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Stein T. Holden and Mesfin Tilahun

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Does War Enhance or Undermine Other-regarding Preferences and Trust?

Stein T. Holden[1*] and Mesfin Tilahun[1,2]

[1*]School of Economics and Business, Norwegian University of Life Sciences, P. O. Box 5003, 1432 Ås, Norway.
[2]Department of Economics, Mekelle University, Mekelle, P. O. Box 451, Tigray, Ethiopia.

*Corresponding author(s). E-mail(s): stein.holden@nmbu.no;
Contributing authors: mesfintilahungelaye@gmail.com;
mesfin.telahun.gelaye@nmbu.no;

Abstract

Our study investigates how the devastating 2020-2022 Tigray War has affected the social preferences, reciprocity norms, and trust in a large sample of rural young adults in Tigray, Ethiopia, belonging to rural business groups. We rely on field experimental data with standardized incentivized experiments conducted in 2019 and 2023 to categorize subjects into social preference types. We also identify reciprocity norms, generosity, trustworthiness, and trust in in-group and out-group conditions for a large balanced sample (N=1939). The in-group framing is for subjects belonging to the same business group (N=238 business groups). The out-group is an unknown person from another business group in the same district. Overall, the war in Tigray has resulted in an erosion of within-community social capital. This erosion of social capital includes weakened reciprocity norms, a reduction in the share of the population that behaves altruistically or egalitarian, and a reduction in generosity, trustworthiness, and trust (reduction of 0.6-0.75 Cohen's d units) that is strongest among those who behaved altruistically or egalitarian before the war. The same and similar effect sizes are also prevalent within business groups, but within business groups, social capital remains high compared to generalized social capital in the study areas. To a small extent, we find that differential exposure to violence or other war incidents among subjects explains the fairly large changes in social

capital that our experiments revealed. This may imply that the war spillover effects overshadow the effects of individual war exposure.

Keywords: War impacts, Social preferences, Reciprocity norms, Trust, Field experiment, Rural business groups, Ethiopia

JEL Classification: C93 , D74 , D84 , D91 , O12

1 Introduction

Multiple studies have been conducted to examine the impacts of past wars on society. Many impacts, such as destroyed physical infrastructure and buildings and loss of lives, are identifiable and physically observable. It has been believed that wars mostly produce negative outcomes for all kinds of capital (Collier et al., 2003). However, more recent literature has found indications that some forms of social capital may be strengthened through a war, lead to more collaboration, and may contribute to the rebuilding of a society after a war (Bauer et al., 2016; Bauer, Cassar, Chytilová, & Henrich, 2014; Bauer, Fiala, & Levely, 2018; Blattman, 2009; Cecchi, Leuveld, & Voors, 2016; Gilligan, Pasquale, & Samii, 2014; Voors et al., 2012).

The fact that wars and war exposure cannot be randomized in controlled experiments implies that the authors of these studies had to rely on natural experiments to assess such impacts. Many of the studies relied on standardized experiments such as dictator and trust games to get standardized measures of social capital. Natural experiments can rarely provide a perfect counterfactual that can be used to get unbiased measures of the effects of interest. None of the studies in the literature had such a pre-war measure of social capital for the subjects they studied after the war. Each study measured social capital at varying times (6 months to 13 years) after the war but not repeatedly for the same subjects. For identification, they relied on recording the different degrees of exposure to war incidents, especially violence, and measuring the impacts of war exposure by comparing the social capital measures of those exposed to violence with those not exposed to such war violence. A meta-study of such impact studies by Bauer et al. (2016) concludes that such war exposure can enhance social participation and cooperation, lead to more in-group prosocial behavior, and enhance altruism towards members of one's group. Moreover, they find a tendency for these effects to increase with time after the war.

The Tigray War started on November 4th, 2020, and ended on November 2nd, 2022, with a Cessation of Hostilities Agreement between the Ethiopian government and the Tigray People's Liberation Front (TPLF) in Pretoria. This war has been called the worst organized violence since the Rwandan genocide in 1994 (Davies, Pettersson, & Öberg, 2023). The Tigray War has also been called a forgotten war, as the wars in Ukraine and Gaza have received much more attention in international media. The Tigray War may have resulted in

the death of up to 380,000 civilians and between 100,000 and 200,000 soldiers and the internal displacement of more than 2 million people in a region with a total population below 6 million before the war. The number of civilian deaths has been decomposed to about 10% due to bombing and massacres, 30% due to lack of medical assistance, and about 60% due to starvation (Nyssen & Naranjo, 2023). While the Tigray War has been called a civil war, the local population perceived their enemies (Federal Government soldiers, Eritrean soldiers, and militia groups from neighboring regions) to come from the outside. Our study focuses on how this war has affected the social capital within the Tigray population and relates the findings to other studies of war impacts on social capital.

Our study is unique in the sense that we have been able to measure the social capital of a large sample (N=2425) just before (2019) the devastating Tigray war (2020-2022) and one year after (2023), the war formally ended (N=1939 of the same subjects). We used several incentivized experiments. First, we used the games of Fehr, Glätzle-Rützler, and Sutter (2013) and Bauer, Chytilová, and Pertold-Gebicka (2014) to classify subjects into social preference types in in-group and out-group contexts. The in-group consisted of anonymous members belonging to the same business group. The out-group was defined as another unknown person who is a member of another business group within the same district. Second, the subjects participated in standard and triple dictator games with the same in-group and out-group framing. Third, the subjects played the trust game, and all played both as trustors and as trustees using the strategy method. This game was followed up with reciprocity norm questions related to how obliged subjects felt to return at least an amount as large as that sent by the trustor in the game. And finally, we asked about the expected returns in the trust game. The same in-group and out-group framings were used for all these games, as well as the follow-up reciprocity norm and expected trustworthiness questions. Which of the in-group and out-group versions of each game became real and was randomly determined for each game after all the games had been played.

Our sample consists of resource-poor rural young adults who joined formalized youth business groups some years before the war started to obtain a complementary source of livelihood. The local government used this to help landless and near-landless youth by providing each business group an area of typically rehabilitated communal land conditional on the group's ability to organize itself as a primary cooperative, make an acceptable business plan for the sustainable utilization of the area as a source of livelihood. Previous studies have demonstrated that this policy initiative has been quite successful (Holden & Tilahun, 2018, 2021, 2023).

We have not been able to find any other studies that have used standardized incentivized field experiments to study the social preferences and trust of the same sample before and after a war. A unique contribution of our study is that we have standardized measures of social capital before and after the war and

can assess the subject-level changes in these and how they relate to differential exposure to several war-related incidents such as kill threats, harassment, violence, rape, looting, starvation, and having been wounded during the war. We test and control for attrition as 20% of the initial sample could not be included in the post-war study. Using individual fixed effects, we also control for observable and unobservable time-invariant characteristics of individuals, business groups, and communities to assess the total war effects. To relate our study to previous studies, we regressed the post-war social capital measures on the subject-level war incidence measures in line with the previous literature.

Our main contributions to the literature are the following: This is the first study to use incentivized experiments to measure the social capital of the same sample of war-affected subjects before and after a war. Second, it is the first study to combine such before- and after-war experimental outcomes with war incidence exposure variables for the same subjects. Third, it is the first study to classify subjects into social preference types before and after the war, thereby assessing the effect of a war shock on social preference type distributions. Fourth, it is the first study to investigate how individual changes in generosity, reciprocity norm, trustworthiness, and trust are associated with subject- and group-level variation in war incidence exposure. Finally, our large sample allows us to investigate the within-sample heterogeneity in social capital and its changes from 2019 to 2023. This gives new insights into the heterogeneous mechanisms of change in social capital related to the war. Our study allows us to decompose the trustworthiness and trust changes associated with war exposure into changes in reciprocity norms, generosity, and expected trustworthiness by social preference type and as social preference-type distributional changes.

