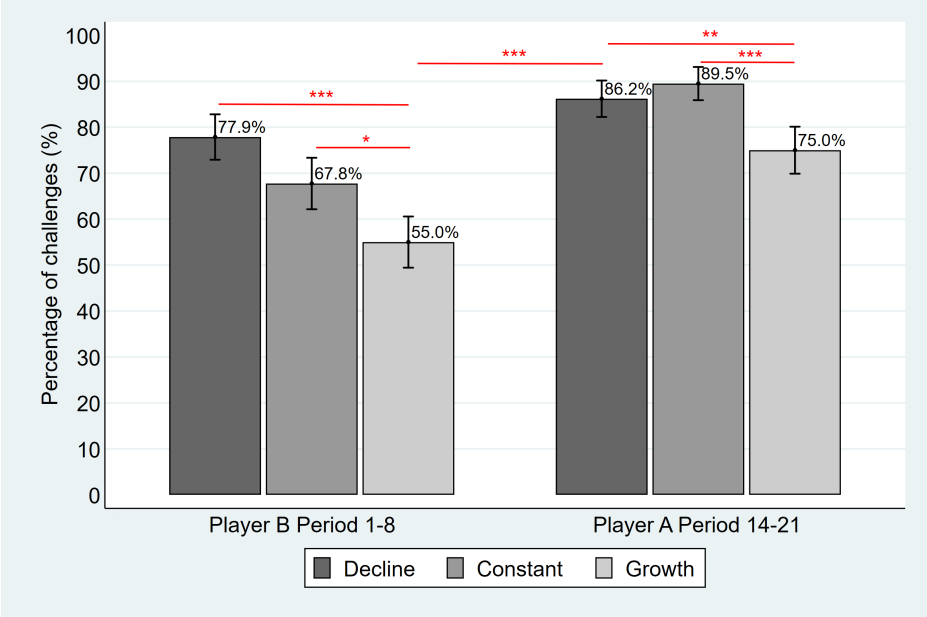

Figure 1: Challenge rates when players are in an absolute advantaged position, by treatment

Notes. The figure displays the challenge rates when players are in an absolute advantaged position (periods 1-8 for Player B and 14-21 for Player A). Error bars represent one standard error. Asterisks indicate significant differences across treatments based on two-tailed Mann-Whitney rank-sum tests. *** p<0.01, ** p<0.05, * p<0.1.

Growth treatment (75.0%), significantly lower than both the Constant treatment (89.5%; $p = 0.007$) and the Decline treatment (86.2%; $p = 0.049$). The difference between the Constant and Decline treatments is not significant ($p = 0.440$).

We then compare the behavior of the two players when they face a similar pie size and possess similar strengths, but experience different trends in the pie size evolution. We start by comparing Player B's behavior in the first 8 periods of the Growth treatment with the behavior of Player A in the last 8 periods of the Decline treatment, that is when players' relative strength is high and the pie size smaller but only Player B faces growing prospects about the pie size and a longer time horizon. In these conditions, Player B challenges significantly less frequently than Player A (55.0% *vs.* 86.2%; $p < 0.001$). We further compare Player B's behavior in the first 8 periods of the Decline treatment with the behavior of Player A in the last 8 periods of the Growth treatment, that is when players' relative strength is high and the pie size larger but only Player B faces declining prospects and a longer time horizon. This time, Player B challenges more frequently than Player A, although not significantly so (77.9% *vs.* 75.0%; $p = 0.669$). This further suggests

Table 4: Shares of maximizers and peace lovers, by treatment

	Maximizers All (1)	Maximizers A (2)	Maximizers B (3)	Peace lovers All (4)	Peace lovers A (5)	Peace lovers B (6)
Decline treatment	61.5%	68.8%	54.2%	8.3%	4.2%	12.5%
	(0.489)	(0.468)	(0.504)	(0.279)	(0.202)	(0.334)
Constant treatment	59.0%	76.0%	42.0%	13.0%	6.0%	20.0%
	(0.494)	(0.431)	(0.499)	(0.338)	(0.240)	(0.404)
Growth treatment	37.0%	50.0%	24.0%	20.0%	14.0%	26.0%
	(0.485)	(0.505)	(0.431)	(0.402)	(0.351)	(0.443)
Decline *vs.* Constant	0.725	0.422	0.228	0.291	0.680	0.315
Decline *vs.* Growth	< 0.001***	0.059*	0.002***	0.020**	0.092*	0.091*
Growth *vs.* Constant	0.002***	0.007***	0.056*	0.182	0.182	0.476

Notes: In column (1), the share of Maximizers is the percentage of Players B who were always challenging in the first 8 periods and Players A who were always challenging in the last 8 periods. In column (4), the share of Peace lovers is the percentage of participants who never challenged when in an advantaged position. Columns (2) and (5) only consider Players A in the last 8 periods and columns (3) and (6) only Players B in the first 8 periods. Rows (4)-(6) report the p-values from pairwise proportion tests between treatments. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

that positive prospects lead to more cooperative behavior than negative prospects.

To further explore the role of prospects, we examine the behavior of distinct player categories. We define a player as a "Maximizer" if he or she always challenges when in an absolute advantaged position, resulting in a 100% challenge rate for Player B in the first 8 periods and Player A in the last 8 periods. Conversely, we define a player as a "Peace lover" if he or she never challenges in an absolute advantaged position, leading to a 0% challenge rate for Player B in the first 8 periods and Player A in the last 8 periods. Table 4 shows the shares of these categories of players, overall and for Players A and B separately, in each treatment.

Table 4 indicates that only 37.0% of players can be classified as Maximizers in the Growth treatment, which is significantly lower than in both the Constant (59.0%; proportion test, $p = 0.002$) and Decline treatments (61.5%; $p < 0.001$). The difference in the share of Maximizers between the Constant and the Decline treatments is not significant ($p = 0.725$). Considering Player A and Player B separately shows a similar pattern, with lower percentages of Maximizers in the Growth treatment than in the two others, with highly significant differences when comparing the Growth treatment with the Constant treatment for Player A and with the Decline treatment for Player B.

Conversely, the percentage of Peace lovers is the highest in the Growth treatment (20.0%) and the lowest in the Decline treatment (8.3%), with significant differences between the two treatments (proportion test, $p = 0.020$). The percentage of Peace lovers in the Constant treatment (13.0%) is intermediate between the other two treatments, with no significant differences from either.

This analysis provides consistent evidence of significant variations in challenge behavior across treatments, particularly reflected in the lower challenge rate in the Growth treatment. This analysis rejects Hypothesis 2 and supports Conjecture 1. It is summarized in our second result:

Result 2. *The challenge rates of both Player A and Player B, as well as the overall incidence of conflicts, are highest under Decline prospects and lowest under Growth prospects. The Growth treatment stands out from the other conditions, with fewer Maximizers and more Peace lovers.*

4.2 Evolution of Challenging Behavior Over Time

Figure 2 displays the evolution of the average proportion of challengers over time for Player A and Player B, separated by treatment. It reveals two interesting patterns.

First, treatment differences in the challenge rate emerge from the very beginning, especially for the strongest player. In period 1, Player B's challenge rate is 83.3% in the Decline treatment, which is lower than the equilibrium prediction but significantly higher than in both the Constant (66.0%; proportion test, $p = 0.049$) and Growth treatments (56.0%; $p = 0.003$). There is no significant difference between the Growth and Constant treatments ($p = 0.305$). Thus, a stronger player with negative perspectives about the pie size tends to immediately challenge more than when this player faces positive prospects. There is also some evidence that a weaker player with positive perspectives (both in terms of relative strength and pie size) tends to challenge more than predicted: the challenge rate of Player A in period 1 is 14.0% in the Growth treatment (Wilcoxon signed-rank test, $p = 0.016$), while it is not significantly different from 0 in the Constant (4.0%; $p = 0.500$) and Decline treatments (6.3%; $p = 0.250$). However, Figure 2 shows that the treatment differences for Player A are small and do not persist.

Second, as the game progresses, Figure 2 shows that there is a consistently lower proportion of challengers in the Growth treatment compared to the other

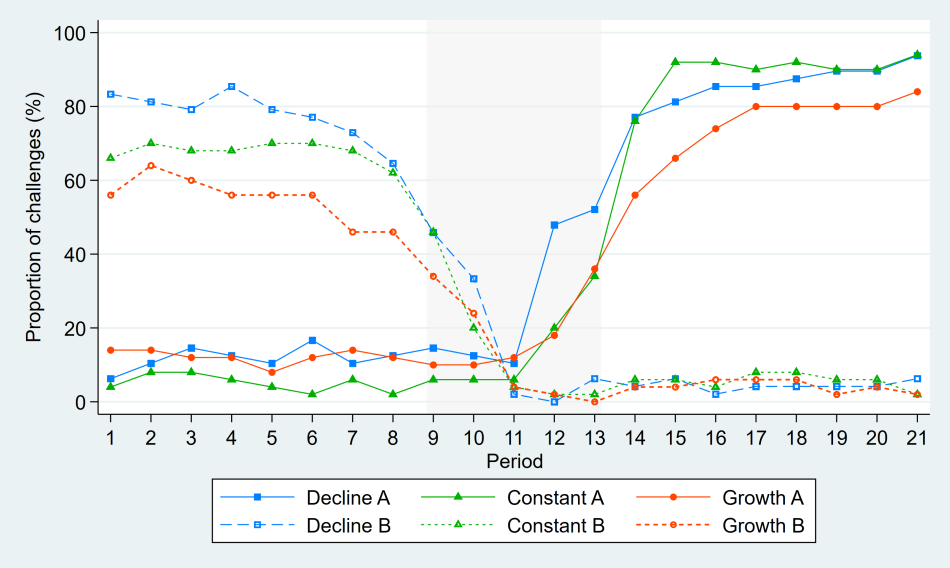

Figure 2: Evolution of challenging behavior over time

Note: The Y-axis represents the average proportion of challenges by Player A (solid lines) and Player B (dashed lines), separated by treatment. The gray area represents the periods in which the equilibrium is for both players to preserve the status quo because none has an absolute advantaged position.

treatments when players are in an advantaged position, whether playing as Player A or Player B. In the last period, there is still a ten percentage point difference in Player A's challenge rate in the Growth treatment (84.0%) compared to both the Constant (94.0%) and the Decline treatments (93.8%), but the difference fails statistical significance (proportion tests, p=0.110 and 0.126, respectively).

Finally, in dynamic games, initial behavior can be crucial in determining the direction of subsequent actions. In total, of the 70.9% of pairs that experienced conflict in period 1, the average conflict rate over the subsequent 20 periods was 78.0%, significantly higher than the 37.7% average conflict rate of pairs that experienced peace in period 1 (rank-sum test, $p < 0.001$). This is true for the three treatments, as shown in Figure C1 in Appendix C. Moreover, regardless of the treatment, when Player B chose to challenge in period 1, this player was more likely to challenge in most of the subsequent periods where he or she kept an absolute advantaged position. The opposite occurred when Player B abstained from challenging in period 1, as shown in Figure C2 in Appendix C.

4.3 Regressions Analysis

Two concomitant factors could explain Player A's fewer challenge decisions when in an absolute advantaged position in the Growth treatment compared to the other treatments: Player B's relatively lower challenge rate in the first part of the game when Player B had higher strength than Player A, and the positive prospects experienced by the pairs in this treatment. We turn to a regression analysis to better understand the mechanism underlying challenge behavior.

To explain the individual decision to challenge or not in a period, we estimated a random-effects probit model with robust standard errors clustered at the individual level for each role. Table 5 reports the marginal effects from these regressions. The model was estimated separately for period 1 (columns (1) for Player A and (2) for Player B), periods 2-21 (columns (3) for Player A and (4) for Player B), and periods where the player holds an absolute advantaged position within the pair (columns (5) for Player B in periods 2-8 and (6) for Player A in periods 14-21). The independent variables include a dummy variable for each treatment (with the Decline treatment as the reference category), a variable capturing the player's relative strength in the period,[15] and, except in the first two columns, a dummy variable indicating whether the paired partner challenged in the previous period ("Partner_challenge$_{t-1}$"). We further added socio-demographic variables that control for gender, preparing a major in economics, and age.[16] The row at the very bottom of the table reports tests for pairwise comparisons of the marginal effects of the Growth and Constant treatments on the decision to challenge.

