Peaceful alternatives to asymmetric conflict

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Chapter 1 - Introduction

Conflict is a fundamental part of human society, with consequences that can reverberate through history. From interpersonal squabbles to international wars, conflict has the power to shape the trajectory of individuals, groups, and nations. Within groups, conflict can disrupt and reorder social hierarchies, resolve or ferment wealth inequality, and overturn existing social norms. Between groups, conflict shapes populations, the dissemination of goods and ideas, the formation of (group) identities, and can lead to longstanding intergenerational grievances between peoples.

Conflict often arises when one party wants something that another party tries to prevent (De Dreu & Gross, 2019). Indeed, from predator-prey dynamics in the animal kingdom (Packer & Ruttan, 1988; Bailey et al., 2013), to hostile take-overs in industry (Schwert, 2000), to military invasions (De Dreu et al., 2016), conflict often involves the asymmetric struggle between an attacking and defending party. While recent experimental work (De Dreu et al., 2015, 2016, 2019, 2021; Gross et al., 2022; Rojek-Giffin et al., 2019; Romano et al., 2022) has shed light on many dynamics of such asymmetric conflict, a key question remains: how can we resolve or reduce such conflicts, and specifically, how can we demotivate an attacking party from aggression? Indeed, if we were to understand the internal logic and underlying motivations of asymmetric conflict and find interventions that reduce attacker aggressiveness, we could close in on ways to actually prevent (asymmetric) conflict to emerge in the first place.

In this dissertation, I explore how the introduction of peaceful alternatives to create and increase wealth impacts the emergence and intensity of asymmetric conflict and its consequences using theoretical models and controlled laboratory studies. I proceed as follows: First, I review the relevant literature on the experimental study of (asymmetric) conflict using economic games. Second, I outline and summarize the three empirical chapters

of this dissertation. Lastly, I discuss general conclusions and give an outlook on further research.

1. Literature Review

The study of conflict using experimental games

Scholars wanting to study (group) conflict are faced with various difficulties. Real world conflict often is highly complex, involving complicated entanglements between participating individuals and environmental factors, leading to the challenge of controlling for confounding variables and establishing causal relationships. Additionally, conflicts involving violence are both rare and, due to their nature, hard to access for researchers, such that most field research has been conducted in specific contexts such as sports (e.g., Szymanski, 2003) or organizations (e.g., Prendergast, 1999).

The experimental study of conflict using games of strategy can help to overcome some of these problems. Experimental games are stylized models of behavior, including clearly defined sets of players, decision strategies and pay-offs. If implemented experimentally they involve real interactions between participants, (often but not always) avoidance of deception, and, importantly, monetary incentives in order to render decisions making consequential. As with other experimental paradigms, experimental games allow researchers to test theoretical predictions about conflict without confounding effects and endogeneity issues.

In addition, economic games offer some distinct advantages. Research on games originated from their theoretical study, in particular with the development of *game theory* (Von Neumann & Morgenstern, 2007). As such, there exists a comprehensive mathematical framework that allows researchers to analyze interactive situations and to make precise theoretical predictions for the behavior of rational players "in equilibrium". Rationality implies that players have consistent preferences over a set of clearly defined choices and

make decisions (even in the face of complexity) to maximize their own utility. While many assumptions underlying rational decision making have been called into question (Camerer, 1999), equilibrium predictions can nonetheless serve as useful benchmarks against which to compare observed behavior. In addition, most experimental games simplify real-life situations by abstracting from specific contextual details and attempt to model (only) the critical features of the phenomena under question. If done well, a game can therefore be used to transcend specific examples, capture their structural essence, and lead to a generalized understanding of the phenomena.

Given these strengths, economic theory and experiments have been highly successful in studying human cooperation and coordination (e.g., van Dijk & De Dreu, 2021), and shed light on many related phenomena such as social preferences (Van Lange et al., 2013), cooperative beliefs (Pruitt & Kimme, 1977), (emotion) signaling (e.g., Ellingsen et al., 2018, Vranceanu & Dubarth, 2019), reputation and gossip (Sommerfeld et al., 2007, Shank et al., 2019), and (in)direct reciprocity (Axelrod & Hamilton, 1981; Balliet et al., 2011).