2 The 2020-2022 Tigray war

The war between the Tigray People's Liberation Front (TPLF) and the Ethiopian Government between November 2020 and November 2022 is one of the most devastating in recent history (Meaza, Hishe, & Gebrehiwot, 2024). We will not discuss the complex history behind the war or its progression but refer to insightful studies such as Plaut and Vaughan (2023). We should note, however, that the Tigray region also experienced a civil war before 1991 and a national war with Eritrea from 1998 to 2000. The war with Eritrea is also an essential reason for Eritrea to join the Ethiopian government in the war against TPLF in the 2020-2022 Tigray war. The Amhara Special Forces and the Fano militia in the neighboring Amhara Region also allied with the Ethiopian Defence forces against TPLF. TPLF had a strong influence on the Ethiopian government from 1991 to 2018, being one of four parties in the Ethiopian People's Revolutionary Democratic Front (EPRDF). In 2019, when Abij Ahmed Ali became the new Ethiopian Prime Minister and chairman of EPRDF, he dissolved EPRDF. He merged the three other constituent parties, except TPLF, into his new Prosperity Party.

The war devastated the Tigray economy and social structures (Plaut & Vaughan, 2023) and exaggerated ethnic division in the country that isolated Tigray and its population from other regions. Therefore, the people in our study areas saw the war as a war against outside enemies, not among people within their ethnic group or society.

Estimates of mortality rates associated with the war are uncertain. The latest estimates for the number of civilian deaths ranges from 162,000 to 378,000 (Nyssen, 2024)(Digest 53, Section 3). The war has been characterized as the deadliest in the world in the 21st Century (Abate, 2022). A recent study of deaths among women of reproductive age during the war found that infectious diseases caused 42.6% of the deaths, with HIV/AIDS being the most critical killer (Abraha et al., 2024). In comparison, childbirth-related causes comprised 30% of all deaths. Widespread starvation continued after the war ended in Tigray and in the affected neighboring regions (Nyssen, 2024)(p.287). Sexual violence was widespread during the war (Worku, 2024).

The COVID-19 pandemic also hit in April 2020 and negatively affected the Ethiopian economy. From January 2020 to July 2023, the registered number of infected persons was about 500,000, with close to 7,600 deaths for the whole country (Woreta, 2024). If we assume a proportional share of these to be in the Tigray region, this would amount to less than 500 deaths for a comparison of the number of deaths associated with the war. The effects of the 2020-2022 war are an order of magnitude larger and contributed to the spread of infectious diseases, including COVID-19 and HIV/AIDS.

A recent study also provides evidence that military tactics, such as destroying crops and property and slaughtering livestock, were an important driver of famine (Meaza et al., 2024). This study refers to tactics by Eritrean soldiers in Wukro, one of our study areas, and the destruction of irrigation equipment in Raya, another of our study areas. The cropped area in Tigray was reduced 20-30 % during the war (Peterson, Husak, Shukla, & McNally, 2024). Crop yields were affected by a shortage of inputs such as improved seeds, fertilizers, livestock, and tools (Meaza et al., 2024). Blockage of food aid and theft and corruption in the food aid system (World Food Programme) have caused further hunger after the war ended (de Waal, 2024; Nyssen, 2024).

3 Literature review of War Impacts on Social Capital

3.1 Survey studies

Different types of conflicts may have different effects, e.g., a war with an external enemy may strengthen internal social relations and cooperation. In contrast, a civil war that pits neighbors against each other may undermine social trust (Bellows & Miguel, 2009; Cassar, Grosjean, & Whitt, 2013).

Bellows and Miguel (2009) use nationally representative postwar household data from Siera Leone to study the postwar outcomes of the 1991-2002 civil

war on economic outcomes and collective action. They found that households that were directly exposed to intensive war violence were more likely to attend community meetings, more likely to join political and community groups, and more likely to vote.

Hartman and Morse (2020) investigate whether exposure to violence can increase individuals' capacity to empathize with others and whether such empathy can transcend group boundaries. They use data from 1500 Liberians during the 2010-2011 Ivorian refugee crisis to assess their willingness to help the Ivorian refugees. They found that those who had been exposed to violence during the Liberian civil war were more willing to help the Ivorian refugees.

Kijewski and Freitag (2018) study how the civil war experiences shaped social trust in Kosovo after the war from 1998 to 1999. They use a cross-section survey from 2010 with disaggregated conflict event data to assess individual war-related experiences and community exposure to war based on data from 26 communities. They find that civil war was negatively related to social trust. They suggest that instances of violence have lasting psychological as well as social structural consequences that diminish social trust in the aftermath of war. They admit that due to the cross-sectional nature of their data, they cannot truly uncover the causal mechanism through which war-related violence affects social trust.

Blattman (2009) study war impacts and political participation in northern Uganda. They found that youth who had been abducted and exposed to variant forms of violence were more likely to vote and participate in other political activities. While they tried to investigate alternative causal mechanisms based on their survey data, they did not find evidence that these were related to altered social preferences, such as shifts in altruism.

3.2 Experimental studies

Carlsson, Johansson-Stenman, and Nam (2014) study the stability of social preferences based on repeated observations of the same sample of about 200 households in a community in Vietnam over six years. They combine public goods games with voluntary contributions to build a bridge in the community. They find that the voluntary contributions were stable over time in terms of being strongly positively correlated. However, their sample was not exposed to any severe shocks over the period they studied.

Experimental evidence on war outcomes on social preferences and trust is limited. Most of the studies with experimental variables were conducted after a war. Very few studies include standardized experiments for the same subjects before and after a war. One of the few that investigated aggregate differences in experimental outcomes before, during, and after a war is Gneezy and Fessler (2012). They combined trust and ultimatum games to study responses before, during, and after the 2006 Israel-Hezbollah war. This war lasted only 34 days, and the experimental sessions were run nine months before the war, during the war, and one year after the war ended. The participants were adult

citizens within one housing facility in Tel Aviv and consisted of 20 independent subjects for the wartime group and 30 independent observations for the peacetime group. This allowed the comparison of rejection behavior in the ultimatum game and returning behavior (trustworthiness) in the trust game. As no difference was observed when comparing the pre-war and post-war behavior, these groups were combined and compared to the wartime group. It was found that the wartime group was significantly more likely to reject low offers in the ultimatum game ($\leq$40% of endowment) in the wartime group than the peacetime group. In the trust game, they found that trustees returned, on average, significantly larger shares in the wartime group than in the peacetime group when the amounts sent by trustors were substantial but returned less when the trustors sent small amounts. The study did not collect any information on individual variation in war exposure and relied on a between-subject design and very small samples in their analysis. Their results indicate that stronger cooperation is expected during wartime than peacetime, and costly punishment is more likely to be used during wartime.

All other experimental studies of war effects that we have been able to find only use experiments at different times after the war and without having a baseline study with the same types of experiments. These studies rely on utilizing variation in subjects' exposure to war and try to demonstrate that the variation in exposure to war can be characterized as a natural experiment or, at least, is not strongly driven by selection after controlling for observable and unobservable effects to the extent possible. Causal interpretations of correlations, therefore, have to be cautious. We give an overview of such studies in Table 1. We review these studies more carefully as a basis for identification of the main contributions and limitations of our study.

Bauer, Cassar, et al. (2014) carried out studies in the Republic of Georgia and Sierra Leone with the same type of experimental approach across the two countries (simple binary dictator games with two different in-group and out-group framing conditions).[1] In Georgia, they sampled 3-12-year-old children with varying degrees of war exposure during the short-duration South Ossetia war and played the games with them six months after the war. It is known that social preferences change during childhood and adolescence. In Sierra Leone, they sampled 8-84-year-old adults and played the games eight years after the war ended. They classified the subjects into treatment groups based on differential war exposure (natural experiment). In both countries, they found subjects to become more egalitarian-oriented, with increasing war exposure in the framing of the in-group (same school or kindergarten). War exposure did not have the same strong effect on egalitarian sharing in the out-group (game with an unknown child in a different school or kindergarten). The results, therefore, triggered more pro-social behavior in the in-group framing. Their

[1] We have used the same kind of games in our study to categorize subjects into social preference types.