Although the theoretical model with standard preferences predicts that there should not be any treatment differences, Table 5 shows that Player B is significantly less likely to challenge in the Growth treatment compared to the Decline treatment, in period 1 (column (2)), periods 2-21 (column (4)), and when considering the sole periods where the player holds an absolute advantaged position (column (5)). Player A is also significantly less likely to challenge in the Growth treatment in periods 14-21 when this player has become the strongest in the pair (column (6)). There is no treatment difference in Player A's behavior in period 1 across treatments. Comparing the Constant and Decline treatments reveals only

[15] This variable is omitted in period 1 because there is no power variation. Since relative power is correlated with the time trend, we omitted a period variable from the analysis.

[16] Table D3 in Appendix D reports similar regressions with controls for trust, altruism, positive and negative reciprocity, willingness to pay to reduce inequality, and risk preference. Given the possible contamination of the measures of preferences elicited at the end of the experiment by behavior in the game, the regressions reported in Table 5 remain our preferred specifications.

Table 5: Determinants of the challenge decision

Dep. var.: Decision to challenge	Player A Period 1 (1)	Player B Period 1 (2)	Player A Periods 2-21 (3)	Player B Periods 2-21 (4)	Player B Periods 2-8 (5)	Player A Periods 14-21 (6)
Decline treatment	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Constant treatment	-0.037	-0.194**	-0.042	-0.042	-0.112	0.026
	(0.057)	(0.094)	(0.035)	(0.035)	(0.074)	(0.033)
Growth treatment	0.071	-0.276***	-0.077*	-0.093**	-0.224***	-0.113**
	(0.051)	(0.086)	(0.045)	(0.037)	(0.068)	(0.047)
Relative strength	-	-	1.428***	1.319***	0.664***	0.747***
			(0.065)	(0.082)	(0.207)	(0.173)
Partner_challenge$_{t-1}$	-	-	-0.054**	0.014	-0.010	-0.036
			(0.027)	(0.028)	(0.037)	(0.033)
Male	0.001	-0.029	-0.012	-0.091**	-0.115*	0.025
	(0.045)	(0.080)	(0.035)	(0.035)	(0.068)	(0.031)
Major: Economics	0.005	0.151*	-0.011	0.017	0.112*	0.042
	(0.044)	(0.085)	(0.033)	(0.031)	(0.064)	(0.031)
Age	0.016*	-0.016	0.001	0.003	0.002	-0.008
	(0.008)	(0.014)	(0.008)	(0.006)	(0.012)	(0.008)
Observations	148	148	2,960	2,960	1,036	1,184
Wald Chi2	13.525	10.566	172.529	116.691	21.960	33.969
Growth *vs.* Constant treatments	0.108**	-0.082	-0.035	-0.051	-0.111	-0.139***
	(0.055)	(0.084)	(0.042)	(0.038)	(0.074)	(0.048)

Notes: Columns (1) and (2) report the average marginal effects from probit regressions with robust standard errors in parentheses. Other columns report the average marginal effects from random-effects probit regressions with robust standard errors clustered at the individual level in parentheses. The dependent variable is the participant's binary choice of "Challenge" in a given period. The row at the very bottom of the table reports the tests for pairwise comparisons of the marginal effects of the Growth and Constant treatments. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

a lower challenge likelihood by Player B in period 1 in the former treatment. The difference between the Constant and Growth treatments reaches significance only for Player A in period 1 (column (1)) and when this player holds an absolute advantaged position (column (6)), as was already visible in Figure 1.

Unsurprisingly, the likelihood of a challenge is highly positively correlated with the participant's relative strength within the pair in all regressions. In contrast, the effect of the partner's behavior in the previous period is not significantly different from zero in most regressions (except for Player A in column (3) but not in column (6)), which is not surprising since players have no monetary incentive to challenge in the same block of periods as their opponent.

We further investigate the factors influencing individual challenge rates across

various blocks of periods. Table 6 reports OLS regressions on the fraction of periods in which the participant challenged. These results are shown first for the entire sample (column (1)), and then separately for Player A (column (2)) and Player B (column (3)) across all periods. Following this, the analysis focuses on periods where the player holds an absolute advantage (columns (4) to (7)). Specifically, column (4) considers only Player B, and column (5) only Player A. Columns (6) and (7) add a control for whether Player B challenged in period 1, and its interactions with each treatment, respectively. Indeed, as illustrated in Figure C2 in Appendix C, Player B's decision in period 1 shows a strong correlation with his or her behavior in subsequent periods (2-8). In this table, we concentrate on Player A, whose lower likelihood of challenging in the Growth treatment when in an absolute advantaged position may stem from the larger pie size or from a reciprocal response to Player B's initial reluctance to challenge. For the regression on the entire sample, robust standard errors are clustered at the pair level.[17]

The regressions in columns (1), (3), (4), and (5) of Table 6 provide robust evidence that participants (especially Player B, before A has gained an absolute advantaged position) demonstrate a significantly lower challenge rate when facing Growth *vs.* Decline prospects.

Column (1) further confirms that Player B's overall challenge rate is significantly lower than that of Player A. The lower challenge rate observed for Player B in periods 1-8 in the Growth compared to the Decline treatment cannot be attributed to reciprocity, as Player A rarely issues challenges early in the game. Instead, this pattern appears to stem from the economic prospects on the pie's growth and anticipations regarding Player A's future behavior when this player becomes the stronger player in the pair. Such economic prospects and anticipations diminish Player B's inclination to challenge when currently in a stronger position, shaping in turn Player A's behavior once this player assumes the position of strength. The results in columns (5) and (6) show that Player A's challenge rate when holding an absolute advantage is influenced only by Player B's behavior in the first period, an effect that is similar across treatments. In summary, the lower challenge rate in the Growth treatment compared to the Decline treatment primarily arises from Player B's reduced likelihood of challenging in period 1. This is presented in Result 3:

[17] Table D4 in Appendix D also provides a robustness test with controls for trust, altruism, positive and negative reciprocity, willingness to pay to reduce inequality, and risk preference.

Table 6: Determinants of the individual challenge rate

Dep. var.: Challenge rate	All players Periods 1-21 (1)	A Periods 1-21 (2)	B Periods 1-21 (3)	B Periods 1-8 (4)	A Periods 14-21 (5)	A Periods 14-21 (6)	A Periods 14-21 (7)
Decline treatment	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Constant treatment	-0.041	-0.042	-0.046	-0.109	0.026	0.084*	0.206
	(0.028)	(0.033)	(0.034)	(0.077)	(0.055)	(0.047)	(0.169)
Growth treatment	-0.080**	-0.063	-0.100***	-0.229***	-0.123*	-0.028	0.036
	(0.034)	(0.043)	(0.034)	(0.075)	(0.066)	(0.057)	(0.168)
Player B	-0.097***	-	-	-	-	-	-
	(0.016)						
B1	-	-	-	-	-	0.335***	0.424***
						(0.060)	(0.145)
Constant*B1	-	-	-	-	-	-	-0.162
							(0.171)
Growth*B1	-	-	-	-	-	-	-0.069
							(0.173)
Male	-0.040*	-0.009	-0.074**	-0.090	0.002	0.002	0.005
	(0.021)	(0.032)	(0.031)	(0.072)	(0.052)	(0.042)	(0.041)
Major: Economics	0.001	-0.012	0.016	0.099	0.037	0.074	0.081*
	(0.021)	(0.031)	(0.030)	(0.069)	(0.051)	(0.045)	(0.044)
Age	0.003	0.003	0.003	-0.002	-0.017	-0.011	-0.009
	(0.005)	(0.008)	(0.005)	(0.012)	(0.013)	(0.010)	(0.010)
Constant	0.399***	0.389**	0.309***	0.819***	1.197***	0.779***	0.672**
	(0.100)	(0.161)	(0.115)	(0.268)	(0.268)	(0.215)	(0.266)
Observations	296	148	148	148	148	148	148
R^2	0.107	0.024	0.097	0.083	0.063	0.305	0.313
Growth *vs.* Constant	-0.039	-0.021	-0.053	-0.120	-0.149**	-0.112**	-0.170
treatments	(0.031)	(0.039)	(0.035)	(0.079)	(0.064)	(0.056)	(0.125)

Notes: The table reports the coefficients from OLS regressions with robust standard errors in parentheses, except Column (1) where robust standard errors are clustered at the pair level. The dependent variable is the individual challenge rate across periods. "B1" indicates whether Player B challenged in period 1. The row at the very bottom of the table reports the tests for pairwise comparisons of the differences between the Growth and Constant treatments. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Result 3. *In the Growth treatment, the first player with an absolute advantage challenges less than in the Decline treatment, anticipating reciprocal behavior from the rival when the latter holds the greatest strength over a larger pie.*

4.4 Social Efficiency

Conflicts impose costs on the challenger and diminish the pie size, ultimately decreasing social efficiency. Although the optimum would be to abstain from challenging in any period, individual players may be tempted to exploit their strength advantage to claim more than half of the pie. However, they may also anticipate that if they challenge when they initially have the higher strength, their rival will likely reciprocate once they hold an absolute advantage. This dynamic game represents an intertemporal social dilemma. Equilibrium predictions based on self-interested behavior anticipate a social loss of 8.38% of the pie. Given that the previous section highlighted differences in challenging behavior across treatments that deviate from the predictions, it is important to assess the extent to which actual social efficiency diverges from the predicted outcome. Figure C4 in Appendix C displays the average proportion of social loss by treatment.

The highest social loss occurs in the Decline treatment (8.06%), where the difference from the equilibrium prediction is not statistically significant (Wilcoxon signed-rank test, $p = 0.355$).[18] The Growth treatment shows the lowest total social loss (6.68%), significantly differing from both the equilibrium prediction ($p = 0.023$) and the Decline treatment (Mann-Whitney rank-sum test, $p = 0.023$). In the Constant treatment, the total social loss falls between the two (7.49%) and is not significantly different from the equilibrium prediction ($p = 0.430$) or the Growth treatment ($p = 519$) and the Decline treatment ($p = 0.067$). This analysis supports our final result:

Result 4. *The lower conflict propensity driven by positive economic prospects limits the social efficiency loss in the Growth treatment compared to the Decline treatment.*

5 A Behavioral Extension of the Model

The analysis of behavior in our dynamic power rivalry game revealed that participants challenged more frequently when facing negative prospects and less when facing positive prospects - an outcome that diverges from the theoretical model introduced in section 2, which assumed standard preferences, but aligns with our Conjecture 1. We begin by ruling out potential explanations for these deviations.

[18] These non-parametric tests are conducted with one observation per pair of players.

First, we reject a pie size effect. In the Decline treatment, players start with a larger pie size than in the other treatments, allowing Player B to potentially earn more by challenging in periods 1-8 than in the other treatments. This might explain the higher challenge rate in the Decline treatment during the first eight periods. However, if this were the main driver of our findings, we would expect Player A to challenge more in the Growth treatment than in the Decline treatment during the last eight periods when the stakes are larger. This is not what we observe in the data, allowing us to confidently reject this interpretation.

We also rule out a wealth effect. Since participants were paid based on their accumulated earnings across all periods, Player B in the Decline treatment could have accumulated more by the end of period 8, potentially enabling more frequent challenges in later periods compared to the Growth treatment, where earnings were lower at the same point in the game. However, if a wealth effect were driving our findings, we would expect Player B to challenge more in later periods than Player A in earlier periods across all treatments, given comparable relative strength. We observe the opposite trend. Moreover, we found significant treatment differences from the very first period, when no wealth differences existed yet.

In an exploratory analysis, we propose an alternative mechanism that accounts for behavioral factors, such as the psychological costs of challenging and reciprocity between players. We extend the model introduced in Section 2 to reconcile it with our data. Specifically, we introduce a framework where players may reciprocate non-challenging behavior from their rival and incur psychological costs when initiating a challenge if their rival has not challenged them previously. The underlying idea is that when the player with higher strength at the onset of the game refrains from challenging, it increases the psychological cost for the other player to initiate conflict later, even when the balance of strength shifts in their favor.