Contest Games

Although a variety of games of strategy have been designed to study conflict and cooperation, a specific subset of games, so called contests, is of particular interest here as they model situations in which collective rationality dictates participants to avoid conflict, and self-interest dictates some competitive action is required. Specifically, a contest can be defined as a situation in which two or more contestants have the opportunity to invest costly and non-recoverable resources in order to affect the probability of winning a prize (Konrad, 2009). While originally developed to study lobbying for government contracts (hence the alternative name of “rent seeking”-games; Tullock, 1988), contest games are highly versatile and can be used to model any competition of individuals or groups over a prize. Indeed, researchers have applied contest models to study a wide range of conflicts between (groups

of) individuals, ranging from elections (e.g., Millner and Pratt, 1989; Davis and Reilly, 1998), to litigation and "lawfare" (e.g., Coughlan and Plot, 1997, Dechenaux and Mancini, 2008), to strategic behavior in wars (e.g., Borel, 1921; Linster et al., 2001).

The two most prominent contest models are Tullock's (1988) rent-seeking contest and all-pay auctions (Hillman and Riley, 1989, Baye et al., 1996). These two differ in their contest success function, that is, the way in which contest success is decided. Tullock contests determine the winner of the contest probabilistically, using the ratio of individual player inputs, whereas all-pay auctions decide the outcome deterministically - the contestant with the highest investment wins the contest. As alluded to above, contest games are characterized by a tension between individually rational and socially optimal behavior. In the Tullock contest, for example, the socially optimal (pareto-efficient) level of investment for the competing parties is zero, since all resources spend on conflict are non-recoverable. In equilibrium, however, rational players will always spend some of their resources on conflict. Since all players engage in the same level of conflict the probability of each player winning the conflict stays constant, making conflict investments both unproductive and socially wasteful.

Both models have been extensively studied in controlled laboratory settings. Experiments are often concerned with variations in contest design - for example, by varying the decisiveness of the player's relative investments (Millner and Pratt, 1989; Potters et al., 1998) or by investigating a sequential decision-making protocol (e.g., Weimann et al., 2000; Sheremeta, 2010). One striking and consistent result emerging from this literature is the significant overinvestment into conflict compared to equilibrium benchmarks - contestants behave far more aggressively than they should, assuming rational play (Dechenaux et al., 2015; Sheremeta, 2014).

While conflict frequently arises over exogenous prizes, often individuals or groups compete over endogenously produced wealth and possessions. This is recognized by so-called "Guns-vs-Butter"-models that focus on the trade-off between production and conflict as two fundamental, yet distinct modes of economic activity (Haavelmo, 1954; Pareto, 2014). For example, Hirshleifer (1988, 1991) and Skaperdas (1992) model this choice as a contest in which two parties divide their initial endowment between an investment in (joint) productive activity and efforts at appropriating the produced wealth. As with other contest models, equilibrium analysis indicates that, while peaceful production is socially optimal, rational players will engage in some level of inefficient and wasteful conflict. Hirshleifer (1991) studies wealth inequality and demonstrates that, in contrast to the popular notion that "the rich get richer, and the poor get poorer", under most conditions, the initially less well-endowed side improves its position compared to its better endowed opponent (the "Paradox of Power"). Experimental results (Durham et al., 1998) largely confirm theoretical predictions - interestingly, however, without finding the typical overinvestment, suggesting that the option for production attenuates the irrational aggressiveness characteristic of pure contest games.

Intergroup Conflict

Although the discussed models have been applied to the study of group conflict, there is a crucial limitation: Groups are made up of individual members, and within-group dynamics play an important role in the initiation, escalation, and settlement of intergroup conflict (De Dreu & Triki, 2022). For example, groups engaging in conflict face problems of cooperation: All group members benefit if they coordinate their actions and act collectively when in competition with another group. However, individual contributions are costly (including, in the case of violent conflict, sacrificing group members' lives), creating a strong incentive to defect and to free-ride on other group members' contributions (Bornstein, 2003).

To study these dynamics, and especially the tension between free-riding by not participating in conflict and making costly contributions that escalates wasteful conflict, researchers have modelled intergroup conflict as two-level contests, with individual players nested in groups which, in turn, are nested within an (adversarial) intergroup system. For instance, researchers have extended Tullock's rent-seeking contest to a group-based version, the Group Lottery Contest (Abbink, 2010). Group members of two groups compete by contributing to local group pools on which basis the likelihood of winning an exogenous prize is determined. Each winning group member then receives an equal share of the prize. Studies observe high levels of intergroup conflict and, as with 2-player contests, demonstrate substantial overinvestment compared to equilibrium predictions (Abbink, 2010, 2012; Sheremeta and Zhang, 2010; Ahn et al., 2011). Indeed, the introduction of institutions that are typically observed to reduce free-riding within groups – including leadership (De Dreu et al., 2016), punishment (Abbink, 2010; De Dreu et al., 2016), and communication (Cason et al., 2012, 2017) – only exacerbates this effect: Group members free-ride less which results in more wasteful and inefficient over-aggressiveness between groups and an overall escalation of conflict.