Table 1 Studies using social experiments to study the effects of violent conflicts on social preferences and trust

Authors, year published	Countries	Experiment type(s)	Timing vs. war	Sample size
Bauer, Cassar, et al. (2014)	Georgia,	Mini-dictator	6 months	565
	Sierra Leone	Mini-dictator	8 years	586
Bauer et al. (2018)	Uganda	Trust game	5 years	337
Cassar et al. (2013)	Tadjikistan	Trust game	13 years	426
Cecchi et al. (2016)	Sierra Leone	Dictator game	8 years	162
Gilligan et al. (2014)	Nepal	Dictator game	3 years	252
		Trust game		
		Public Goods game		
Gneezy and Fessler (2012)	Israel	Ultimatum	1 year vs. during	50
		Trust game		
Voors et al. (2012)	Burundi	Social value experiment	6 years	287

Note:

study may suggest that war exposure generates more emphasis on egalitarian in-group norms or motivations, but they cannot distinguish between these.[2]

Bauer et al. (2018) used the trust game to study the trust and trustworthiness of abducted youth who were recruited as soldiers in Northern Uganda. The study took place five years after the war and included ex-soldiers rehabilitated into their communities. Two groups of trustors (senders) were recruited, one group being too old to have been recruited as soldiers, and one group consisting of younger males (18-34 years old), including some who had been forcibly recruited as soldiers during the war, were recruited as trustees (receivers). Trust was measured by the share of an allocated endowment the trustors sent to the receivers, while trustworthiness was measured by the share of the (tripled) amounts returned by the trustees. Trust in the ex-soldiers was assessed by giving alternative information to the trustors about the abduction history of the trustees. Trustors were also asked about the expected returns and played a triple dictator game to help separate trust from generosity. The study revealed that former soldiers were more trustworthy than young adults without such a history. They also found that trustors did not trust ex-soldiers less than others. Parents who had an ex-soldier son invested significantly more in ex-soldiers, but this was not due to higher generosity towards ex-soldiers but rather due to higher trust in their trustworthiness.

Cassar et al. (2013) conducted trust games in Tajikistan 13 years after the civil war to assess the impact of civil war exposure on trust. They found that exposure to violence undermined trust within communities, especially in communities where there was more infighting and polarization during the civil war. They, therefore, rely on the spatial variation in infighting and political polarization to identify the effects of civil war on trust. Their study indicates that the war impacts on trust last for more than a decade and are unlikely to be explained by selection.

Cecchi et al. (2016) use players in a football tournament in Sierra Leone eight years after the civil war ended as their sample. They studied the within-team and across-team preferences based on dictator games. They related it to the players' war experience recorded in a survey and player behavior in the football tournament. They found that players who had experienced more intense conflict-related violence during the war were more likely to receive a yellow or red card during the football tournament and more likely to behave altruistically within their team but not towards players from other teams. Their robustness checks indicated that the results are not likely to be driven by selection but rather by changes in preferences and attitudes.

Gilligan et al. (2014) studied members of communities with different exposure to Nepal's civil war three years after the 10-year war ended. They combined dictator, trust, and public goods games. They found that communities more exposed to the war demonstrated higher levels of generosity in dictator games, trust, trustworthiness, and public goods contributions. They

[2]In our study, we can distinguish between the social norm to reciprocate and the motivation to share (generosity).

found some evidence of selection as less social persons were more likely to flee from more war-exposed communities and that members with few options to flee built stronger within-community ties.

Voors et al. (2012) studied the impact of the civil war in Burundi by utilizing the variation in the share of the population that died during 1993-2003 and an index for individual exposure to violence in the period. They conducted social valuation, risk- and time-preference experiments in 2009, about six years after the war ended. They found a positive and significant relationship between war exposure and altruistic behavior at the community and household levels, and the results were robust after controlling for ethnic fixed effects and a set of community controls.

Furthermore, Bauer et al. (2016) conducted a meta-study including the reviewed experimental studies as well as a broader set of survey studies of how war violence can affect social cooperation. They noted that many studies have found wars instrumental in societal transformations and strengthening institutions. Bauer et al. (2016) summarize their meta-study by concluding that people exposed to war tend to behave more cooperatively after the war. Their meta-study covered three African countries (Burundi, Sierra Leone, and Uganda), Israel, Nepal, and many European countries. Their general finding was that many people become more prosocial and active after such exposure and have also been found to be more altruistic in experimental laboratory games. They found little systematic difference in outcomes by the type of violence experienced. Their assessment of in-group versus out-group differences was tentative, as out-groups were defined differently across studies.

It is against this literature we judge the value added by our study.

3.3 Theory and hypothesis testing

The first hypothesis we want to test relates to the survival of the youth business groups and whether their performance before the war has been important for their survival and re-establishment of group activity after the war. We propose:

H1) High-trust groups (before the war) have been more able to survive.

Beyond this key hypothesis, we are keenly interested in understanding some underlying mechanisms of how the war may have affected local social capital, such as social preferences, reciprocation norms, generosity, trustworthiness, and trust in the general community (out-group) context and the specific business (in-group) context. For this, we will draw on recent literature that studies the impact of war. While this literature is rather empirical, many studies refer to various theories as a basis for their analyses. In particular, we will draw on Bauer et al. (2016), who reviewed much of this literature, conducted a meta-analysis, and, based on this, put together a more comprehensive theoretical foundation.

First, we briefly outline the theoretical framework developed by Bauer et al. (2016) and specify relevant hypotheses for our study based on this. Then, given our unique data, we propose some additional theories and hypotheses that can be important to investigate in our context.

Bauer et al. (2016) propose the following sets of explanatory variables related to how wars can affect local cooperation:

1. **Changes in Constraints, Economic Payoffs, and Beliefs.** War can initiate a higher demand for social insurance to protect household assets and provide better personal security. War victims may, therefore, seek more social security after a war and be more willing to cooperate. On the other hand, higher social insecurity could undermine the willingness to invest in physical and social capital, and asset losses may also reduce the ability to invest. We include individual and group characteristics, prewar asset endowments, and business group performance indicators.
2. **Changes in Parochial Norms and Preferences.** Exposure to war-related events may cause a change in social preferences and norms. Evolutionary theories propose that war violence may lead to favoring one's group compared to antagonistic out-groups Choi and Bowles (2007). Bowles (2006) have suggested that groups with more altruists are more likely to survive when groups compete. Groups controlling free-riders and cooperating reasonably are also more likely to survive (Henrich, 2006). The extent to which these selection processes occur through changes in preferences and moral norms of members or through within-group member selection and exclusion or across-group competition and survival is an open question. A study must carefully assess the nature of the in-groups and out-groups in each case (Bauer et al., 2016). Our definitions of in-groups and out-groups are not suitable to study how the war affected parochial norms towards the war enemies but can capture generalized social capital within the communities versus within each business group before and after the war.
3. **Changes in General Preferences and Other Psychological Explanations.** Severe war incidents can have lasting effects on individuals in terms of traumatic outcomes that can lead to depression, hopelessness, and paralysis. However, there are also examples of opposite effects for some who revive and find new meaning in life and interactions within the family and broader social contexts. Some also become politically more active (Bauer et al., 2016). We include individual and group exposure to war incidents and asset losses due to the war.

The following hypotheses H2a-H2e are all based on the assumption that exposure to a severe war and attacks by outside enemies have strengthened local cooperation (Bauer et al., 2016):

H2a. The share of members with altruistic preferences has increased, and the shares with spiteful and selfish preferences have declined from 2019 (prewar) to 2023 (postwar) in the in-group setting.

H2b. The norm to reciprocate in the trust game has been strengthened from 2019 (prewar) to 2023 (postwar) in the in-group setting.

H2c. In-group and out-group generosity increased and was higher after the war than before.

H2d. The expected returns in the trust game have increased from 2019 (prewar) to 2023 (postwar) in the in-group setting.

H2e. Trustworthiness and trust have increased from 2019 (prewar) to 2023 (postwar) in the in-group and out-group settings.