For simplicity, we assume Player A incurs a psychological cost for challenging only if Player B has never challenged before. We also account for Player B's belief about Player A's psychological cost and how it affects Player B's decision to challenge in the dynamic game with various fluctuating pie sizes. We assume that the psychological cost for Player A to challenge at period t, $\delta_{A,t}$, depends on whether Player B has challenged in the past:

$$\delta_{A,t} = \delta \left(1 - \min \left\{ 1, \sum_{\tau=1}^{t-1} \text{Challenge}_{B,\tau} \right\} \right), where \delta \geqslant 0.^{19} \tag{6}$$

[19] $\delta_t = \delta$ if $\sum_{\tau=1}^{t-1} \text{Challenge}_{B,\tau} = 0$ and $\delta_t = 0$ if $\sum_{\tau=1}^{t-1} \text{Challenge}_{B,\tau} > 0$, where $\text{Challenge}_{B,\tau}$

Player B has a belief about δ, which, in rational expectation, coincides with the distribution of δ, represented by $F(\delta)$.

Suppose that Player B chooses to challenge in period 1. This implies that Player A's psychological cost $\delta_{A,t}$ is 0 for any period $t \geq 2$, and thus Player A will have no reluctance to challenge from the 14th to the 21st periods. Rationally expecting how Player A will behave, Player B will also challenge in the 2nd to the 8th periods. Thus, the cumulative expected payoff of Player B for choosing to challenge in period 1 is:

$$\mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 1] = \sum_{t=1}^{8}(s_{B,t}kR_t - cR_t) + \sum_{t=9}^{13} 0.5R_t + \sum_{t=14}^{21}(s_{B,t}kR_t) \quad (7)$$

Suppose instead that Player B does not challenge in period 1. We can easily show that Player B has no incentive to challenge in any subsequent period.[20] This implies that Player A's psychological cost $\delta_{A,t}$ is $\delta > 0$ for any period $t \geq 2$.

Assuming that B never challenges, Player A's behavior in period t is as follows:

$$\text{Challenge}_{A,t} = \begin{cases} 1 & \text{if } (s_{A,t}k - c)R_t - \delta > 0.5R_t \\ 0 & \text{otherwise} \end{cases} \quad (8)$$

Player A will choose to challenge ($\text{Challenge}_{A,t} = 1$) if and only if $\delta < (s_{A,t}k - c - 0.5)R_t$, for which $t \geq t_H$ is a pre-condition. This implies that, given Player A's fixed psychological cost, there is a higher probability of fulfilling this condition in the Growth treatment and a lower probability in the Decline treatment, since for $t \geq t_H$, R_t is greater in the Growth treatment than in the Decline treatment.

Player B's cumulative expected payoff if B does not challenge, considering Player A's decision, is:

$$\mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 0] = \sum_{t=1}^{21}\left((1 - \text{Challenge}_{A,t})(0.5R_t) + \text{Challenge}_{A,t}(s_{B,t}kR_t)\right) \quad (9)$$

Since Player B expects that, upon challenging, Player A's psychological cost will be 0 and Player A will act as a rational maximizer, the best strategy for Player B is to challenge during periods 1-8. Notice that for $t < 14$, Player A's optimal decision is $\text{Challenge}_{A,t} = 0$ and it is rational for Player B to believe so. Player B

is the indicator function with value 1 if Player B challenges at period τ and 0 otherwise.

[20] Suppose B challenges in some period $\tau > 1$. This implies that A's psychological cost $\delta_{A,t}$ is 0 for any period $t > \tau$, and thus A will choose to challenge from the 14th to the 21st periods. Rationally expecting this, B has no reason not to challenge in period 1, leading to a contradiction.

will decide not to challenge if and only if Eq. (9) is strictly greater than Eq. (7). This yields:[21]

$$\sum_{t=1}^{8}(s_{B,t}k - c - 0.5)R_t < \sum_{t=14}^{21}(0.5 - s_{B,t}k)(1 - \text{Challenge}_{A,t})R_t \tag{10}$$

Player B will compute his or her cumulative expected payoff taking into account his or her belief about Player A's psychological cost. This analysis delivers different predictions for the three treatments.

In the Decline treatment, we always have $\mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 1] > \mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 0]$, suggesting that Player B should always choose to challenge in period 1 (see Appendix E for details).

In the Constant treatment, $\text{Challenge}_{A,t} = 1$ if and only if $\delta < 540t - 7140 \equiv \delta_{Constant}(t)$. Thus, Player B will choose to maintain the status quo in period 1 ($\mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 1] < \mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 0]$) if his or her belief on Player A's psychological cost is larger than a threshold:

$$F(\delta) > \delta_{Constant}(t = 18) = 2580. \tag{11}$$

In the Growth treatment, $\text{Challenge}_{A,t} = 1$ if and only if $\delta < 27t^2 - 114t - 3213 \equiv \delta_{Growth}(t)$. Thus, Player B will choose to maintain the status quo in period 1 if his or her belief on Player A's psychological cost is larger than a threshold:

$$F(\delta) > \delta_{Grwoth}(t = 16) = 1875 \tag{12}$$

. This analysis shows that a lower cutoff value of Player A's psychological cost is required for Player B to maintain the status quo in the Growth compared to the Constant treatment. It also confirms that, in the Decline treatment, Player B has an incentive to challenge regardless of Player A's level of psychological cost.

Thus far, we have only considered the psychological cost that Player A incurs when initiating a challenge if Player B has not previously challenged. Extending this to assume that Player B also experiences a psychological cost when initiating a challenge could also explain why not all Players B choose to challenge at the beginning of the game, particularly in the Decline treatment. Since the decision to challenge depends on the condition $\delta_B < (s_{B,t} - c - 0.5)R_t$, the predictions vary across treatments. The highest psychological cost threshold is found in the Decline

[21] See Appendix E for details of the derivation.

treatment, while the lowest occurs in the Growth treatment. In the Decline treatment, the expected payoff from challenging is so substantial at the game's onset that even higher psychological costs are compatible with a decision to challenge.

This extended model may explain why Player B's challenge behavior is more restrained in period 1 compared to the standard preference model, setting the stage for the subsequent evolution of conflict throughout the game described in Section 4.2. Given Player B's belief distribution regarding Player A's psychological costs, Player B is less likely to challenge in the Growth treatment than in the other treatments. Regression results in Tables D3 and D4 in Appendix D, which replicate the analyses from Tables 5 and 6 with controls for social preferences, show that Player B participants with higher trust levels (potentially indicating a higher belief in others' psychological costs) were less likely to challenge. Player A participants with stronger positive reciprocity were also less inclined to challenge.

6 A Survey Experiment

To test the external validity of the findings from our laboratory experiment, we conducted a pre-registered *post-hoc* online survey experiment (AEA RCT Registry #15055). The survey was conducted on Prolific in January 2025 with 813 valid observations. The selection criteria were a representative sample of the U.S. population in terms of age, gender, ethnicity, and political affiliation.[22] This survey aimed to elicit the U.S. respondents' beliefs about the likelihood of conflict between the U.S. and China in the coming decade, depending on global economic trends. We briefly present the design of the survey (detailed in section F.1 in Appendix F with a presentation of the respondents' characteristics in Table F1), before summarizing its main findings (developed in section F.3).

Design. Respondents began by reading a brief passage on the evolving international relations between China and the United States, highlighting the current relative advantage of the U.S. and China's growing strength. They were then asked to estimate the likelihood that tensions between the two nations could escalate into conflict over the next decade after being presented with two economic scenarios. The growth scenario presented a statement describing optimistic long-

[22] We targeted participants in the U.S. rather than China because the established power plays a more important role in our model. As the stronger player, the U.S. citizens' beliefs and attitudes toward the rising powers largely determine the direction of the international situation.

term global economic prospects with continuous growth and prosperity.[23] The decline scenario presented a statement describing pessimistic prospects emphasizing decline and regression.[24] Half of the respondents saw the growth scenario first (Growth-Dec treatment), while the other half saw the decline scenario first (Dec-Growth treatment). After reviewing a scenario, respondents were asked to estimate the likelihood of conflict in this scenario on a scale from 0 to 100.

Then, respondents were asked a few questions, notably which economic trends they believed would most and least likely lead to conflict among major powers. They also had to rate, on a scale from 1 (strongly disagree) to 5 (strongly agree), their (dis)agreement with the statement: "*If we demonstrate friendliness first, others will reciprocate with peace, even if they become stronger than us.*"

Results. The primary outcomes showed that, on average, respondents estimated a 31.55% probability that tensions between China and the U.S. would escalate into a conflict within the next decade under the growth scenario and a 44.52% probability under the decline scenario. The difference is significant (Wilcoxon signed-rank test, $p < 0.001$). The difference in conflict probabilities between the two scenarios (pessimistic - optimistic) is significantly larger than 0 (diff=12.97; Wilcoxon signed-rank test, $p < 0.001$). As shown in Table 7, this within-subject difference is robust across treatments (Growth-Dec: 34.09% *vs.* 45.66%, $p < 0.001$; Dec-Growth: 28.99% *vs.* 43.37%, $p < 0.001$). The difference in estimated conflict probabilities between the two scenarios (decline-growth) is significantly greater than 0 for both treatments (Growth-Dec treatment: diff=11.56; Dec-Growth treatment: diff=14.38; $p < 0.001$ for both). The between-subject difference is also significant for both the first and the second presented scenario ($p < 0.001$).

Furthermore, when asked which economic trends were most and least likely to lead to conflict, 60.3% of respondents believed conflicts are most likely under "global economic depression and decline", compared to 22.8% under "global economic prosperity and growth", and 17.0% under "global economic stagnation". 66.1% believed that they are least likely under prosperity and growth, compared

[23] *"Consider a scenario of optimistic long-term global economic prospects, marked by continuous growth and prosperity over the coming decades. In this scenario, advancements in technology and the expansion of global trade drive sustained economic growth, leading to a larger and increasingly prosperous global economy".*

[24] *"Consider a scenario of pessimistic long-term global economic prospects, marked by a continuous decline and regression in global economic conditions over the coming decades. In this scenario, stagnation in technological innovation, financial instability, and unexpected shocks drive sustained economic decline, leading to a shrinking global economy."*

Table 7: Economic prospects and estimated conflict probability

	1st scenario		2nd scenario		1st *vs.* 2nd
Treatment	Scenario	Conflict prob	Scenario	Conflict prob	p-value
Growth-Dec	Growth	34.1% (0.247)	Decline	45.7% (0.246)	<0.001***
Dec-Growth	Decline	43.4% (0.237)	Growth	29.0% (0.246)	<0.001***
GD *vs.* DG p-value		<0.001***		<0.001***	

Notes: GD for Growth-Dec treatment, DG for Dec-Growth treatment. The final column reports the p-values from within-subject Wilcoxon signed-rank tests comparing the two scenarios within each treatment. The bottom row displays the p-values from between-subject Wilcoxon rank-sum tests for each scenario sequence. Standard deviations are in parentheses. *** $p<0.01$.

to 18.7% under depression and decline and 15.3% under stagnation.

Secondary outcomes reveal that 57.6% of respondents endorsed the idea that showing friendliness first would lead to peaceful reciprocity, even after the balance of power has changed. An OLS regression analysis shows that gender, age, education, and political orientation were significant predictors of conflict-related beliefs and preferences (see Table F3 in Appendix F). In particular, males estimated lower probabilities of conflict. Respondents with more conservative orientation reported higher probabilities of conflict, lower belief in reciprocity to friendliness, and were less pessimistic about future global economy than more liberal people.

Overall, the survey results suggest that a majority of U.S. citizens perceive the likelihood of conflict between China and the U.S. as higher when long-term global economic prospects are bleak, compared to when prospects are positive, and a majority endorses the idea of positive reciprocity to peaceful behavior in international relations. These (hypothetical) survey results align with the conclusions of our (incentivized) laboratory experiment and our behavioral model.

7 Conclusion

We conducted an experimental test of a dynamic power rivalry game to investigate how economic prospects affect the likelihood of cooperation or conflict between rising and established powers. Our experiment designed a shifting power dynamic in which the rising power player began with low relative strength that increased over time, while the established power player started with high relative strength

that gradually decreased. Between treatments and across subjects, we varied the evolution of the pie size to reflect favorable, constant, and unfavorable economic prospects. In the game, players chose whether to maintain the status quo with equal earnings or challenge their partner to secure a larger share of resources.