Further evidence that people will engage in intergroup competition if beneficial to the ingroup comes from research on the Intergroup Prisoner's Dilemmas Game (Bornstein, 1992, see Bornstein, 2003 for a review). Group members have to decide whether to contribute to a public good which offers a return but simultaneously inflicts a cost on the other group. Despite the harmful effect on the other group, contributions are substantial. In fact, compared to an otherwise structurally identical public good, group members are almost twice as likely to cooperate if negative externalities are present (Bornstein & Ben-Yossef, 1994). An extended version - the Intergroup Prisoner's Dilemma-Maximizing Difference game - introduces an additional within-group public good to each group. Contributions to both the

in-group and the between-group pool serve in-group welfare equally, and the only reason for investing in the between-group pool, thereby imposing a negative externality, is to punish the other group. Experimental results indicate that, if given the choice, groups prefer to contribute to the purely cooperative within-group pool, but invest also, albeit to a lesser and less consistent degree, into the competitive between-group pool (e.g., De Dreu, 2010, Halevy et al., 2008, 2012; Schweda et al., 2019, Weisel & Böhm, 2015, Weisel & Zultan, 2022).

The experimental research therefore suggests that if negative interdependencies between groups exist, group members will contribute substantially to intergroup conflict, exceeding the amount of contribution that would be expected from rational players. Nonetheless, groups prefer peaceful (parochial) cooperation if options for such are present. A key question is therefore under which conditions intergroup relations change from peaceful (within-)group cooperation to intergroup conflict. Recently, De Dreu et al. (2020) have suggested that endogenously (e.g., through group growth and expansion) or exogenously (e.g., through natural disasters) created carrying capacity stress can serve as a cause for groups to engage in intergroup conflict.

Carrying capacity stress occurs when a groups' demand for resources exceeds the available supply and falls short of what the group needs or is accustomed to (Read & LeBlanc, 2003; Tyler et al., 2021). Indeed, De Dreu et al. (2022) demonstrate experimentally that carrying capacity stress, induced through a risk of destruction of group members' endowments, triggers out-group aggression and (attempts at) appropriating resources from others. An accompanying analysis of archival data on interstate conflicts likewise showed that states were more likely to engage in warfare when their economic and climatic conditions were more volatile and unpredictable prior to conflict.

Asymmetric Conflict and the Attacker-Defender Contest

Not all conflicts occur between two parties competing over an exogenous prize. Structurally, many, if not most, conflicts occur between a party that wants something that another party tries to prevent from happening (De Dreu & Gross, 2019). Often one of the parties has an initial claim to a resource, giving rise to an asymmetric conflict structure (Grossman and Kim, 1995). From predator-prey dynamics in the animal kingdom (Packer & Ruttan, 1988; Bailey et al., 2013), to hostile take-overs in the business world (Schwert, 2000), to military invasions of one state by another, conflict is often a struggle between an "attacking" and "defending" party. Indeed, two-thirds of 2000 interstate conflicts since 1816 were between a revisionist aggressor - seeking a change in territory, policy, or government - and a non-revisionist defender (De Dreu et al., 2016).

Recent work (Chowdhury & Topolyan, 2016; De Dreu et al., 2015, 2016, 2019, 2021; Gross et al., 2022; Rojek-Giffin et al., 2019; Romano et al., 2022) has investigated such asymmetric conflict more closely utilizing both economic analysis and experimental methods. The Attacker-Defender Contest (henceforth AD-C; see De Dreu & Gross, 2019, for a review) consists of two (or more) players, one in the role of an "attacker", one in the role of "defender". Attackers can invest (part of) their endowment into attack and attempts at appropriation, defenders can invest (part of) their endowment to try to prevent such appropriation. If the attacker's investment exceeds that of the defender, the attacker will appropriate all of the defenders remaining resources. Investments are always wasted so both the attacker and defender have to balance the costs of conflict against the prospect of an uncertain gain (for attacker) or loss (for defender).