Next, we want to investigate the extent to which the subject group-level differential war incidence exposure can explain the changes in the social capital measures from 2019 to 2023. This amounts to testing whether each of the war incidence exposure categories, kill threats, harassment, rape, violence, looting, starvation, and having been wounded, are correlated with the social capital variables, especially in-group and out-group generosity, reciprocity norm, expected returns in the trust game, trustworthiness, and trust, similarly, for the group-level war exposure index. In line with hypotheses H2a-e, such exposures should positively correlate with the social capital variables (H2f).

H3. Alternatively, we want to test the opposing hypotheses based on the idea that war leads to the breakdown of all kinds of capital, including social capital ("development in reverse") (Collier et al., 2003): This should lead to a reduction in the different measures of social capital from 2019 to 2023, and this should also lead to negative correlations between the subject and group war exposure indicators and the social capital measures (Hypotheses H3a-f).

H4. The collapse of youth business groups during the war has harmed other-regarding preferences within groups (H4a), in-group norms to reciprocate (H4b), in-group generosity (H4c), and reduced the in-group expected returns in the trust game (H4d), and reduced in-group trustworthiness and trust (H4e). These hypotheses are based on the theory that within a business group, social capital is labile and depends on nurturing through frequent interactions and collaboration. With the collapse of the group businesses when the war started, we hypothesize that in-group social capital declined relative to the out-group social capital measures (H4f) but that this decline is smaller for business groups that have restarted their activity by the time of our postwar survey and experiments (H4g).

The hypotheses are tested by using the prewar sample as the baseline and the postwar sample as the war treatment sample to measure the impact of war exposure. We do this for the balanced sample for which we have complete data from 2019 and 2023 (N=1939) while we control for possible attrition bias.

4 Survey, Experimental Design and Data

4.1 Sample and survey data

The study is based on a random sample of 2425 members of 246 youth business groups in the 2019 prewar baseline sample drawn from a census of 742 such groups conducted in 2016 in five districts in the semiarid Tigray Region of Ethiopia. Up to 12 members were randomly sampled from each group. While the postwar follow-up study aimed to cover the same groups and members, it

allowed for additional members up to the limit of 12 members per business group if previously surveyed members were not available.[3]

The business group program was established as a policy initiative to create a complementary natural resource-based livelihood opportunity for landless and near-landless youth and young adults in this risky environment. Eligibility criteria for joining the business groups were residence in the community and resource poverty regarding limited land access. The main group production activities they could establish were animal rearing, beekeeping, forestry, and irrigation/horticulture. Self-selection into groups was most common (80% of the groups) by youth from the same neighborhood. It enabled them to continue living in their home community close to their parents.

The group members also have limited education, with a mean of 5.5 years of completed education. About one-third of the subjects were female.

All experiments and survey questions were translated and asked in the local language, *Tigrinya*. Trained experimental and survey enumerators introduced the experiments and asked survey questions in the local language. Tablets and CSPro were the digital tools used for the data collection. Careful training of enumerators was first conducted in classrooms at Mekelle University. They were then trained by doing experiments and interviews with each other before they were trained in the field with out-of-sample groups and subjects. To minimize within-group spillover effects, the twelve sampled members from each business group were interviewed simultaneously by 12 enumerators using three classrooms in a local school. One enumerator was placed in the corner of each classroom, and the subjects faced them during the experiments and survey interviews. Supervisors were used to ensure order and no disturbance. The orthogonal placement of enumerators on groups minimizes the risk of enumerator bias in the analyses. In addition, the researchers monitored potential enumerator bias during data collection. They had follow-up meetings with the enumerators to identify reasons for observed enumerator bias in the data collected and find ways of minimizing such bias. Overall, the enumerators were very committed to good work and performed well.

4.2 Experimental and survey designs

Before and after the war, we used standardized incentivized behavioral economics experiments combined with fit-for-purpose survey instruments (see Appendix in our Pre-Analysis Plan (Holden, Tilahun, Sommervoll, & Sandorf, 2023)). These experiments enabled us to classify subjects into social preference types in the in-group and out-group framing conditions based on the games of Bauer, Chytilová, and Pertold-Gebicka (2014); Fehr et al. (2013). They also gave us measures of their generosity in the in-group and out-group framing

[3]We had less than 12 members for some groups in the baseline study but allowed for up to 12 members also for these groups. The total number of surveyed members in 2023 became 2528 members, giving a total sample of 4953 respondents across the two survey and experimental rounds. However, we achieved a balanced sample for only 1939 members that provided complete data for both rounds. This implies an attrition rate of 20.0% from 2019 to 2023.

with standard and triple dictator games. Furthermore, they gave us measurements of members' in-group and out-group trust and trustworthiness based on the standard trust game with the strategy method, where all subjects played the roles of trustors and trustees. Whether the real game was for the in-group or out-group was determined randomly for each player. The in-group game was played with an anonymous player of their business group, and the out-group game was played with an unknown member of another business group in the same district. The trust game was also complemented with questions about subjects' moral obligation to reciprocate in the trust game by returning an amount at least as large as the amount sent by the trustor. These questions were asked for both in-group and out-group framing. Finally, we also asked about the trustors' expected amounts returned in the trust game to assess the importance of such expectations for trustors' behavior and to have a measure of expected trustworthiness. With subjects answering these questions before and after the war, we can also assess whether the war has influenced their moral obligations and expectations regarding the trustworthiness of other players within their business group and, in general, in their districts.

Our definition and framing of out-groups do not qualify as competing (antagonistic) out-groups in the war. The outside enemy in the Tigray War were the central Ethiopian government and Eritrean military forces. Unknown business group members within the same district in our study districts would belong to the same ethnic group and are not associated with these external enemies. We used them as a reference to measure generalized trust and social preferences towards strangers within the districts to assess whether the war has resulted in decay or increased generalized trust, trustworthiness, moral obligations to reciprocate in the trust game, expected returns in the trust game, and the distribution of social preference types in our out-group framing.

4.3 Identifying impacts from war: Individual war incidence exposure variation versus broader effects

The primary approach to identifying war impacts has been assessing individual variation in direct exposure, particularly to war violence (Bauer et al., 2016). Using those not directly exposed to war violence as counterfactuals, these studies may identify a lower bound on war impacts as these counterfactuals cannot be assumed unaffected by the war. War can have large spillover effects and multiple direct and indirect impacts.

Overall, the war had a tremendous impact on everybody in our study areas during and after the two years it lasted from November 2020. Therefore, the impact of war may be studied by comparing the situation before and after for the key outcome variables. We cannot eliminate some other confounders, such as the COVID-19 pandemic, but we argue that in our study context, the impacts of the war are an order of magnitude larger than the impacts of the COVID-19 pandemic. Our unique data allow us to compare the changes in the key outcome variables and relate them to the subject-level variation in direct war exposure of different forms.

Table 2 War exposure descriptive statistics

Variable	All 2023 Proportion N=2528	Balanced panel Proportion N=1939
kill threat	0.563	0.548
harassment	0.064	0.061
raped	0.026	0.027
violence	0.091	0.091
looting	0.558	0.560
starvation	0.944	0.949
wounded	0.055	0.053

Table 3 Correlation between war exposure variables

	kill threat	harassment	raped	violence	looting	starvation	wounded
kill threat	1.0000						
harassment	0.0861	1.0000					
raped	0.1079	0.1726	1.0000				
violence	0.2059	0.0023	0.0968	1.0000			
looting	0.2237	0.0561	0.0742	0.0701	1.0000		
starvation	-0.0626	-0.0912	-0.0364	0.0291	-0.0858	1.0000	
wounded	0.1157	-0.0419	-0.0066	0.0320	0.0728	-0.0311	1.0000

The war had variable impacts in different locations. Such variation could be due to the randomness of the spatial distribution of the war activities. Nyssen et al. (2023) provides the example of a lucky village in Tigray in one of our study districts (woredas), Degua Tembien. This village did not have any war incidents in terms of fighting, looting, raping, or killing of civilians during the war period. They managed to hide and keep their food reserves, although their food production was severely affected during the two years due to a lack of farm inputs such as seeds and fertilizer. The vegetation was also affected by the cutting of trees for charcoal production, and they had to sell their livestock at meager prices to buy food at high prices. This village still experienced strong spillover effects from the war.