Our results reveal higher rates of challenge and conflict when economic prospects shrink, and greater cooperation when these prospects are improving, especially from the players with higher relative strength. Treatment differences are significant across various metrics, including the distribution of player categories: more "Maximizers" engage in challenges in the Decline treatment, while more "Peace lovers" aim to establish a cooperative norm in the Growth treatment. Growth prospects significantly increase cooperation and social welfare. These findings deviate from predictions of a theoretical model based on standard self-interested preferences, and they show that the Thucydide's trap is not inevitable. The observed behavior aligns with a model that incorporates reciprocity and the psychological costs of initiating conflict, along with players' anticipation of these factors.

We are careful not to draw strong direct implications for real-world conflicts from our results, as they were derived from a stylized environment that abstracts from many complexities inherent in relationships outside the laboratory. Nevertheless, our findings are further supported by an online survey experiment with a representative sample of the U.S. population. Respondents predicted a significantly higher likelihood of escalating tensions leading to conflict between the U.S. and China under negative economic prospects compared to continued growth. The survey also revealed that most respondents believe in reciprocity, seeing initial friendliness as key to fostering peaceful international relations.

These results suggest a key takeaway: in a context where the balance of forces varies dynamically, tensions between nations or organizations are more likely to escalate, underscoring the heightened importance of diplomatic efforts, when economic outlooks are unfavorable. When economic prospects are weak, sustaining cooperative relationships between an established and a rising power becomes more challenging. This emphasizes the importance of enhancing communication and interaction between nations to help mitigate the impact of adversarial economic perspectives on stability and avoid falling into the Thucydides Trap. Increasing the psychological cost for the rival when an established power chooses not to challenge could be a crucial role for third-party organizations. By increasing the perceived cost associated with initiating a conflict, these organizations may

help reinforce stability. This responsibility can involve promoting cooperation and highlighting the benefits of peace, supporting established powers in maintaining a cooperative stance even when faced with rising powers.

We acknowledge several limitations of our study, which highlight potential avenues for future research. In particular, our study establishes a status quo that guarantees equal sharing of resources between players. Exploring scenarios where the status quo involves unequal sharing would be a compelling direction for future research, as this could significantly influence perceptions of fairness, particularly regarding the psychological costs associated with initiating conflict. Furthermore, examining these dynamics could provide deeper insights into how unequal distributions affect the overall landscape of conflicts and cooperation.

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A Online Appendix - Instructions for the Laboratory Experiment

[*Translated from Chinese*]

Your seat number is:_____. Please take your numbered seat.

A.1 General Instructions

Welcome and thank you for participating in this experiment.

Precautions before starting

1. Please follow the experimenter's instructions and refrain from operating the computer until instructed to do so. Turn off your phone and put it away before starting. We ask that you not to communicate with other participants in the room.
2. By arriving on time, you have already earned a 5-Yuan show-up fee. During this experiment, you can earn additional variable earnings. The exact amount of these variable earnings will depend on your own choices and the choices of other participants. All transactions during the experiment will be conducted in tokens. At the end of the experiment, the tokens you have earned will be converted into Chinese Yuan at the following exchange rate:

   4500 tokens = 1 yuan Renminbi.

3. Throughout the entire experiment, your choices and answers will remain anonymous. You will never be informed about who you are interacting with. Your final earnings will also be kept confidential: no other participant will be informed of your final earnings. Payment will be made by an assistant who is not present during the session and is unaware of the content of the experiment.

If you have any questions during the experiment, raise your hand and we will answer your questions privately at your desk.

A.2 Task Instructions

Growth treatment [*The instructions for the Decline treatment and the Constant treatment are similar, except for the elements in brackets*].

At the beginning of the experiment, the computer program will **randomly pair you with another participant**. In each pair, one participant will be assigned the role of **Player A** and the other the role of **Player B**. Throughout the session, pairs and roles

will remain fixed. This means that you will interact with the same person for all 21 periods.

Main decisions

In each period, Player A and Player B have to decide simultaneously and independently how to allocate a pie of X tokens. **The default initial allocation of the pie is 50% for each player**, that is $0.5X$ for each player.

In each period, each player has to choose among two possible actions: **"Maintain Status Quo"** or **"Challenge".**

- If both players choose to **"Maintain Status Quo"**, the pie will be shared according to the **initial allocation scheme**, and each player will receive $0.5X$ tokens.
- If **at least one player** chooses to **"Challenge"**, both players will engage in a competition. In this case, the pie size will be **reduced by 10%**; its amount will become $0.9X$ tokens. This amount will be split between the two players based on their relative strength. Assuming that the **relative strength** of Player A in a particular round is a, then the relative strength of Player B is $1 - a$. Player A will receive $a0.9X$ tokens, while Player B will receive $(1 - a)0.9X$ tokens. Additionally, each player choosing to "Challenge" will have to pay a cost, which is equal to 1% of the initial pie size of each period. Therefore, **challenging costs** $0.01X$ **tokens**.

What does change across periods?

At the start of the first period, Player A has a **relative strength of 0.2**, while Player B has a **relative strength of 0.8**. The pie size is **10,000 tokens** [*30,000 tokens (Decline treatment) / 20,000 tokens (Constant treatment)*].

The relative strengths of the two players and the pie size vary across periods according to the following rule:

Changes in relative strength: In each period of the game, Player A's relative strength **increases by 0.03**, whereas Player B's relative strength **decreases by 0.03**.

Changes in the pie size: In each period of the game, the pie size **increases by 1,000 tokens** [*decrease by 1,000 tokens (Decline treatment) / does not change (Constant treatment).*]

For example, in period 2 Player A's relative strength is 0.23, Player B's relative strength is 0.77, and the pie size is 11,000 tokens.

Information

Before period 1 starts, you will learn your role. At the beginning of each period, you will be informed of the pie size and your relative strength. After both you and your

paired participant have made your choices, you will receive feedback on the choices and earnings of both players for that period. Your final earnings are the sum of your earnings from all 21 periods.

The following screenshot displays the decision interface in each period:

End of the session

After the 21 periods have been completed, you will have to complete a survey. All information provided in the survey will also be anonymous, and no one, including the experimenters, will be able to link this information to any specific individual. The collected data will be used solely for academic research purposes. After you have completed the survey, you will be informed on your earnings from this experiment. Finally, we will pay you on-site.

To ensure that you fully understand the instructions, there will be a comprehension test before the experiment begins. Period 1 will start only after everyone has correctly answered the comprehension test questions.

A.3 Control questionnaire

[*The questions are the same in all treatments, but with different correct answers for some questions.*]

Before we start the experiment, you will have to answer several questions about the experiment. You will not be allowed to begin until you answer them correctly. You can ask us for assistance, but you are not allowed to copy the answers of others.

1. How many periods of decision-making are included in the experiment?
2. Regardless of whether you are assigned to Player A or Player B, your assigned role will remain unchanged throughout the experiment.

- True
- False

3. Under which of the following circumstances, are the shares of the pie allocated according to the relative strength in this period?
    - Both Player A and Player B choose “Maintain Status Quo”
    - Both Player A and Player B choose “Challenge"
    - Player A chooses “Challenge” and Player B chooses “Maintain Status Quo”
    - Player A chooses “Maintain Status Quo” and Player B chooses “Challenge”
4. As the periods progress, the relative strength of Player A:
    - Increases
    - Decreases
    - Remains unchanged
5. As the periods progress, the relative strength of Player B:
    - Increases
    - Decreases
    - Remains unchanged
6. As the periods progress, the pie size:
    - Increases
    - Decreases
    - Remains unchanged
7. In a specific period, if the initial pie size is 20,000 tokens, and either Player A or Player B chooses “Challenge”, then:
    - (a) What is the pie size available for distribution between the two players in this period? _____
    - (b) Assuming that one player’s relative strength in this period is 0.4, how many tokens would this player receive in this period? _____
    - (c) How many additional tokens must the player who chooses “Challenge” pay as a challenging cost for this period? _____

A.4 Post-experimental questionnaire

[*Displayed on screen*]

Q1. What is your gender?

1. Female
2. Male

Q2. What is your age? _____

Q3. What is your current major?

1. Science, engineering, agriculture, or medicine
2. Business, economics, or management
3. Social sciences excluding business, economics, and management
4. Humanities and Arts

Q4. What is your current university level?

1. Bachelor - First year
2. Bachelor - Second year
3. Bachelor - Third year
4. Bachelor - Fourth year
5. Master's student
6. Doctoral student

Q5. Positive Reciprocity (Falk et al., 2023) Imagine the following scenario: After shopping in an unfamiliar city, you find yourself lost without access to navigation or a map. You ask a stranger for directions. The stranger offers to take you with their car to your destination. The ride costs the stranger about 80 Yuan in total. The stranger does not want money for it. Among the items you purchased while shopping, there are six items that could be suitable as a thank-you gift, with values of 20 Yuan, 40 Yuan, 60 Yuan, 80 Yuan, 100 Yuan, and 120 Yuan, respectively. Which item would you choose to give as a thank-you gift to the stranger?

1. 20 Yuan gift
2. 40 Yuan gift
3. 60 Yuan gift
4. 80 Yuan gift

5. 100 Yuan gift
6. 120 Yuan gift

Q6. How well do the following statements describe you as a person? Please indicate your answer on a scale from 0 to 10, with 0 for "does not describe me at all" and 10 for "describes me perfectly".

- **Q6a. Trust (Falk et al., 2023)** As long as I am not convinced otherwise, I assume that people have only the best intentions.
- **Q6b. Altruism (Falk et al., 2023)** I am only willing to help others if I expect that they would do the same for me.
- **Q6c. Negative Reciprocity (Falk et al., 2023)** I am a person who is generally willing to punish unfair behavior even if this is costly?

Q7. Risk preference (Falk et al., 2023) Please imagine the following scenario: you have to choose between a lottery and sure payment. The lottery has a 50 percent chance of winning 300 Yuan when at the same time there is 50 percent chance of winning nothing.

Now imagine that you have to make a choice between the lottery and the sure payment. We will show you five different scenarios. In all scenarios, the lottery is the same, but the sure payment varies in each scenario. Your choice in this question will not affect your experimental earnings.

- **Q7-1. What would you prefer: a 50 percent chance of winning 300 Yuan when at the same time there is 50 percent chance of winning nothing, or would you rather have the amount of 160 Yuan as a sure payment?**
    1. The lottery with 50 percent chance of winning 300 Yuan and 50 percent chance of winning nothing
    2. The sure payment of 160 Yuan

[*Note: Participants were required to answer five questions similar in structure to the one above consecutively, with different sure payments in each question. Based on their choice in the previous question, they were directed to different subsequent questions. The response in the fifth question reflects the participant's risk attitude, with a smaller switching row indicating a greater risk aversion.*]

Q8. Distributional preferences (Balafoutas et al., 2014)

- **Q8-1. Disadvantageous inequality.**

Imagine that you and another person will jointly receive a sum of money, and you do not know each other and you will not interact later. However, you have the right to decide how much money to give to the person, thus, the person is a passive agent.

You need to make decisions in the following five scenarios, choosing either the left or the right distribution. The passive agent can only accept the amount you choose and cannot make any decisions that affect his or her own earnings.

For example: in the first decision, if you choose "Left", you get 150 Yuan, and the passive agent gets 300 Yuan. If you choose "Right", you get 200 Yuan, and the passive agent gets 200 Yuan. Please make your choice for each decision.

Left		Your choice (please mark)	Right	
You get	Passive agent gets		You get	Passive agent gets
150 yuan	300 yuan	Left ○○ Right	200 yuan	200 yuan
190 yuan	300 yuan	Left ○○ Right	200 yuan	200 yuan
200 yuan	300 yuan	Left ○○ Right	200 yuan	200 yuan
210 yuan	300 yuan	Left ○○ Right	200 yuan	200 yuan
250 yuan	300 yuan	Left ○○ Right	200 yuan	200 yuan

- **Q8-2. Advantageous inequality.**

Imagine that you and another person will jointly receive a sum of money, and you do not know each other and will not interact later. However, you have the right to decide how much money to give to the person, thus the person is a passive agent.

You need to make decisions in the following five scenarios, choosing either the left or the right distribution. The passive agent can only accept the amount you choose and cannot make any decisions that affect his or her own earnings.

For example: in the first decision, if you choose "Left", you get 150 Yuan, and the passive agent gets 100 Yuan. If you choose "Right", you get 200 Yuan, and the passive agent gets 200 yuan. Please make your choice for each decision.