Results from multiple experimental studies (e.g., De Dreu et al., 2015; De Dreu et al., 2016; Rojek-Giffin et al., 2020) indicate that defenders spend both more and more frequently on defense than attackers on aggression. As a result, attacks are only successful about 30% of

the time - closely resembling success rates in interstate warfare, corporate hostile takeovers, and group-hunting predators (De Dreu, Gross, et al., 2016). Nonetheless, since attackers spend overall less on conflict while profiting from appropriation at least some of the time, they realize substantially higher earnings than defenders. As with other conflict games, both attackers and defenders overinvest into conflict when compared to equilibrium predictions.

2. Outline of Thesis

This thesis presents three empirical chapters that explore how to reduce asymmetric conflict and, specifically, how to demotivate attackers and prevent aggression against defenders. The following sections provide a detailed outline of the empirical chapters.

Chapter 2

When faced with the threat of aggression, a defending party can respond in several ways. They can adapt by fighting, they can attempt to flee or migrate away from the aggressor, or they can try to "befriend" or appease a potential aggressor with gifts and related payments. "Befriending" is a risky strategy but can also be successful. For example, the British Government unsuccessfully attempted to appease Nazi Germany by accepting the annexation of the Sudetenland from Czechoslovakia, resulting in the invasion of Poland in 1938 (Ripsman & Levy, 2008). On the other hand, the Chinese tributary system is an example of how tributary payments ensured stable relations between China and its neighboring states for long periods of Chinese history (Kang, 2010). In chapter 2, two experiments investigate if defenders will make use of the option to transfer resources and if such transfer will be effective in reducing aggression.

Standard economic theory predicts that attackers will exploit any resource transfers and lower their attack investments only to account for the defenders' diminished capacity of defense (Méder et al., 2022). A rational defender, in turn, should anticipate this and refrain from any transfer of resources. From a behavioral perspective, however, there is reason to

assume that defenders will make use of the option to transfer. Indeed, work on bargaining and reciprocal tension reduction suggests that conciliatory messaging and making small unilateral concessions can be effective in building trust, reducing punitive actions and increasing cooperation (Boyle and Lawler, 1991; Large, 1999, Lawler et al., 1999, Osgood, 1962), including in prisoner's dilemmas (Lindskold & Han, 1988) and other bargaining games (De Dreu, 1995). On the attackers' side the notion that defender transfers can appease attackers is based on a general norm of reciprocity (Cialdini, 1984; Cialdini & Goldstein, 2004; Gouldner, 1960; Regan, 1971) - attackers may feel compelled to "return the favor" by not attacking. This possibility would, for example, resonate with extant work on trust games in which trustees have no rational interest in returning anything, and yet abide by some implicit norm of reciprocity and back-transfer a non-trivial amount (Berg et al., 1995; Chaudhuri and Gangadharan, 2007; Cox, 2004).

We conducted two experimental studies to investigate the use of resource transfers as a strategy for reducing aggression. In the first study, we compared the AD-C with the Transfer Attacker-Defender Contest (TAD-C). In the TAD-C, participants go through an additional stage before the contest where the defenders can transfer some of their endowment to the attackers. The defenders can defend themselves with whatever resources they have left after the transfer, while the attackers can use their endowment and any transferred resources for investments in attack. In the second study, we employed a strategy method of the TAD-C for both attackers and defenders to replicate our results and better understand participants' decision-making. We tested the expectations that defenders have towards attacker aggression after transfer and the influence of social value orientation and probability of transfer on attacker aggression.

Results from study 1 showed that defenders in the TAD-C used the option to transfer resources, presumably as a means of appeasing attackers. A comparison of AD-C and TAD-C

showed that the transfer option was effective in reducing overall conflict. Both attackers and defenders invested less in conflict in the TAD-C, but attackers benefited disproportionately. The added wealth inequality in the TAD-C was explained through the voluntary transfer of resources from defenders to attackers. Transfer had other shortcomings as well. While defenders significantly lowered their defense spending when they transferred resources, attackers did not significantly decrease their aggression, leading to higher attacker success and increased earning disparity in favor of attackers in the trials involving transfer.