We use several dummy variables to capture the seriousness of the war's impact on each of the youth group members (i.e., direct exposure to violence (kill threat, harassment, sexual abuse (rape), violence, looting, starvation, and having been wounded). The likelihood of each of these war effects is presented in Table 2 for the total sample (N=2528) covered in 2023 and the balanced sample (N=1939) covered in 2019 and 2023. The exposure is very similar across the two samples, indicating that the selection bias associated with these exposures is small.

These war exposure variables are only moderately correlated (Table 3), where we present a correlation matrix. Hence, we must not worry about severe multicollinearity when including the variables as a dummy vector.

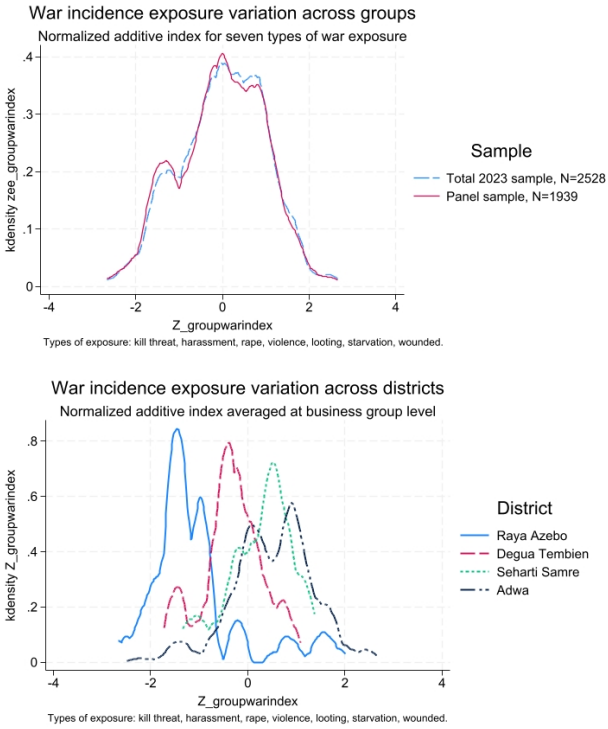

Fig. 1 Group level variation in war incidence index a) Total vs. panel sample, and b) by district.

However, we generate an additive index of the variables to measure variation in the severity of war exposure. We normalize this variable with mean=0 and sd=1. To assess the spatial variation of this variable, we take its mean for each business group and inspect the across-group variation (see Figures 1a and 1b).[4] Figure 1a assesses whether we need to worry about attrition due to the loss of 20% of the sample due to attrition. It would not be surprising to find more attrition in groups severely affected by the war. The graph only indicates a weak effect in this direction. We return to how we deal with this attrition problem. There was substantial variation in war exposure both across and within districts (Figure 1b). We will utilize this variation in average exposure across groups to capture war spillover effects that the subject-level war exposure variables may not capture.

No obvious way exists to generate an ideal cumulative index for war exposure. What also matters is how people react to war exposure and how it affects their perceptions and emotions. Fears and trauma can vary among people, and over time, they are likely to be affected differently by different types of exposure. There can be large spillover effects from hearing about events even though

[4]By taking the group mean, we eliminate some of the within-group noise and correlations between the group-level war exposure index variable and the subject level war exposure variables.

persons were not directly exposed. The use of direct exposure to violence measures may, therefore, only capture the average relative impacts of such exposure at some point after the war. The total effect, which includes spillover effects on all, cannot be captured with such measures. The strength of our study lies in the fact that we have baseline data for the key outcome variables from before the war. We ask how much of the total change in these outcome variables can be explained by the variation in the war exposure variables commonly used to study war impacts at different points after the war.

For many outcome variables (e.g., asset ownership, investments, preferences, trust, group survival, and performance for groups that are still active), we can compare the situation before and after the war, and we can relate the difference to the variation in severity in exposure to the war. This implies a natural experiment approach. Testing and controlling for attrition bias will be important in this type of analysis. The empirical strategy below further elaborates.

4.4 Empirical strategy

We follow a step-wise process as follows.

1. Investigate and control for attrition using Inverse Probability Weighting (IPW) (see Appendix A for attrition models and an explanation of the IPW generation).

2. Use the unbalanced sample to test for potential sample selection and learning effects for subjects participating in the experimental rounds in 2019 and 2023 (see Appendix B for these model results).

3. The impact assessment is further scrutinized by imposing group member fixed effects in linear regressions to control for observable and unobservable time-invariant member, group, and community characteristics in balanced panel models. The year dummy measures the total war effect (with some possible confounds).[5] These models are run for all the subject-level time-variant social capital experimental variables as dependent variables. The results for the balanced vs. unbalanced samples are compared to assess possible attrition bias (see also Figure 1a).

4. We use the subject-level war exposure recall data collected in 2023 to classify different types of exposure, generate an additive war exposure index at the subject level, and generate an average group exposure index to investigate across-group variation in exposure and whether it is related to attrition. The group-level war exposure index is normalized with mean zero and standard deviation (SD)=1. We assess the spatial distribution of this index for the balanced and the unbalanced sample to inspect for possible attrition.

To align our analyses with previous studies, we construct models that assess the correlations between the war exposure variables and the postwar experimental outcome variables.

[5]This war effect may be confounded with other time-variant variables, such as the COVID-19 pandemic. However, we consider the devastating war the dominant change factor in the study areas over this period.

We run these models with several additional control variables:

a) Age, gender, and years of education of subjects

b) A war asset loss index for subjects combined with an asset and livestock endowment (tropical livestock units=TLU) indices for subjects before the war

f) Business group characteristics (group size and main production type)

g) District fixed effects.

These models are presented in Appendix C. We assess the coefficients' robustness and significance for the key war incidence variables across outcome and alternative control variable specifications. We also inspect how a large share of the variation in the outcome variables can be "explained" by the direct war incidence exposure variables. We keep in mind that a war may create large spillover effects that can go beyond individual war exposure variables. Identifying war exposure impacts based on such individual variation in direct exposure may only capture a part of the total war effect.

With our unique prewar experimental social capital variables, we investigate the changes in social capital variables from 2019 to 2023 by comparing the prewar and postwar in-group and out-group distributions of

a) social preference types.

b) norms to reciprocate.

c) expected returns in the trust game

d) dictator game-giving in standard and triple dictator games

e) trustworthiness in the trust game

f) trust in the trust game.

g) and by investigating the correlations across the different social capital variables and how they may be related to the war.

We have normalized the generosity, trustworthiness, and trust variables to measure changes in SD units and facilitate comparisons with other studies.

To test the hypotheses from the theoretical framework, we run several types of parametric models:

1) Two-round panel models with social capital variables in each round combined with the subject- and group-level war exposure, individual prewar asset endowments, roles in the business groups, and business group performance indicators as additional controls.

2) Two-round models like above but with interactions between year and reciprocity norm and year and social preference type added.

To further assess the possible mechanisms of how war exposure has influenced the social capital measures, we run the following models:

3) Changes in trustworthiness and trust from 2019 to 2023 as functions of prewar social capital and the other war exposure and control variables.

4) Systems of equations models. These models build on social capital and behavioral economics theories that theorize the relationships between reciprocity norms, generosity, trustworthiness, and trust in different contexts (Holden & Tilahun, 2021, 2023).

To address the endogenous relationships between the norm to reciprocate, social preference type, generosity, expected trustworthiness, trustworthiness,

and trust, we estimate systems of equations models as a robustness check of the findings in the single equation models with endogenous right-hand side (RHS) variables. We build on the models developed by Holden and Tilahun (2021). The models build on the assumptions that trustworthiness and trust can be decomposed or assumed to be driven by underlying social and economic preferences, moral norms to reciprocate, and expectations about the trustworthiness of others. Furthermore, in-group trustworthiness and trust are assumed to be embedded in or built on the out-group trustworthiness and trust. Trustworthiness and trust may be seen as forms of social network capital that depend on the underlying other-regarding preferences within the network. A business group may succeed in forming stronger trust and trustworthiness through frequent interactions and collaboration. The war has caused their businesses and collaboration to collapse or be reduced to a much lower level than before the war. This may also explain a reduction in trust and trustworthiness within such groups.