Left		Your choice (please mark)	Right	
You get	Passive agent gets		You get	Passive agent gets
150 yuan	100 yuan	Left ○○ Right	200 yuan	200 yuan
190 yuan	100 yuan	Left ○○ Right	200 yuan	200 yuan
200 yuan	100 yuan	Left ○○ Right	200 yuan	200 yuan
210 yuan	100 yuan	Left ○○ Right	200 yuan	200 yuan
250 yuan	100 yuan	Left ○○ Right	200 yuan	200 yuan

B Online Appendix - Instructions for the Exploratory Survey Experiment

B.1 Participant Information Statement

What does the study involve?

In this study, we will ask you to give your perspectives on the evolution of global economic trends and international relations.

Who is carrying out the study?

This survey is conducted under the responsibility of Marie Claire Villeval, CNRS Research Professor, at the GATE research institute, University of Lyon (France), in collaboration with S. Jiang, Z. Zhang, and J. Zheng from Shandong University (China).

The legal basis for the processing (Article 6 of the GDPR) is the mission of public interest for the researchers involved. You should only confirm your agreement to participate if you agree with the elements mentioned on this page.

How much time will the study take?

Participating should take approximately 5 minutes.

Will the study benefit me?

There are no direct benefits to participation beyond contributing to scientific knowledge and compensation provided. Respondents who complete the study will receive a $1 compensation posted into their Prolific account. You need to complete the study for your submission to be approved and paid. We do not anticipate any risks to participation beyond those encountered in daily life.

What about my data?

All aspects of the study, including results, will be anonymous and only the researchers will have access to all the responses. The researchers involved in this study will not have access to any nominative information about you. The data collected during the study will be stored on a secure server of the GATE research institute.

Your data will be collected in a non-nominative way. The only identifier we will record will be your Prolific ID, which we as researchers cannot link to personally identifiable data of yours. We will destroy this identifier one month after all the data for this study have been collected. Your pseudo-anonymized responses will be transferred outside of the European Union in connection with the conduct of the research project and the submission of the results from this study for publication in international journals.

Your rights regarding the use of your personal data:

Right to object: Participating in this study is completely voluntary, you are not under any obligation to consent. If you do consent, you can at any time during the session object to the processing of your personal data and have the right to withdraw your consent. There will be no payment to participants who withdraw during the course of the study, but withdrawal from the study will not affect your relationship with the researchers or with Prolific.

You can exercise the rights of access, rectification and deletion of your personal data during one month after all the data for this study have been collected.

Can I tell other people about the study?

The researchers request that, for the purpose of maintaining study integrity, you do not share with anybody the nature of the questions asked of you.

What if I require further information about the study or my involvement in it?

The Ethics Review Board of GATE-Lab at the University of Lyon has approved our study (ref/2024-12). You can contact our Review Board writing to thevenet@gate.cnrs.fr If you have specific questions regarding the study, please feel free to contact the researchers via email at villeval@gate.cnrs.fr

If you would like to learn more about the purpose of this research, please feel free to contact the researchers using the same email once the study is completed.

For more information about your rights regarding your data, you can contact the Data Protection Officer at the following address by mail at CNRS DPD - 2, rue Jean Zay - 54519 - Vandoeuvre lès Nancy Cedex (France) or by email at dpd.demandes@cnrs.fr.

To participate, please acknowledge your consent to participate in this study by selecting the "I consent" option below and clicking the arrow button to begin. By choosing this option, you confirm that your participation is voluntary, you are 18 years of age or older, and you understand that you may withdraw from the study at any time and for any reason.

- I consent, I wish to continue with this study
- I do not consent to participating and do not wish to continue

[*If they do consent*] **Please provide your unique Prolific ID:**

B.2 Survey Questions

Welcome to this study!

You may be paid in £ (with £0.75 = USD1) on your Prolific account.

You will earn USD 1 as a fixed payment. The task should last for about 5 minutes.

Please read the instructions carefully and pay full attention while you are responding.

This is an anonymous experiment. No one will know your identity.

Please do not talk to anyone while you answer our questions.

– – –

What do you have to do?

Please read the paragraphs about projected future international trends on the next screen. Consider them carefully before answering the questions that follow.

– – –

Evolution of international relations: Over recent decades, China's overall strength has grown rapidly, continually narrowing the gap with the United States in terms of economic and strategic capacities. While the United States is likely to maintain a relative advantage in the short term, this advantage is not guaranteed in the long term, and it is conceivable that China could surpass the United States in the future.

In this context, one can wonder if tensions between China and the United States could escalate into conflict over the next decade.

In the following screens, we will outline **several economic scenarios** for consideration.

Review each economic scenario carefully and assess the likelihood of a conflict between China and the US.

– – –

[*Order 1 (order 2 is similar, except that subjects start with the pessimistic scenario)*]

Consider a scenario of optimistic long-term global economic prospects, marked by continuous growth and prosperity over the coming decades. In this scenario, advancements in technology and the expansion of global trade drive **sustained economic growth, leading to a larger and increasingly prosperous global economy.**

Take a moment to **reflect on these positive long-term global economic prospects**. Once you are ready, click "Next" to proceed.

– – –

Please answer the following question.

Q1. Considering this scenario of positive global economic prospects leading to a larger and increasingly prosperous global economy, what do you think is the probability that tensions between China and the United States could escalate into a conflict within the next ten years?

Please indicate a probability on a scale from 0% to 100%.

_____ [Scale between 0% to 100%]

– – –

Now, consider a scenario of pessimistic long-term global economic prospects, marked by a continuous decline and regression in global economic conditions over the coming decades. In this scenario, stagnation in technological innovation, financial instability, and unexpected shocks drive **sustained economic decline, leading to a shrinking global economy.**

Take a moment to **reflect on these negative long-term global economic prospects**. Once you are ready, click "Next" to proceed.

– – –

Please answer the following question.

Q2.Considering this scenario of negative global economic prospects leading to a shrinking global economy, what do you think is the probability that tensions between China and the United States could escalate into a conflict within the next ten years?

Please indicate a probability on a scale from 0% to 100%.

_____ [Scale between 0% to 100%]

– – –

[*Attention check*] We want to make sure that you are paying attention while responding to this survey. The following are the names of two different colors: blue, yellow. Pick these two colors from the list given below.

1. Yellow
2. Black
3. Purple

4. Blue
5. Red
6. Green
7. Pink

– – –

Q3. **In your own opinion**, how do you expect global economic activity to evolve over the coming decades? Please select one option:

- Significantly improve, with robust growth and widespread prosperity
- Improve moderately, with steady but limited growth
- Remain stable, with minimal changes in global economic conditions
- Decline moderately, with slower growth and emerging challenges
- Significantly decline, with major disruptions and widespread economic challenges

– – –

Q4. In your opinion, under which of the following global economic trends are major powers **most likely** to engage in conflicts or even wars?

- Global economic prosperity and growth
- Global economic stagnation
- Global economic depression and decline

– – –

Q5. In your opinion, under which of the following global economic trends are major powers **least likely** to engage in conflicts or even wars?

- Global economic prosperity and growth
- Global economic stagnation
- Global economic depression and decline

– – –

Q6. In international relations, to what extent do you agree with the statement: “If we demonstrate friendliness first, others will reciprocate with peace, even if they become stronger than us."

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

– – –

Q7. **Considering your beliefs about the evolution of the global economic activity** over the coming decades, to what extent would you support a preemptive strike by the US against China while they still hold a relative advantage?

- I would strongly disapprove
- I would somewhat disapprove
- I would neither approve nor disapprove
- I would somewhat approve
- I would strongly approve

– – –

Thank you for answering the following questions about yourself.

Q8. What is your gender?

- Female
- Male
- Other
- I prefer not to answer

Q9. What is your age? (in years) _____

Q10. What is the highest level of education you have completed?

- Less than high school
- High school diploma or equivalent (e.g., GED)
- Some college, no degree
- Associate degree
- Bachelor's degree

- Master's degree
- Professional degree (e.g., JD, MD)
- Doctorate degree (e.g., PhD)
- Other (please specify): _____

Q11. What is the pre-tax monthly income of your household?

- $0 – $1000
- $1001 – $ 2000
- $2001 - $ 3000
- $3001 – $4000
- $4001- $5000
- $5001- $6000
- $6001- $7000
- $7001- $8000
- $8001- $9000
- $9001- $10000
- More than $10,000
- I prefer not to say

Q12. In political matters, people talk of "the left" and "the right." How would you place your views on this scale, generally speaking?

- 0-Left (more liberal)
- 1
- 2
- 3
- 4
- 5 Center (neither liberal nor conservative)
- 6
- 7
- 8
- 9

- 10-Right (more conservative)
- I prefer not to answer

Q13. In the last national elections, which party on this list did you vote for?

- Democratic Party
- Republican Party
- Others
- I did not vote
- I prefer not to say

– – –

Thank you for your participation. Please note down the completion code XXXXX. We will transfer your earnings to your account within 7 days.

– – –

C Appendix Figures

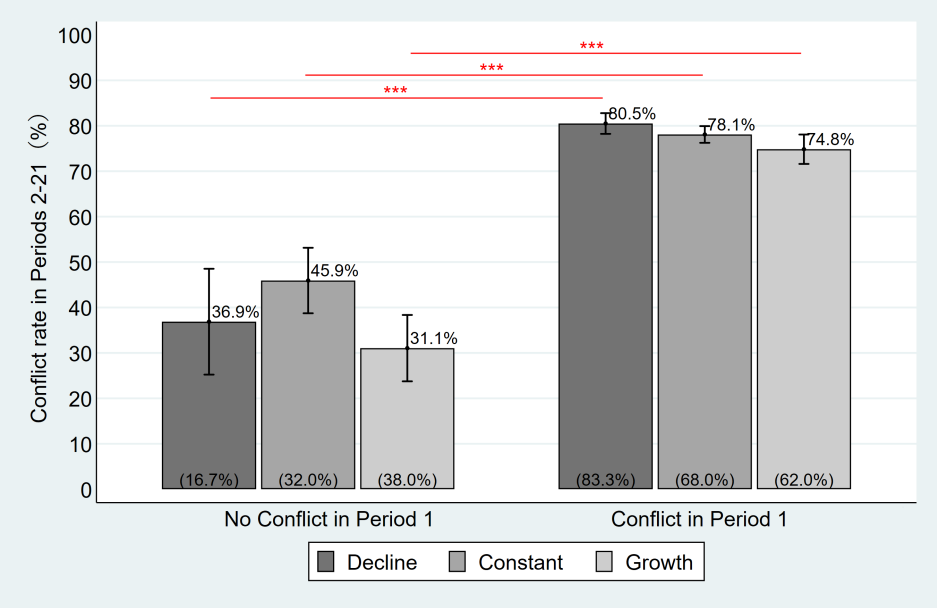

Figure C1: Incidence rate of conflicts in periods 2-21 conditional on whether a conflict occurred in period 1

Note: The figure represents the average proportion of conflicts (triggered by one or two players in the pair) across treatments. The percentages in parentheses correspond to the number of times a conflict occurred (or did not occur) in period 1 divided by the total number of pairs in a treatment. Error bars represent one standard error. Asterisks indicate significant differences based on two-tailed Mann-Whitney rank-sum tests. *** $p<0.01$.

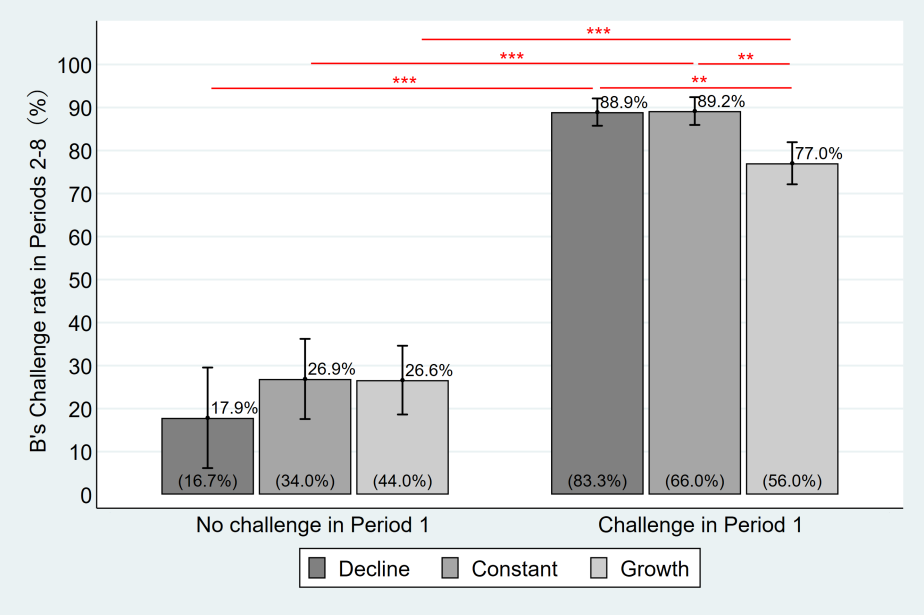

Figure C2: Player B's challenge rate in periods 2-8 conditional on whether B challenged or not in period 1

Notes: The figure represents Player B's average challenge rate in periods 2-8 (when B's relative power is higher than that of Player A), conditional on whether Player B challenged or not in period 1, by treatment. The percentages in parentheses correspond to the number of times Player B challenged (or did not challenge) in period 1 divided by the total number of Players B in a treatment. Error bars represent one standard error. Asterisks indicate significant differences based on two-tailed Mann-Whitney rank-sum tests. *** $p<0.01$, ** $p<0.05$.