In study 2, we replicated some of the findings from the interactive experiment. In particular, defenders made use of the option for peaceful transfer and expected attackers to aggress them less when they did, lowering their defense investment. Attackers exploited this by using transferred MU to increase aggression at lower levels of transfer and adjusting their conflict spending according to the defenders' remaining endowment at higher levels of transfer. This effect was moderated by social value orientation, especially at lower levels of transfer.

Overall, our results suggest that asymmetric conflict indeed can be alleviated by providing the defending party with an alternative to transfer (some of their) resources to the attacker. Results were mixed, however, since some attackers exploit transfers by aggressing the defender, a behavior (in part) moderated by social value orientation. In chapter 3, we explore another approach to reducing conflict in the AD-C, in particular, by providing outside options for wealth production.

Chapter 3

To advance their own social and economic prosperity, humans can invest in the production of goods and services, or in the appropriation of goods and services provided by others (Haavelmo, 1954; Pareto, 2014). In Chapter 3, we explore whether adding production

opportunities to an asymmetric contest can reduce attackers' attempts at appropriation, and how these production opportunities affect conflict dynamics overall.

Scholars in political economy and conflict studies (Maoz & Russett, 1993a; Rousseau, Gelpi, Reiter, & Huth, 1996; Wittman, 2000) have suggested that providing individuals or groups with alternative ways to produce wealth may reduce the temptation to engage in aggression. For instance, providing criminal offenders with job opportunities has been shown to decrease their likelihood of committing crimes such as burglary (Becker, 1968; Uggen & Shannon, 2014). Similarly, firms with more innovative research and development activities are more likely to engage in friendly rather than hostile takeovers (Bena & Li, 2014). However, the idea is not without critics (Luce, 2015) and evidence for it is mixed. In fact, creating opportunities for economic production may actually increase the probability and intensity of conflict by incentivizing aggressors to appropriate produced wealth (cf. the "natural resource curse"; Brunnschweiler & Bulte, 2009; and the "paradox of power"; Hirshleifer, 1988, 1991; Olsson, 2007; van der Ploeg, 2011).

We conducted a game-theoretic analysis and an experiment to investigate the effects of production opportunities on asymmetric conflict. For both the analysis and the experiment, we compared the AD-C to an extended version called the PAD-C (Production Attacker-Defender Contest). In the PAD-C, players have the option to invest some of their endowment in production in order to achieve a payoff. In order for a player's production investment to be successful, it must meet or exceed a certain threshold. For our theoretical analysis, we examined how the predictions for equilibrium play changed based on the production threshold and production payoff. In the experiment, we compared the AD-C to the PAD-C to test the predictions generated by our model. To keep the PAD-C unpredictable for human participants, the production threshold varied randomly across rounds.

Our game-theoretical analysis shows that having opportunities for economic production can reduce conflict expenditures and promote equality in wealth distribution. However, the ease with which production can be achieved (the "production threshold") plays a role in determining the level of aggression and inequality. When production thresholds are low, our model predicts that there will be less aggression and more equal wealth distribution. On the other hand, when production thresholds are high and difficult to meet, our model predicts that there will be more predatory behavior and unequal wealth distribution favoring attackers. The ease with which successful production can be realized is therefore a key factor in the emergence or decrease of predatory conflict.

Our behavioral experiment largely confirmed the first prediction of our theoretical model: providing opportunities for economic production can reduce attacker aggression and overall conflict. In the PAD-C, individuals did not invest less frequently in attack and defense, but their investments were of overall lower magnitude. In other words, conflict became less intense when participants had alternative means to accumulate wealth other than through predatory aggression. In addition, we observed that individuals were often successful at production, and as a result, contestants in the PAD-C became wealthier than those in the AD-C. However, the unchanged frequency of conflict limited the defenders' resources available for production and defenders were unable to accumulate as much wealth as their attackers. As a result, wealth disparities increased in favor of attackers.

In sum, chapter 3 explores the effects of providing contestants in an asymmetric conflict with an alternative means to generate wealth through production. Our findings show that such production opportunities can help to reduce attacker aggression and the intensity of conflict. In Chapter 4, we further investigate the impact of production opportunities on asymmetric conflict, specifically in a group setting.

Chapter 4

To sustain and support themselves and their members, groups need to cooperate on club goods in order to produce food, goods or services (such as healthcare and education). Groups can also cooperate on aggressing and appropriating resources from other groups or - if targeted by such aggression - on defending themselves. In chapter 4, we examine if and how carrying-capacity stress on the (peaceful) production of resources via a club good is related to the emergence of outgroup aggression and intergroup conflict.