Compared to Holden and Tilahun (2021), we make two important extensions. First, instead of using the levels of trustworthiness and trust at a specific time, we use the change in out-group and in-group trustworthiness and trust from 2019 to 2023 as the recursively dependent variables to utilize that we have a two-round panel. Second, we include the subject- and group-level war exposure variables in all equations in the system to better identify how such exposure may affect the different social capital variables such as the norms to reciprocate, generosity, social preference types, and expected trustworthiness that all may have changed due to the war and jointly explain the changes in trustworthiness and trust.

The first system model estimates the reciprocity norm, trustworthiness, and trust models recursively in the out-group and in-group context in line with what was done by Holden and Tilahun (2021) but with the abovementioned changes.

The model is specified as follows. The out-group reciprocity norm is represented by an ordered probit model in equation E1 where RNO_{gi23} is the stated postwar out-group norm to reciprocate by member i in group g, W_{gi} is the subject-level vector of war incidence exposure dummy variables, WI_g is the normalized group-level war exposure index, SPO_{gi19} is the categorical prewar out-group social preference type, C_T is community (*tabia*) Fixed Effects (FEs), and e_{gi} is the error term. We assume that reciprocity norms vary spatially and can be identified by including the community FE.

$$RNO_{gi23} = oprob(W_{gi}, WI_g, RNO_{gi19}, SPO_{gi19}, C_T, e_{gi}) \tag{1}$$

The normalized change in out-group trustworthiness is modeled (E2) as a function of war exposure incidents, the prewar out-group reciprocity norm, the (predicted) postwar out-group reciprocity norm, the prewar out-group

social preference type, the expected returns in the trust game (expected trustworthiness), and a vector of enumerator dummy variables (E_d).[6]

$$\begin{aligned}\Delta TWO_{gi} =&\alpha_{two} + \alpha_{1k}W_{gi} + \alpha_2 WI_g + \alpha_{3r}RNO_{gi23} + \alpha_{4r}RNO_{gi19} \\ &+ \alpha_{5s}SPO_{gi19} + \alpha_{6m}ERetO_{gi19} + \alpha_{7e}E_d + \epsilon_{gi}\end{aligned} \tag{2}$$

The normalized out-group change in trust from 2029 to 2024 is modeled on the war exposure, out-group reciprocity norms, social preference type, expected returns in the trust game, and the predicted trustworthiness from equation E2.

$$\begin{aligned}\Delta TO_{gi} =&\beta_{to} + \beta_{1k}W_{gi} + \beta_2 WI_g + \beta_{3r}RNO_{gi23} + \beta_{4r}RNO_{gi19} \\ &+ \beta_{5s}SPO_{gi19} + \beta_{6m}ERetO_{gi19} + \beta_7 \Delta TWO_{gi} + \varepsilon_{gi}\end{aligned} \tag{3}$$

For the in-group models, we have the same logical sequence as for the out-group models. With an ordered probit model, we model the in-group postwar reciprocity norms (RNI_{gi23}) on the war exposure variables, the in-group prewar social preference types (SPI_{gi19}), and the out-group prewar reciprocity norm.

$$RNI_{gi23} = oprob(W_{gi}, WI_g, RNO_{gi19}, SPI_{gi19}, e_{gi}) \tag{4}$$

The normalized change in in-group trustworthiness from 2019 to 2023 is modeled as shown in equation E5, where we utilize the in-group social preference type and expected in-group returns in addition to the predicted out-group change in trustworthiness from equation E2.

$$\begin{aligned}\Delta TWI_{gi} =&\eta_{twi} + \eta_{1k}W_{gi} + \eta_2 WI_g + \eta_{3r}RNO_{gi23} + \eta_{4r}RNI_{gi19} \\ &+ \eta_{5s}SPI_{gi19} + \eta_{6m}ERetI_{gi19} + \eta_7 \Delta TWO_{gi} + \nu_{gi}\end{aligned} \tag{5}$$

Finally, the normalized in-group change in trust from 2019 to 2023 is modeled on the predicted normalized change in out-group trust, predicted normalized change in-group trustworthiness, in addition to in-group social preference type, prewar in-group expected returns, and prewar reciprocity norms.

$$\begin{aligned}\Delta TI_{gi} =&\theta_{twi} + \theta_{1k}W_{gi} + \theta_2 WI_g + \theta_{3r}RNO_{gi23} + \theta_{4r}RNI_{gi19} \\ &+ \theta_{5s}SPI_{gi19} + \theta_{6m}ERetI_{gi19} + \theta_7 \Delta TWI_{gi} + \theta_8 \Delta TO_{gi} + \mu_{gi}\end{aligned} \tag{6}$$

The model results are presented in Tables E16 and E17 in Appendix E.

The models above did not include the generosity variables from our experiments, as we assumed that the social preference types captured generosity.

[6] Enumerators were randomly allocated to subjects within groups and may impose some random error that is orthogonal on groups. We utilize this random error in our identification strategy.

However, the social preference types may capture other things than differences in generosity. We construct an alternative model that explores whether including the generosity variables can provide additional insights compared to the model above. We focus on the out-group part of the system and investigate a different out-group model system that includes the standard and triple dictator games. Both trustworthiness and trust may partly be explained by generosity. We suggest that the standard dictator game resembles the trustworthiness decision.

In contrast, the triple dictator game is closer to the trusting decision where the amount received by the other party is tripled. Suppose out-group trustworthiness and trust are driven by generosity. In that case, the out-group changes in the generosity variables should be strongly positively correlated with the out-group changes in trustworthiness and trust variables.

The new system models are changed as follows. We retain equation E1 unchanged but include the normalized change in out-group generosity equations.

$$\begin{aligned}\Delta DO1x_{gi} =&\delta_{to1} + \delta_{1k1}W_{gi} + \delta_{21}WI_g + \delta_{31s}SPO_{gi19} \\ &+ \delta_{41}DO1x_{gi19} + \omega_{gi}\end{aligned} \tag{7}$$

$$\begin{aligned}\Delta DO3x_{gi} =&\delta_{to3} + \delta_{1k3}W_{gi} + \delta_{23}WI_g + \delta_{33s}SPO_{gi19} \\ &+ \delta_{43}DO1x_{gi19} + \varsigma_{gi}\end{aligned} \tag{8}$$

The normalized out-group change in trustworthiness from 2019 to 2023 is expanded compared to equation E2 by adding the normalized prewar out-group standard dictator variable and the predicted normalized change in the standard dictator variable in equation E9.

$$\begin{aligned}\Delta TWO_{gi} =&\gamma_{two} + \gamma_{1k}W_{gi} + \gamma_2 WI_g + \gamma_{3r}RNO_{gi23} + \gamma_{4r}RNO_{gi19} \\ &+ \gamma_{5s}SPO_{gi19} + \gamma_{6m}ERetO_{gi19} + \gamma_7\Delta DO1x_{gi} + \gamma_8 DO1x_{gi19} \\ &+ \gamma_9 E_d + \epsilon_{gi}\end{aligned} \tag{9}$$

The normalized out-group change in trust from 2019 to 2023 is expanded compared to equation E3 by adding the normalized prewar out-group triple dictator variable and the predicted normalized change in the triple dictator variable in equation E10.

$$\begin{aligned}\Delta TO_{gi} =&\lambda_{to} + \lambda_{1k}W_{gi} + \lambda_2 WI_g + \lambda_{3r}RNO_{gi23} + \lambda_{4r}RNO_{gi19} \\ &+ \lambda_{5s}SPO_{gi19} + \lambda_{6m}ERetO_{gi19} + \lambda_7\Delta TWO_{gi} \\ &+ \lambda_8\Delta DO3x_{gi} + \lambda_9 DO3x_{gi19} + \varepsilon_{gi}\end{aligned} \tag{10}$$