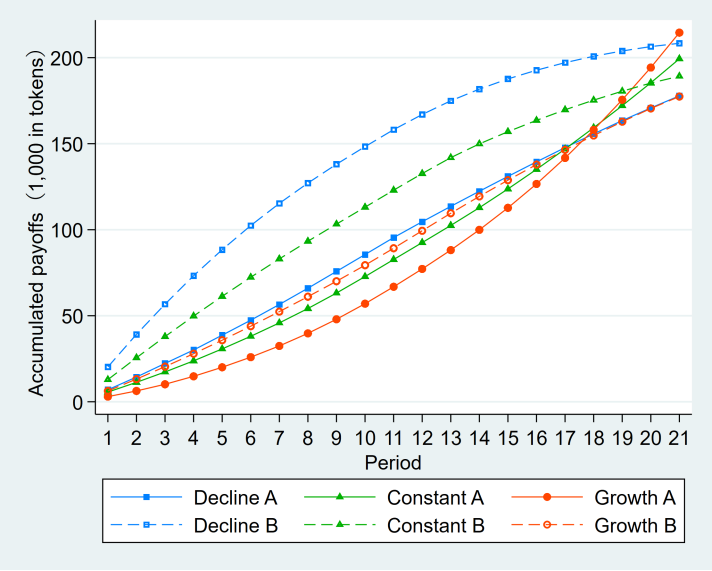

Figure C3: Accumulated payoffs over time across treatments

Note: The figure illustrates for each treatment the average accumulated payoffs of Player B (dashed lines) and Player A (solid lines).

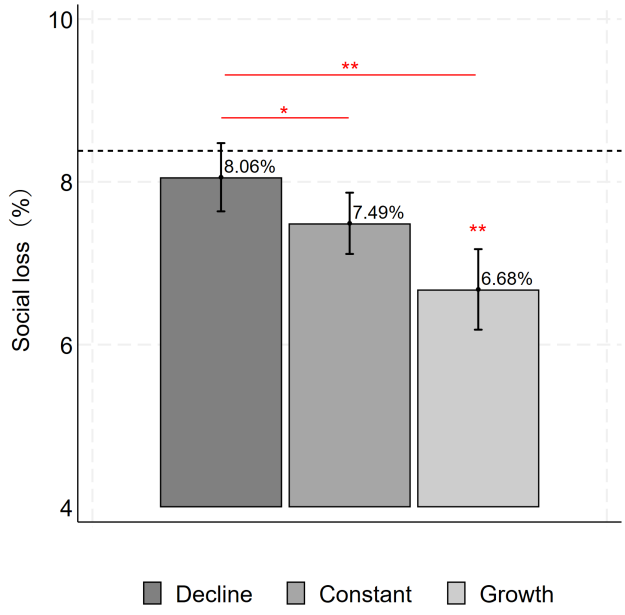

Figure C4: Proportion of social loss by treatment

Notes: The Y-axis represents the proportion of total social loss across treatments, with the dashed line indicating the equilibrium prediction (8.38%). Stars above the standard error bars denote comparisons between each treatment and the equilibrium, while stars above the horizontal line represent comparisons between treatments. ** $p<0.05$, * $p<0.1$.

D Appendix Tables

Table D1: Definition of variables and descriptive statistics

Variables	*Definition*	*Mean*	*Std. Dev.*
Male	Male=1, female=0	0.34	0.47
Major: Economics	Major in economics = 1; other majors = 0	0.32	0.47
Age	Age in years	20.65	2.39
Trust	Response to the general trust question (Q6a) 1-10 scale; order ascending with trust	6.46	2.30
Altruism	Response to the altruism question (Q6b) 1-10 scale; order descending with altruism	4.31	2.46
Negative reciprocity	Response to the negative reciprocity question (Q6c) 1-10 scale; order ascending with reciprocity	6.20	2.34
Positive reciprocity	Response to the positive reciprocity question (Q5) Min=20; Max=120	88.85	21.53
Risk preference	Staircase choice 1-32 (Q7); Order ascending with increasing risk tolerance	9.86	5.99
WTP^d	Willingness to pay to reduce disadvantageous inequality (Q8-1) Six values: -0.5, -0.3, -0.05, 0.05, 0.3, 0.5	-0.10	0.25
WTP^a	Willingness to pay to reduce advantageous inequality (Q8-2) Six values: -0.5, -0.3, -0.05, 0.05, 0.3, 0.5	0.15	0.25
Partner_challenge$_{t-1}$	Dummy for whether the paired participant challenged in the previous period (yes=1, no=0)	0.35	0.48

Notes: For both WTP variables (based on the responses to Q8 in Appendix A.4), a higher value means a higher aversion to inequality. The values of these variables were computed following the same method as in Balafoutas et al. (2014).

Table D2: Summary of sessions and participants' individual characteristics

Treatment	Decline	Constant	Growth	Decline *vs.* Constant	Growth *vs.* Constant	Decline *vs.* Growth
Male	0.33 (0.47)	0.34 (0.48)	0.35 (0.48)	0.921	0.882	0.806
Major: Economics	0.32 (0.47)	0.33 (0.47)	0.31 (0.46)	0.916	0.762	0.846
Age	20.94 (2.33)	20.58 (2.45)	20.44 (2.38)	0.189	0.486	0.046
Trust	6.89 (2.08)	6.22 (2.29)	6.30 (2.49)	0.032	0.713	0.137
Altruism	3.92 (2.07)	4.52 (2.60)	4.49 (2.66)	0.184	0.828	0.268
Negative reciprocity	6.40 (2.33)	5.92 (2.35)	6.28 (2.34)	0.143	0.305	0.658
Positive reciprocity	91.04 (20.49)	89.40 (20.59)	86.20 (23.39)	0.322	0.495	0.103
Risk preference	10.19 (6.59)	9.47 (5.36)	9.95 (6.04)	0.779	0.733	0.954
Observations	96	100	100			
WTP^d	-0.15 (0.25)	-0.07 (0.24)	-0.09 (0.27)	0.026	0.315	0.246
Observations	96	99	97			
WTP^a	0.13 (0.24)	0.14 (0.24)	0.17 (0.27)	0.739	0.296	0.165
Observations	91	98	95			

Notes: The table reports the p-values from pairwise treatment comparisons. P-values are from two-tailed proportion tests for binary variables (Male, Major) and two-tailed Mann-Whitney rank-sum tests for interval variables. The variables are defined in Table D1.

Table D3: Determinants of the challenge decision with controls for social and risk preferences

Dep. var.: Decision to challenge	Player A Period 1 (1)	Player B Period 1 (2)	Player A Periods 2-21 (3)	Player B Periods 2-21 (4)	Player B Periods 2-8 (5)	Player A Periods 14-21 (6)
Decline treatment	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Constant treatment	0.020	-0.204**	-0.030	-0.063*	-0.139*	0.005
	(0.052)	(0.091)	(0.035)	(0.035)	(0.073)	(0.036)
Growth treatment	0.113**	-0.281***	-0.080*	-0.094**	-0.232***	-0.134***
	(0.048)	(0.085)	(0.046)	(0.038)	(0.070)	(0.048)
Relative strength	-	-	1.442***	1.303***	0.570***	0.734***
			(0.065)	(0.085)	(0.213)	(0.160)
Partner_challenge$_{t-1}$	-	-	-0.049*	0.013	-0.012	-0.018
			(0.028)	(0.028)	(0.036)	(0.036)
Male	-0.010	-0.021	0.019	-0.079**	-0.093	0.054*
	(0.044)	(0.077)	(0.032)	(0.034)	(0.061)	(0.032)
Major: Economics	-0.006	0.126	-0.007	-0.003	0.071	0.045
	(0.039)	(0.084)	(0.032)	(0.032)	(0.064)	(0.034)
Age	0.012*	-0.010	-0.001	0.009	0.014	-0.009
	(0.007)	(0.015)	(0.008)	(0.005)	(0.012)	(0.008)
Trust	0.001	-0.042***	-0.003	-0.016**	-0.035***	-0.005
	(0.011)	(0.016)	(0.008)	(0.007)	(0.012)	(0.009)
Altruism	-0.028***	-0.014	-0.009	-0.001	-0.006	-0.013
	(0.010)	(0.014)	(0.008)	(0.006)	(0.012)	(0.008)
Positive reciprocity	-0.002***	-0.001	-0.002**	-0.000	-0.001	-0.001*
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Negative reciprocity	0.008	0.010	-0.010	0.003	0.013	-0.009
	(0.007)	(0.017)	(0.006)	(0.007)	(0.013)	(0.007)
Risk preference	0.004	0.004	-0.002	0.001	-0.001	-0.006*
	(0.003)	(0.007)	(0.003)	(0.002)	(0.005)	(0.003)
WTP^d	-0.182**	-	-0.156***	-0.042	-	-
	(0.079)		(0.057)	(0.063)		
WTP^a	-	-0.216	0.008	-0.164***	-0.237*	0.003
		(0.180)	(0.084)	(0.062)	(0.142)	(0.088)
Observations	147	140	2,860	2,760	980	1,152
Wald Chi2	32.073	23.014	177.558	111.406	25.028	37.442
Growth *vs.* Constant	0.093*	-0.077	-0.049	-0.031	-0.093	-0.140***
treatments	(0.050)	(0.088)	(0.039)	(0.038)	(0.074)	(0.045)

Notes: Columns (1) and (2) report the average marginal effects from probit regressions with robust standard errors in parentheses. Other columns report the average marginal effects from random-effects probit regressions with robust standard errors clustered at the individual level in parentheses. The dependent variable is the participant's binary choice of "Challenge" in a given period. WTP^d represents the participant's willingness to pay to reduce disadvantageous inequality and WTP^a represents the participant's willingness to pay to reduce advantageous inequality, both measured in the post-experiment questionnaire. The regressions include only WTP^d when the participant is at a strength disadvantage in the game, and only WTP^a when the participant has a strength advantage. Both measures are included when analyzing all periods collectively. The row at the very bottom of the table reports the tests for pairwise comparisons of the marginal effects of the Growth and Constant treatments.*** p<0.01, ** p<0.05, * p<0.1.