Carrying-capacity stress emerges when group members' individual and collective needs and desires exceed resource availability (see e.g., Read & LeBlanc, 2003; Tyler et al., 2021) or when resource supply and returns from club goods become erratic and unpredictable (Bloom, 2009; Duncan, 1972; Ellis, Figueredo, Brumbauch & Schlomer, 2009). Individuals dislike unpredictability and invest cognitive and physical effort to reduce uncertainty and create stable and predictable futures (Kruglanski, Pierro, Mannetti, & De Grada, 2006; Landay, Kay & Whitson, 2015). In response to carrying-capacity stress, individuals may decrease their contributions to local club goods, leading to a classic "tragedy of the commons" in which groups are worse off collectively (e.g., Gustafsson, Biel & Gärling, 2000; Messick et al., 1988; Rapoport et al. 1992; Van Dijk et al., 1993; Wit & Wilke, 1998). However, external threats and environmental disasters can also increase within-group commitment and solidarity (De Dreu, Gross & Reddmann, 2022; Hogg, 2002; Barth, Masson, Fristsche & Ziemer, 2018), as well as willingness to contribute to group-benefitting club goods (Lojowska et al., 2022). Indeed, individuals may seek alternative ways to sustain their group, such as expanding their territory and engaging in hostile attacks on neighboring out-groups. If true, we would expect carrying-capacity stress not only to reduce cooperation on local club goods with uncertain returns, but also to increase participation in collective aggression against out-groups.

To examine the possibility that individuals in groups under carrying-capacity stress invest energy in competing for resources with other groups, we created an experimental model in which six individuals were nested in two groups of three. Within each group, individuals were given an endowment from which they could make contributions to a local club good or to conflict. To operationalize and manipulate carrying-capacity stress, we made the group benefit from club good provision either predictable (Mean Per Capita Return, MPCR = 1.5 on every trial) or unpredictable (MPCR being 0.5 in half of the trials and 2.5 in the other half). Hence, in the one condition, in-group cooperation created a predictable amount of wealth, shared across all group members whereas in the other condition, in-group cooperation could sometimes lead to a very low and sometimes to a very high return for the group. In addition to their club goods, individuals could also contribute to a contest with the other group. This contest was designed as a group attacker-defender game. Thus, in addition to their local club good, participants could contribute towards out-group attack or, in the other group, in-group defense. This setup provided attackers with an alternative means to obtain resources for their group. Participants played the game for 80 decision trials, with 4 counterbalanced blocks (of 20 trials each) manipulating the (un-)predictability of attackers' and defenders' local club good. Across trials, the expected value (assuming risk neutrality) of the groups' club goods was the same in all treatments, but the predictability of the returns differed.

Despite the expected utility of club good contributions being the same under standard economic theory, experimental results indicate startling differences in behavior for both attackers and defenders under uncertainty. Under the uncertain condition, attackers substantially lowered their club good provision, decreased coordination, and more frequently opted to invest nothing. In turn, they demonstrated improved conflict coordination and increased their overall investments in out-group attacks. In fact, both uncertain returns in the

attacker club good and certain returns in the defender club good were associated with increased investment into attack. Defenders, however, adapted their defense investments to the attackers' aggression. As a result, appropriation attempts were unsuccessful, did not contribute to higher attacker earning, and thus increased attack investments under attacker uncertainty were ultimately wasted. Despite no change in the expected value of their choices, because of the breakdown in contribution to their club good, attackers earned less under uncertainty than when club good returns were certain. Attackers also earned less than they could have if they wasted less resources on conflict and simply kept more resources to themselves. Defenders' earnings likewise declined when either their own or the attacker's club goods was uncertain. Thus, an uncertain environment increased wasteful conflict, leading to a decline in the overall social welfare, particularly when the attacker groups faced an uncertain club good.

Overall, chapter 4 complements chapter 3 by demonstrating that production opportunities can be a successful means of reducing asymmetric conflict in a group setting. Importantly, however, a productive club good needs to provide stable, predictable returns. Under uncertain conditions, club good cooperation breaks down, and group members put (a part of) their resources into out-group aggression, leading to overall more wasteful conflict, and reduced earnings for both attackers and defenders.