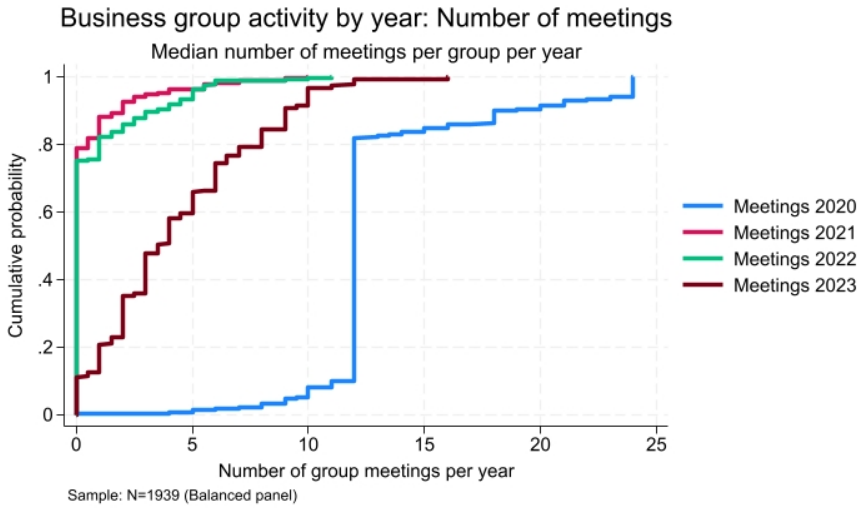

Fig. 2 Number of Business Group Meetings by Year Before, During and After the War

The models are estimated with the gsem command in Stata 18. The results from this five-equation system are presented in Tables E18 and E19 in Appendix E.

5 Results

5.1 Business group activity before, during, and after the war

As an initial inspection of the business group's survival and activity levels before, during, and after the war, we have computed the median number of group meetings the group members participated in by the year 2020 to 2023, with the cumulative distributions across the sample in Figure 2.

All groups had meeting activities in 2020 before the war started in November 2020. Most groups had monthly meetings for all their members. The war resulted in the collapse of the activity in most groups. About 20% had some meeting activities in 2021 and 2022, when most of the war activities took place. However, in 2023, the large majority of the groups (above 80%) restarted their group meetings in the hope of reestablishing their business activities.

5.2 In-group and Out-group Prewar vs. Postwar Experimental Outcome Distributions

Figures 2a (in-group) and 2b (out-group) present the social preference type distributions in 2019 versus 2023. Figure 2a shows a significant reduction in the proportion of altruists and egalitarian subjects and a large increase of selfish

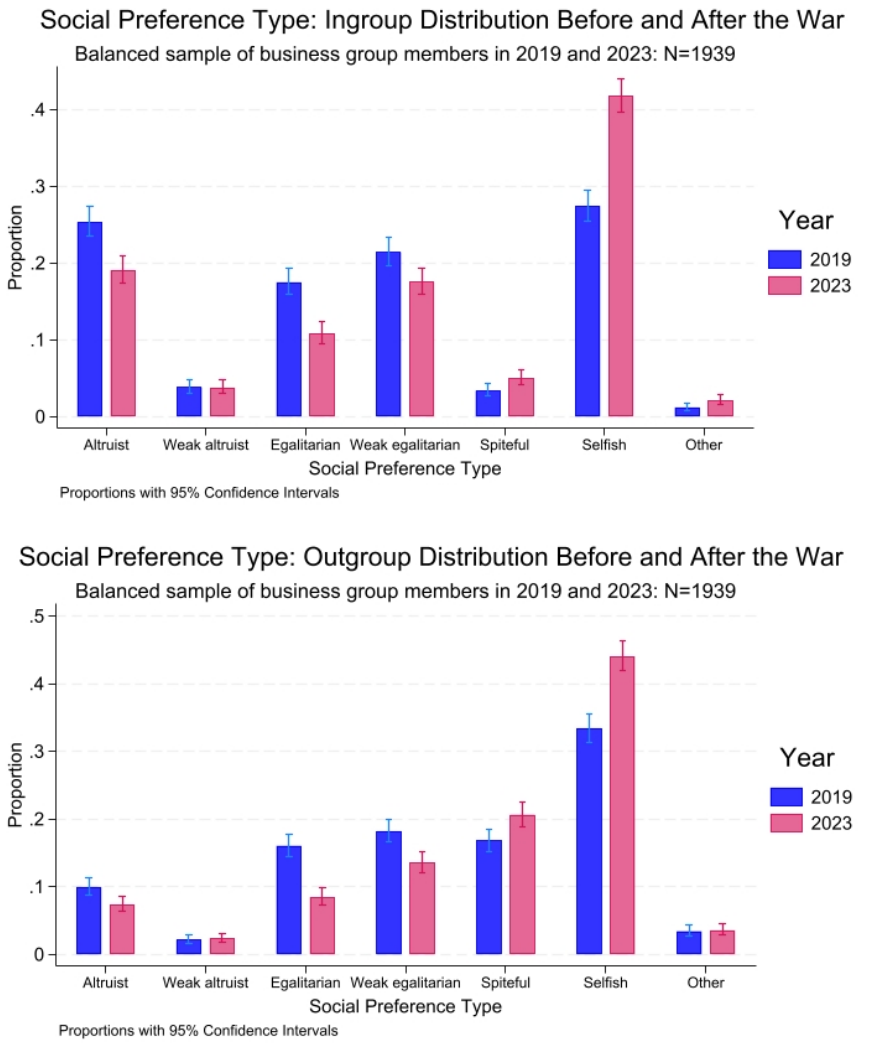

Fig. 3 Social Preference Type Distribution in a) In-group and b) Out-group Framing Before and After the War

types and a small increase in spiteful types. The same trend is also observable in Figrue 2b.

Figures 3a (in-group) and 3b (out-group) present the changes in reciprocity types from 2019 to 2023. Figure 3a shows a significant reduction in the proportion of those with the strongest norm to reciprocate and significant increases in the proportions of subjects with weak or no obligation to reciprocate. In Figure 3b, we see a reduction in the shares of both those with strong and weak norms to reciprocate and a substantial increase in those feeling no obligation