Table D4: Determinants of the individual challenge rate with controls for social and risk preferences

Dep. var.: Challenge rate	All players Periods 1-21 (1)	Player A Periods 1-21 (2)	Player B Periods 1-21 (3)	Player B Periods 1-8 (4)	Player A Periods 14-21 (5)	Player A Periods 14-21 (6)	Player A Periods 14-21 (7)
Decline treatment	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Constant treatment	-0.038	-0.026	-0.067*	-0.145*	-0.007	0.050	0.187
	(0.027)	(0.034)	(0.034)	(0.081)	(0.057)	(0.046)	(0.164)
Growth treatment	-0.083**	-0.063	-0.102***	-0.250***	-0.153**	-0.057	0.024
	(0.034)	(0.044)	(0.036)	(0.079)	(0.071)	(0.060)	(0.159)
Player B	-0.096***	-	-	-	-	-	-
	(0.016)						
B1	-	-	-	-	-	0.330***	0.436***
						(0.059)	(0.140)
Constant*B1	-	-	-	-	-	-	-0.178
							(0.169)
Growth*B1	-	-	-	-	-	-	-0.092
							(0.167)
Male	-0.020	0.019	-0.061**	-0.070	0.045	0.043	0.045
	(0.021)	(0.031)	(0.031)	(0.069)	(0.049)	(0.047)	(0.046)
Major: Economics	-0.006	-0.008	-0.004	0.074	0.038	0.077*	0.085*
	(0.022)	(0.030)	(0.032)	(0.072)	(0.052)	(0.045)	(0.045)
Age	0.005	0.002	0.008	0.012	-0.017	-0.012	-0.011
	(0.005)	(0.007)	(0.005)	(0.012)	(0.013)	(0.010)	(0.010)
Trust	-0.008*	-0.004	-0.014**	-0.039***	-0.004	-0.004	-0.002
	(0.005)	(0.007)	(0.006)	(0.013)	(0.013)	(0.011)	(0.011)
Altruism	-0.003	-0.007	-0.001	-0.004	-0.011	-0.007	-0.006
	(0.005)	(0.008)	(0.005)	(0.012)	(0.012)	(0.010)	(0.010)
Positive reciprocity	-0.001**	-0.002**	-0.000	-0.001	-0.002	-0.001	-0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Negative reciprocity	-0.002	-0.007	0.003	0.017	-0.021**	-0.016*	-0.015*
	(0.004)	(0.006)	(0.007)	(0.014)	(0.009)	(0.009)	(0.009)
Risk preference	-0.000	-0.002	0.001	0.000	-0.008	-0.009*	-0.009*
	(0.002)	(0.003)	(0.002)	(0.006)	(0.005)	(0.005)	(0.005)
WTP^d	-0.093**	-0.148**	-0.020	-	-	-	-
	(0.037)	(0.057)	(0.058)				
WTP^a	-0.090**	-0.011	-0.165***	-0.243	0.007	0.002	-0.006
	(0.044)	(0.074)	(0.063)	(0.161)	(0.140)	(0.116)	(0.116)
Constant	0.516***	0.659***	0.326**	0.849***	1.630***	1.166***	1.040***
	(0.116)	(0.189)	(0.125)	(0.301)	(0.351)	(0.273)	(0.313)
Observations	281	143	138	140	144	144	144
R^2	0.178	0.133	0.212	0.184	0.119	0.353	0.363
Growth *vs.* Constant	-0.045	-0.037	-0.035	-0.106	-0.146**	-0.107*	-0.163
treatments	(0.031)	(0.037)	(0.036)	(0.083)	(0.063)	(0.055)	(0.163)

Notes: The table reports the coefficients from OLS regressions with robust standard errors in parentheses, except Column (1) where robust standard errors are clustered at the pair level. The dependent variable is the individual challenge rate across periods. "B1" indicates whether Player B challenged in the first period. All control variables are the same as in Table D3. WTP^d represents the participant's willingness to pay to reduce disadvantageous inequality and WTP^a represents the participant's willingness to pay to reduce advantageous inequality, both measured in the post-experiment questionnaire. The regressions include only WTP^a when the participant is at a strength advantage in the game. Both measures are included when analyzing all periods collectively. The row at the very bottom of the table reports the tests for pairwise comparisons of the differences between the Growth and Constant treatments. *** p<0.01, ** p<0.05, * p<0.1.

E Behavioral Model

Here we provide a detailed analysis of players' dynamic interactions in the behavioral model introduced in Section 5.

Recall that Eq. (9) is Player B's expected payoff if he or she does not challenge in period 1, and Eq. (7) is Player B's expected payoff if he or she does challenge in period 1. Player B will decide not to challenge if and only if (9) is strictly greater than (7). Thus, the following condition holds:

$$\sum_{t=1}^{8}(s_{B,t}kR_t - cR_t) + \sum_{t=9}^{13} 0.5R_t + \sum_{t=14}^{21}(s_{B,t}kR_t) < \sum_{t=1}^{21}\left((1-\text{Challenge}_{A,t})(0.5R_t) + \text{Challenge}_{A,t}(s_{B,t}kR_t)\right) \tag{13}$$

The above inequality can be rewritten as:

$$\sum_{t=1}^{8}(s_{B,t}k - c - 0.5)R_t < \sum_{t=14}^{21}(0.5 - s_{B,t}k)R_t + \sum_{t=1}^{21}\text{Challenge}_{A,t}(s_{B,t}k - 0.5)R_t \tag{14}$$

Since $\text{Challenge}_{A,t} = 0$ for $t < 14$, we obtain:

$$\sum_{t=1}^{8}(s_{B,t}k - c - 0.5)R_t < \sum_{t=14}^{21}(0.5 - s_{B,t}k)R_t + \sum_{t=14}^{21}\text{Challenge}_{A,t}(s_{B,t}k - 0.5)R_t \tag{15}$$

This yields:

$$\sum_{t=1}^{8}(s_{B,t}k - c - 0.5)R_t < \sum_{t=14}^{21}(0.5 - s_{B,t}k)(1 - \text{Challenge}_{A,t})R_t \tag{16}$$

Player B computes his or her cumulative expected payoff considering his or her belief about Player A's psychological cost.

The parameter settings are $c = 0.01$, $k = 0.9$ in all the experimental treatments. The relative strength of Player B in a period is $s_{B,t} = 0.8 - 0.03(t-1)$.

In the Decline treatment, the pie size is $R_t = 30000 - 1000(t-1)$. We thus obtain $\sum_{t=1}^{8}(s_{B,t}k - c - 0.5)R_t = 25620$, which is greater than $\sum_{t=14}^{21}(0.5 - s_{B,t}k)R_t = 23220$. This implies that the inequality in Eq. (16) cannot hold since $1 - \text{Challenge}_{A,t} \leq 1$ for all t. For any Player B's belief about Player A's psychological cost, we have:

$$\mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 1] > \mathbb{E}[\Pi_B \mid \text{Challenge}_{B,1} = 0]. \tag{17}$$

This suggests that a rational Player B in the Decline treatment should choose to challenge in period 1 and continue to challenge in the following periods 2-8.

In the Constant treatment, the pie size is $R_t = 20000$. We thus obtain $\sum_{t=1}^{8}(s_{B,t}k - c - 0.5)R_t = 18480$. Recall that Player A will choose to challenge ($\text{Challenge}_{A,t} = 1$) if and only if $\delta < (s_{A,t}k - c - 0.5)R_t == 540t - 7140 \equiv \delta_{Constant}(t)$. Since the threshold psychological cost

condition, $\delta_{Constant}(t)$, is increasing in t, if Player A decides once to challenge, he or she will continue to do so in subsequent periods.

We obtain:

$$\sum_{t=14}^{17}(0.5 - s_{B,t}k)R_t = 13720 < 18480; \tag{18}$$

and

$$\sum_{t=14}^{18}(0.5 - s_{B,t}k)R_t = 18500 > 18480. \tag{19}$$

To guarantee that $\sum_{t=14}^{21}(0.5 - s_{B,t}k)(1 - \text{Challenge}_{A,t})R_t > 18480$, we need $\text{Challenge}_{A,t} \neq 1$ for all $t \leq 18$. This implies that Player B will choose to maintain the status quo if he or she expects Player A will not challenge before period 19. This imposes the following condition on Player B's belief about Player A's psychological cost:

$$F(\delta) > \delta_{Constant}(t = 18) = 2580 \tag{20}$$

This suggests that when Player B's belief about Player A's psychological cost is larger than 2580, Player B in the Constant treatment should maintain the status quo in period 1. Conversely, if this belief is less than 2580, Player B should challenge as early as period 1.

In the Growth treatment, the pie size is $R_t = 10000 + 1000(t - 1)$. We thus obtain $\sum_{t=1}^{8}(s_{B,t}k - c - 0.5)R_t = 11340$. Player A will choose to challenge ($\text{Challenge}_{A,t} = 1$) if and only if $\delta < (s_{A,t}k - c - 0.5)R_t == 27t^2 - 114t - 3213 \equiv \delta_{Growth}(t)$. Similarly, $\delta_{Growth}(t)$ increases in t when $t \geq 14$.

We obtain:

$$\sum_{t=14}^{15}(0.5 - s_{B,t}k)R_t = 6805 < 11340. \tag{21}$$

and

$$\sum_{t=14}^{16}(0.5 - s_{B,t}k)R_t = 11430 > 11340. \tag{22}$$

To guarantee that $\sum_{t=14}^{21}(0.5 - s_{B,t}k)(1 - \text{Challenge}_{A,t})R_t > 12340$, we need $\text{Challenge}_{A,t} \neq 1$ for all $t \leq 16$. Player B in the Growth treatment should choose to maintain the status quo if he or she expects that Player A will not challenge before period 17. This imposes the following condition on Player B's belief about Player A's psychological cost:

$$F(\delta) > \delta_{Growth}(t = 16) = 1875 \tag{23}$$

This suggests that when Player B's belief about Player A's psychological cost is larger than 1875, Player B in the Growth treatment should maintain the status quo in period 1. Conversely, if this belief is less than 1875, Player B should challenge as early as period 1.

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F Analysis of the Survey Experimental Data

We begin by outlining the design of the survey experiment, followed by a description of its implementation. Finally, we present the survey's results in detail.

F.1 Survey Design

All survey participants began by reading the following paragraph about the evolution of international relations between China and the U.S.:

Over recent decades, China's overall strength has grown rapidly, continually narrowing the gap with the United States in terms of economic and strategic capacities. While the United States is likely to maintain a relative advantage in the short term, this advantage is not guaranteed in the long term, and it is conceivable that China could surpass the United States in the future. In this context, one can wonder if tensions between China and the United States could escalate into conflict over the next decade.

Then, participants were instructed to review sequentially two scenarios about future global economic trends, a growth scenario and a decline scenario. After discovering the first scenario, participants were asked to estimate the likelihood (on a 0-100 scale) that tensions between China and the United States could escalate into a conflict within the next ten years. After answering this question, they received the second scenario and answered the same question. The scenarios were described as follows:

- Growth scenario: *Consider a scenario of optimistic long-term global economic prospects, marked by continuous growth and prosperity over the coming decades. In this scenario, advancements in technology and the expansion of global trade drive sustained economic growth, leading to a larger and increasingly prosperous global economy.*
- Decline scenario: *Consider a scenario of pessimistic long-term global economic prospects, marked by a continuous decline and regression in global economic conditions over the coming decades. In this scenario, stagnation in technological innovation, financial instability, and unexpected shocks drive sustained economic decline, leading to a shrinking global economy.*

The survey varied randomly the presentation order between respondents: half of the respondents saw the growth scenario first, followed by the decline scenario (Growth-Dec treatment), while the other half saw the decline scenario first, followed by the growth one (Dec-Growth treatment).

In both treatments, after evaluating how they expect global economic activity to evolve over the coming decades, respondents were asked to indicate under which global economic trends they believe major powers are most and least likely to engage in conflicts (presented in random order). Next, they were asked to rate, on a scale from 1 (strongly disagree) to 5 (strongly agree), their (dis)agreement with the statement: "*If we demonstrate friendliness first, others will reciprocate with peace, even if they become stronger than us.*" Finally, respondents were asked to indicate their degree of support for a preemptive strike by the U.S. against China while the U.S. still holds a relative advantage.

At the end of the survey, socio-demographic characteristics and political orientation and vote in the last national election were recorded (see section B.2 in Appendix F).

F.2 Survey Implementation and Sample

The GATE-Lab Ethics Review Board approved the survey experimental design (#2024-12). We pre-registered the experiment on the AEA RCT Registry (#15055, Jiang et al. (2025)). The survey experiment was conducted on Prolific on January 11 and January 15, 2025.[25]

We requested that Prolific collect data from a representative sample of the U.S. population, considering gender, age, ethnicity, and political affiliation. We pre-registered a target of 800 observations,[26] and we eventually collected 813 valid observations, with 409 respondents in the Growth-Dec treatment and 404 in the Dec-Growth treatment. The actual distribution of the respondents is close to the initial target regarding gender (target: 50% male; actual percentage: 49.2%) and age categories (target: 12.5% 18-24 years, 50% 25-54, 38% 55-100; actual percentages: 14.9%, 49.4%, 35.7%). Table F1 displays the descriptive statistics of the sample.