3. Conclusions

The present dissertation uses theoretical models and experiments to investigate if and how asymmetric conflict can be reduced or resolved, and, in particular, how the attacking party can be demotivated from aggression. Across three empirical chapters I provide first answers to this question. In chapter 2, I introduce the option for peaceful resource transfers from defenders to attackers. In chapter 3, I provide contestants with an alternative to generate wealth in the forms of (risky) production opportunities. In chapter 3, I extend such

productions opportunities to a group setting and investigate how (un-)predictable returns to a local club good effects cooperation and inter-group conflict. While experimental designs and manipulations across these chapters differ, findings allow for the following generalizations:

1. *Both attackers and defenders use peaceful alternatives for wealth generation if they are provided.*

In chapter 2, I show that defenders use the option for peaceful resource transfers at least some of the time. In chapter 3, both attackers and defenders invest into production opportunities if they are provided. And in chapter 4, attackers and defenders cooperate on productive local club goods, especially if the returns from these club goods are predictable (rather than unpredictable).

2. *Peaceful alternatives for wealth generation reduce attackers' aggression, but do not fully eradicate conflict.*

The introduction of transfer options (Chapter 2), the provision of production opportunities (Chapter 3) and of productive club goods with predictable (rather than unpredictable) returns (Chapter 4) reduce attackers' aggression significantly. Across all studies I also observe that defenders simply adjust their defense investments to attacker behavior, resulting in an overall decrease in conflict spending. Reductions in conflict were mostly explained through significant reductions in the magnitude and either no (Chapter 3) or only modest (Chapter 2 and 4) decreases in the frequency of conflict investment. In other words, contestants continue to engage in conflict, but conflicts become less intense.

3. *Because less resources are spent on wasteful conflict, the introduction of peaceful alternatives for wealth creation is of mutual benefit.*

Across all three chapters, we observe that both parties increase their overall earnings when peaceful alternatives to conflict are present. In all studies, earnings increase due to

reduced investments into wasteful and destructive conflict. In chapter 3 and 4, both parties additionally benefit from the provided opportunities for peaceful wealth generation.

4. *Peaceful alternatives for wealth creation benefit attackers more, paradoxically leading to more wealth inequality compared to when peaceful alternatives are absent.*

Due to defenders adjusting their defense investments to attackers' aggression, in all three chapters attack success rates stay constant across manipulations, excluding changes in resource appropriation as a cause of increased attacker earnings. In chapter 2, the increased inequality favoring attackers can be explained exclusively due to resource transfers increasing the attackers' (and decreasing the defenders') payoffs. In chapter 3 and 4, the threat of aggression results in defenders spending both more and more frequently on conflict then attackers. Compared to attackers, this restrains defenders in their ability to take advantage of production opportunities. Attackers, on the other hand, can more efficiently allocate their resources between conflict and production when production facilities are present (Chapter 3) or contribute more to a club good with predictable returns (Chapter 4), and thus realize higher earnings. Attackers' strategically advantaged position thus helps them to take greater advantage of the conflict alternatives that we provide.

5. Peaceful alternatives to wealth creation eliminate over-investment in conflict and align contestants' behavior more closely with theoretical predictions based on rational selfish play.

While not the primary focus of this dissertation, it is noteworthy that in the two chapters that include equilibrium analyses, providing participants with peaceful alternatives reduces conflict over-investment usually found in contest games (Dechenaux et al., 2015; Sheremeta, 2014). In chapter 2, game theory posits that rational defenders should not make use of the option to transfer, and thus predictions are the same for the AD-C and its extended version. The behavioral data, in contrast, show strong conflict overinvestment in the AD-C while investments in the extended version approach theoretical benchmarks. In chapter 3, the

introduction of production opportunities changes theoretical predictions compared to those for the AD-C. Nonetheless, I again observe significant conflict overinvestment in the AD-C while participants' behavior in the extended version including production opportunities closely aligns with the theoretical analysis.

Discussion

Preventing a conflict by appeasing a potential aggressor can work in some cases but as demonstrated in chapter 2, comes with a significant risk of emboldening the aggressing party and being exploited. Indeed, examples of failed appeasement strategies abound in history and its risks have been well demonstrated by previous scholarly work (Treisman, 2004). Providing opportunities for production and peaceful cooperation, as indicated by chapters 3 and 4, might therefore be a more fruitful means to reduce the intensity of conflict in general and predatory aggression in particular. Depending on the context, policy makers aiming to reduce conflict might therefore focus on creating such opportunities. For example, policy makers wanting to reduce crime could focus on providing labor market opportunities such as improved access to education, (re-)employment programs, and wage increases (Draca and Machin, 2015). Governments and international institutions wanting to reduce violent conflict and war should aim at promoting economic development, for example, through foreign aid (cf. Nielsen et al., 2012) and by creating conditions conducive to economic growth (Hegre & Nygård, 2015).