Table F1: Descriptive statistics of the respondents in the survey experiment

Treatment	Growth-Dec (1)			Dec-Growth (2)			Total			(1) *vs.* (2)
	Mean	SD	Obs.	Mean	SD	Obs.	Mean	SD	Obs.	p- value
Male	0.474	0.500	409	0.510	0.501	404	0.492	0.500	813	0.310
Age	44.80	16.66	409	45.41	16.36	404	45.1	16.5	813	0.585
Education	4.51	1.51	409	4.48	1.55	404	4.5	1.53	813	0.991
Income	5.74	3.27	392	6.11	3.30	392	5.93	3.29	784	0.084
Political orientation	4.86	3.13	396	4.77	2.95	394	4.82	3.04	790	0.743
Republican vote	0.386	0.487	409	0.371	0.484	404	0.379	0.485	813	0.659
Democrat vote	0.443	0.497	409	0.470	0.500	404	0.456	0.498	813	0.427
Reciprocity	3.46	1.07	409	3.32	1.14	404	3.39	1.1	813	0.077

Notes: *Education* and *Income* are ordered categorical variables. Education is divided into eight categories, ranging from 1 to 8, based on ascending levels of education. Income is divided into eleven categories, ranging from 1 to 11. *Political orientation* is the answer to the question: "*In political matters, people talk of "the left" and "the right." How would you place your views on this scale (from 0 –more liberal– to 10 –more conservative), generally speaking?"*. *Republican* and *Democrat* report the self-reported vote at the last U.S. national election (the omitted category is Independent). P-values are from chi-square tests for binary variables and rank-sum tests for other variables.

[25] Some participants clicked on the survey but did not complete it, resulting in data collection stopping after 713 observations. This issue could have been avoided by providing a larger number of initial URL links, as Prolific would have automatically managed the required observation limit. To meet the quota for participants under 25 years and above 49 years, while also balancing gender, we launched a second wage of data collection. This wave included 50 participants under 25 years (20 males and 30 females) and 50 participants over 49 years (20 males and 30 females).

[26] To detect a small-size effect (d=0.25) with alpha=5% and a 95% power when comparing the within-subject probabilities of conflict in the growth and decline scenarios (Wilcoxon signed-rank tests), at least 220 observations were needed in each condition. We pre-registered a sample of 800 observations to allow for heterogeneity analyses.

F.3 Survey Results

Main Results We first present the primary outcomes regarding respondents' beliefs about the probability that tensions between China and the United States would escalate into a conflict within the next decade, for each scenario. On average, the estimated probability of conflict under the growth scenario was 31.55%, which is significantly lower than the estimated probability under the decline scenario (44.52%; Wilcoxon signed-rank test, $p < 0.001$). The Wilcoxon signed-rank test indicates that the difference in conflict probabilities between the two scenarios (decline - growth) is significantly greater than 0 (diff=12.97, $p < 0.001$). Table F2 reports these statistics by treatment.[27]

Table F2: Economic prospects and estimated conflict probability

	1st scenario		2nd scenario		1st *vs.* 2nd
Treatment	Scenario	Conflict prob	Scenario	Conflict prob	p-value
Growth-Dec	Growth	34.1%	Decline	45.7%	<0.001***
		(0.247)		(0.246)	
Dec-Growth	Decline	43.4%	Growth	29.0%	<0.001***
		(0.237)		(0.246)	
GD *vs.* DG					
p-value		<0.001***		<0.001***	

Notes: GD for Growth-Dec treatment, DG for Dec-Growth treatment. The final column reports the p-values from within-subject Wilcoxon signed-rank tests comparing the two scenarios within each treatment. The bottom row displays the p-values from between-subject Wilcoxon rank-sum tests for each scenario sequence. Standard deviations are in parentheses. *** $p<0.01$.

As shown in Table F2, the within-subject difference remains robust across both treatments. When the growth prospects were presented before the decline prospects, the difference of probabilities was statistically significant (34.09% *vs.* 45.66%, $p < 0.001$). The same holds when the growth scenario was presented after the decline scenario (28.99% *vs.* 43.37%, $p < 0.001$). The Wilcoxon signed-rank test indicates that the difference in estimated conflict probabilities between the two scenarios (decline - growth) is significantly greater than 0 for both treatments (Growth-Dec treatment: diff=11.56, $p < 0.001$; Dec-Growth treatment: diff=14.38, $p < 0.001$). Moreover, the between-subject difference is also significant for both the first presented scenario ($p < 0.001$) and the second presented scenario ($p < 0.001$).

These findings are further corroborated by additional questions asking respondents under which global economic trends major powers are most and least likely to engage in conflicts. As shown in Figure F1, 60.3% of respondents believed that major powers are most likely to engage in conflicts under "global economic depression and decline", compared to 22.8% under "global economic prosperity and growth", and 17.0% under "global economic stagnation". On the other hand, 66.1% of respondents believed that major powers are least likely to engage in conflicts under "global economic prosperity and growth", compared to 18.7% under "global economic depression and decline" and 15.3% under "global economic stagnation".

[27] This table is similar to Table 7 in the main text.

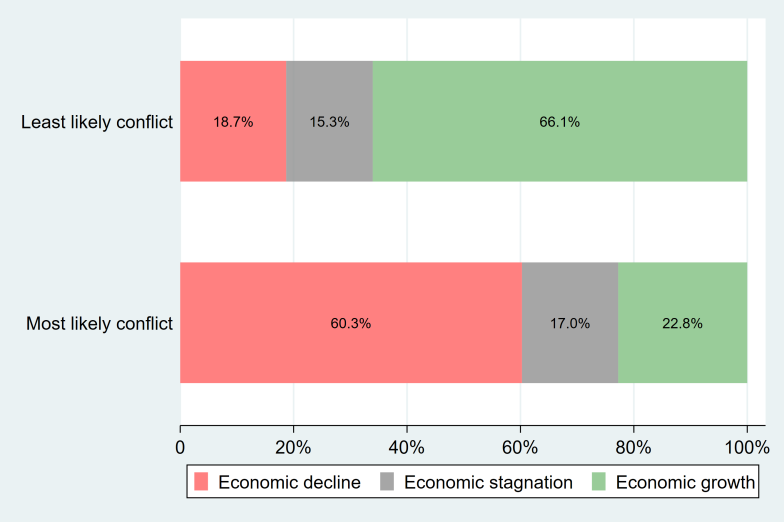

Figure F1: Beliefs about the economic trends most and least likely to lead to conflict

Note: The figure illustrates the proportion of respondents who believe that major powers are most likely or least likely to engage in conflicts or even wars under different global economic trends.

Secondary Outcomes. 57.6% of respondents reported reciprocal beliefs, either somewhat agreeing or strongly agreeing with the statement "If we demonstrate friendliness first, others will reciprocate with peace, even if they become stronger than us". This finding aligns with our behavioral model.

Beliefs about the evolution of global economic activity over the coming decades show that most respondents (61.3%) had positive expectations: 19.7% believed the global economy would significantly improve, and 41.6% believed it would improve moderately. In contrast, 25.5% of respondents had negative expectations about the future economy. Those with negative expectations estimated a significantly higher conflict probability under the decline scenario (48.5%) than those with positive expectations (43.2%; $p = 0.006$). However, their estimated conflict probability under the growth scenario (30.4%) does not differ significantly from the more optimistic respondents (32.0%) ($p = 0.251$).

More than half of the respondents (50.3%) strongly disapproved and 20.4% somewhat disapproved of a preemptive strike by the U.S. against China. Contrary to our pre-registered hypothesis, those who are pessimistic about future economic prospects did not show significantly more support for such a preemptive strike. Only 7.3% of the pessimistic respondents strongly approved or somewhat approved of the strike, compared to 16.3% of the more optimistic respondents (Proportion test, $p = 0.001$).

Heterogeneity analysis. There are significant differences in beliefs and preferences among respondents based on gender and political affiliation. Males reported a lower average estimated probability of conflict compared to females, both under the growth scenario (29.7% *vs.* 33.3%; Mann–Whitney test, $p = 0.034$) and the decline scenario (42.2% *vs.* 46.8%, $p = 0.006$). Those

who voted for the Republican party estimated a higher average probability of conflict compared to those who voted for the Democratic party. This difference is significant in the growth scenario (35.5% *vs.* 29.7%, $p < 0.001$) but not in the decline scenario (46.3% *vs.* 44.5%, $p = 0.339$). Republican supporters reported significantly lower reciprocal beliefs than Democratic supporters (3.22 *vs.* 3.54, $p < 0.001$).

We conclude with a regression analysis, presented in Table F3, that accounts for the influence of individual characteristics on conflict-related beliefs and preferences in the survey.

Table F3: Individual determinants of conflict-related beliefs in the survey

Variables	1st Prob	2nd Prob	Reciprocity	Eco Belief
	(1)	(2)	(3)	(4)
Dec-Growth Treatment	10.076***	-16.015***	-0.135*	-0.050
	(1.712)	(1.783)	(0.079)	(0.080)
Eco Belief	1.514*	1.163	-0.123***	-
	(0.803)	(0.815)	(0.037)	
Male	-4.020**	-4.464**	-0.066	-0.018
	(1.710)	(1.775)	(0.079)	(0.079)
Age	-0.177***	-0.086	-0.009***	0.008***
	(0.051)	(0.053)	(0.002)	(0.002)
Education	0.177	0.538	0.088***	-0.175***
	(0.634)	(0.640)	(0.029)	(0.028)
Income	-0.023	-0.034	0.003	-0.010
	(0.282)	(0.302)	(0.014)	(0.013)
Political orientation	1.092***	0.761**	-0.040***	-0.096***
	(0.284)	(0.310)	(0.014)	(0.013)
Constant	34.034***	42.951***	3.964***	3.462***
	(4.718)	(4.682)	(0.216)	(0.186)
Obs.	765	765	765	765
R^2	0.073	0.116	0.067	0.131

Notes: All models are OLS regressions with robust standard errors reported in parentheses. *'1st Prob'* (*'2nd Prob', respectively* refers to the estimated likelihood of a conflict under the first (second) scenario. *'Reciprocity'* refers to the belief about reciprocity to friendliness on a scale between 1 to 5, where a higher number indicates more agreement. *'Eco Belief'* represents beliefs about the future global economy, measured on a scale from 1 to 5, with a higher number reflecting more pessimistic expectations for the future global economic outlook. *'Political orientation'* is the answer to the question: "*In political matters, people talk of "the left" and "the right." How would you place your views on this scale (from 0 –more liberal– to 10 –more conservative), generally speaking?".* *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Columns (1) and (2) show the coefficients from OLS regressions on the first and second estimated probabilities of conflict, respectively. Column (3) presents the coefficients from the OLS regression on reciprocity belief, and column (4) on the beliefs about the evolution of global economic activity over the coming decades (with a higher value indicating more pessimistic beliefs). The independent variables include a dummy variable for the Dec-Growth treatment. The coefficient of this variable indicates the relative impact of the decline scenario on the estimated likelihood of a conflict compared to the growth scenario in the Growth-Dec treatment in model

(1) and the relative impact of the growth scenario compared to the decline scenario in the Growth-Dec treatment in model (2). We control for beliefs about future economic trends (only for models (1) to (3)) and various socio-demographic variables, including gender (male dummy variable), age, education, income levels, and political orientation (with a higher value indicating a more conservative opinion).

The regressions confirms the robustness of our primary result: model (1) shows that when the decline scenario was presented first (Dec-Growth treatment), respondents on average estimated a conflict probability that was more than 10% higher than when the growth scenario was presented first (Growth-Dec treatment). This between-subject difference is even more pronounced for the second presented scenario in model (2): when the growth scenario was presented second (Dec-Growth treatment), respondents on average estimated a conflict probability that is more than 16% lower than when the decline scenario was presented second (Growth-Dec treatment).

Participants with more pessimistic beliefs about future economic prospects were less likely to believe in reciprocity to friendliness in international relations. The regressions further reinforce the findings that male respondents generally estimated a lower probability of conflict compared to females in both scenarios. Older participants believed less in reciprocity to friendliness and were more pessimistic regarding future economic prospects. In contrast, a higher level of education did not affect the perceived probability of conflict in any scenario but it correlated with a higher belief in reciprocity to friendliness and less pessimistic beliefs about future economic prospects. Political ideology also plays a significant role in shaping conflict-related beliefs. More conservative respondents, on average, expected higher probabilities of conflict, expressed less belief in reciprocity, and had less pessimistic expectations about the future of the global economy.