My research demonstrates that alternatives to conflict reduce but do not eliminate conflict. Indeed, as has previously been argued "individuals, groups or nations are rarely if ever, totally at war or totally at peace" (Hirshleifer, 1988). Instead, resources are divided amongst productive and conflictual activity, especially if a longer time horizon is taken into account (Hirshleifer, 1988, 1995). While this finding at first might appear somewhat pessimistic, it must not necessarily be seen this way. The reduction (rather than eradication)

of conflict can make a big difference and might in some cases even be desirable: An athletic competition is better than a knife fight, a clash in court is better than one on the street, and a "cold" war is preferable to a "hot" one.

As illustrated, being aggressed (or the threat of being aggressed) necessitates investing scarce resources into defense which impedes investment into production. Indeed, similar dynamics have been observed across disciplines. Plants face a trade-off between defending against herbivores (through a variety of physical and chemical means) and other functions related to evolutionary fitness. For example, it has been demonstrated that contact with herbivores can reduce plant growth (see Züst and Agrawal, 2017, for a recent review). Likewise, companies in less competitive markets are more innovative and productive (Aghion, Bloom, Blundell, Griffith, & Howitt, 2005; Chemmanur & Tian, 2018; Conti, 2014) and defense spending can have a detrimental effect on countries economic growth (Dunne and Tian, 2013).

Results for the "pure" attacker-defender contests in Chapter 2 and 3 replicate a typical finding of experimental contest games: Significant overinvestment into conflict relative to the standard Nash equilibrium benchmark (De Dreu et al., 2021; Sheremeta, 2013). In contrast, no such deviations from equilibrium could be found when adding peaceful alternatives in the form of transfer options (Chapter 2) or production opportunities (Chapter 3), a finding that is mirrored in the scarce experimental literature on "Guns-vs-Butter"-models (Durham et al., 1998). While the reason for over-investment in competitive environments is an open question (Dechenaux et al., 2015; Sheremeta, 2014), one interesting possibility is that humans, instead of maximizing absolute pay-offs as posited by game theory, are evolutionarily adapted to maximize pay-offs relative to the other party and therefore express spiteful preferences (Hamilton 1970; Hehenkamp, Leininger, and Possajennikov 2004; Leininger 2003; Frey and Stutzer, 2003). Thus, providing outside options might have provided attackers with an

alternative means to maximize their pay-offs relative to the other party. This explanation would fit our observations that providing alternatives increased the overall inequality in favor of attackers.

Future Research

In my studies, attackers were in an advantaged position and therefore benefited more than defenders from the peaceful alternatives to conflict that were provided. Further experimental research could therefore examine ways in which to alleviate conflict while archiving more equitable outcomes.

In chapter 4, I show that carrying capacity stress can lead to a break-down in in-group cooperation on a productive club good and a (partial) switch to out-group aggression. The interaction between environmental and economic conditions, within-group dynamics, and intergroup cooperation and competition is an understudied area, and experimental researchers have only begun to explore it. For example, it has been suggested that economic threat and turmoil gives rise to authoritarian leadership structures (e.g., Miller, 2017). Further research could explore if and how uncertain economic conditions affect support for leadership institutions, and if, in turn, such institutions might increase outgroup aggression. In a similar vein, researchers could explore the use of punishment if club good returns turn (un-)certain. It would be interesting to investigate whether groups under (un-)certainty would increase punishment not only to prevent free-riding, but also, depending on the condition, to curb club good contributions vs outgroup aggression.

Economic games abstract from specific contextual details of a situation and attempt to model the critical features of the phenomena under question, hoping to achieve a generalized understanding. Economic experiments are also limited, however, by using such an artificial and stylized environment. De Dreu et al. (2016, 2022) show that conflict dynamics found in the experimental study of the AD-C extend to other data such as corporate takeovers and

interstate disputes. Further research could validate my findings by integrating them with data from real-world settings. For example, it would be interesting to see if countries or companies in a "defending" position exhibit higher defense spending (e.g., investment in marketing rather than new product development) and negative economic growth and how inequality between attacking and defending parties is affected.