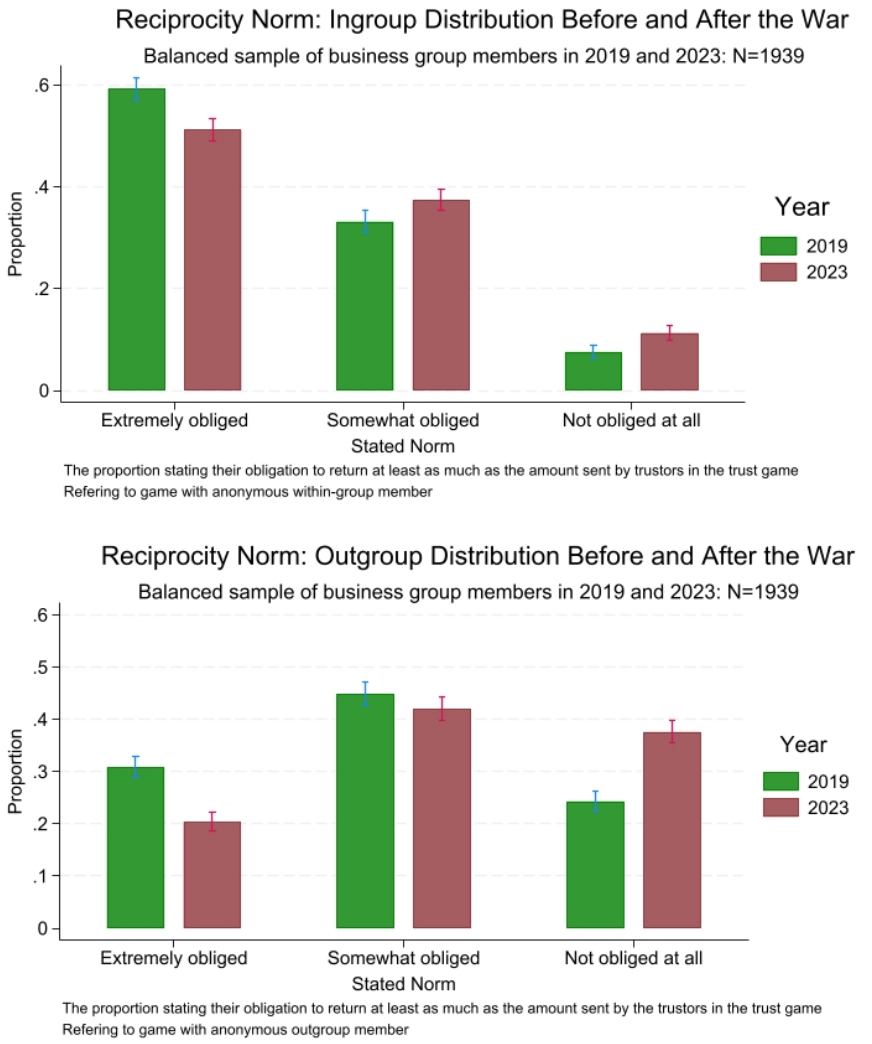

Fig. 4 Norm to Reciprocate Distribution in a) In-group and b) Out-group Framing Before and After the War

to reciprocate. However, the reciprocity norm stays stronger in the in-group than in the out-group context.

Figures 4a and 4b present the expected return distributions in the trust game and how they have changed from before to after the war in the in-group and out-group framing conditions. For the in-group distributions, we see a significant reduction in those expecting trustees to return half of the amount received and a significant increase in those expecting less than one-third of the amount received by the trustees. In the out-group framing, we see a substantial

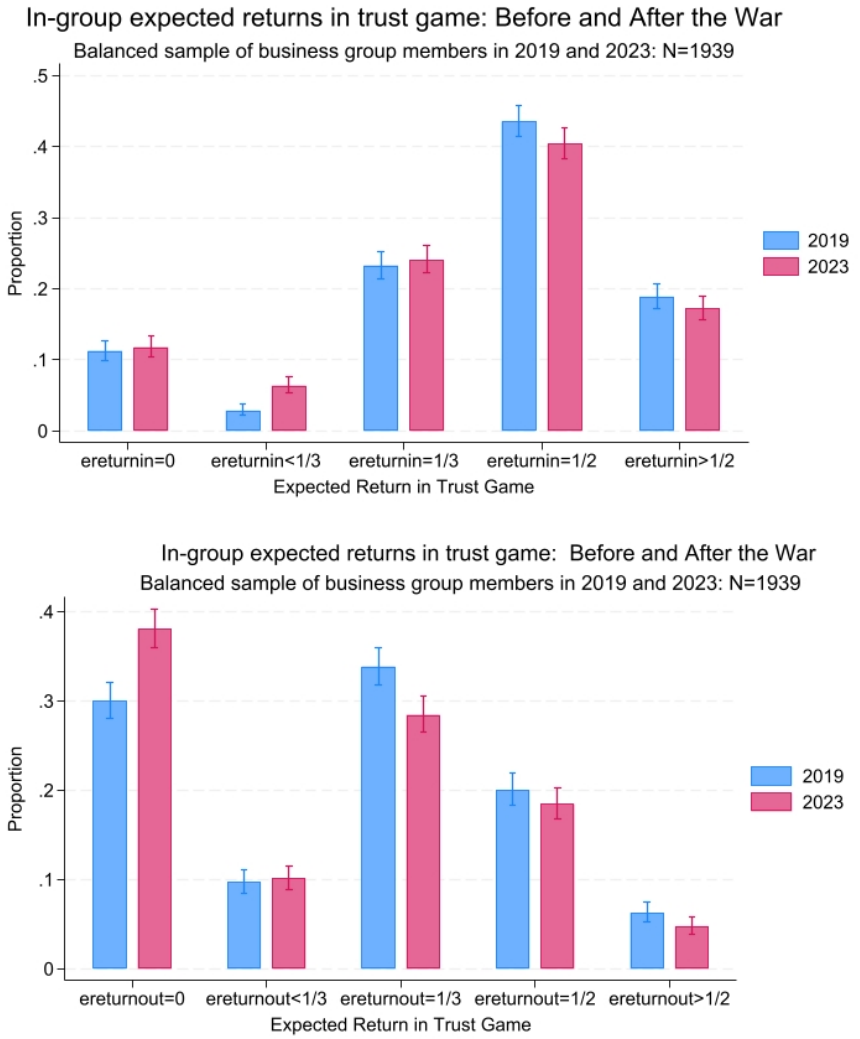

Fig. 5 Expected Returns in the Trust Game Distributions in a) In-group and b) Out-group Framing Before and After the War

increase in the proportion expecting no amount returned by the trustees and a reduction in all the other categories from 2019 to 2023.

Figure 5 presents the average in-group and out-group trust and trustworthiness shares sent or returned in the trust game in 2019 and 2023. The figure includes 95% confidence intervals for each of these mean measures. The graphs clearly show a strong reduction in the average shares from 2019 to 2023. While out-group trust and trustworthiness shares are quite close in size in both years, the gaps between in-group trust and trustworthiness remain larger. Comparing Figures 4a, 4b, and Figure 5 reveals that large proportions of the sample

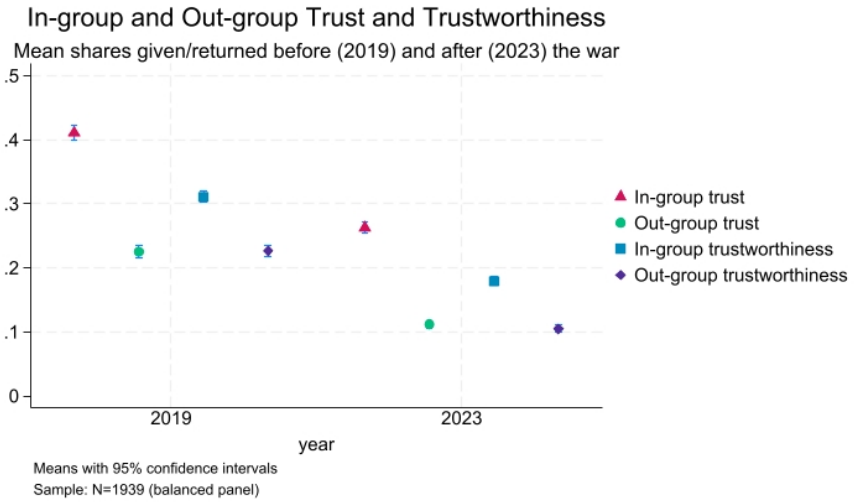

Fig. 6 In-group and Out-group Trust and Trustworthiness Before and After the War

are too optimistic about other subjects' trustworthiness in the in-group and out-group contexts. This applies to the situation both before and after the war.

To better understand the relative changes in trustworthiness and trust from 2019 to 2023, Figure 6a presents Cohen's ds for the effect sizes measured in SD units. The figure indicates that the in-group and out-group trust and trustworthiness reductions are similar and close to 0.7 SD units. These may be considered large reductions in trust and trustworthiness, representing measures of the total war effects on in-group and out-group trustworthiness and trust.

One may wonder about the extent to which reductions in generosity drive the reduction in trust and trustworthiness. Figure 6b presents the changes in generosity in the standard and triple dictator games and demonstrates that these are in the range of 0.5-0.7 SD units and, therefore, not much smaller than the reductions in trust and trustworthiness.

Figures 7a and 7b present their estimated means with 95% confidence intervals to better illustrate the heterogeneity in in-group and out-group trust across in-group and out-group social preference types before and after the war. The relative pattern of trust differences across social preference types is similar across the in-group and out-group framing conditions. The same can be said about the relative sizes across social preference types in 2019 versus 2023. We note that in these graphs, the amount sent or invested in the game is measured as a share of the endowment the trustor received up-front in the game. We note some highly significant differences in the average amounts sent by persons from different social preference types, with the altruists and the spiteful representing the extremes, which were significantly more and less trusting than all other groups.

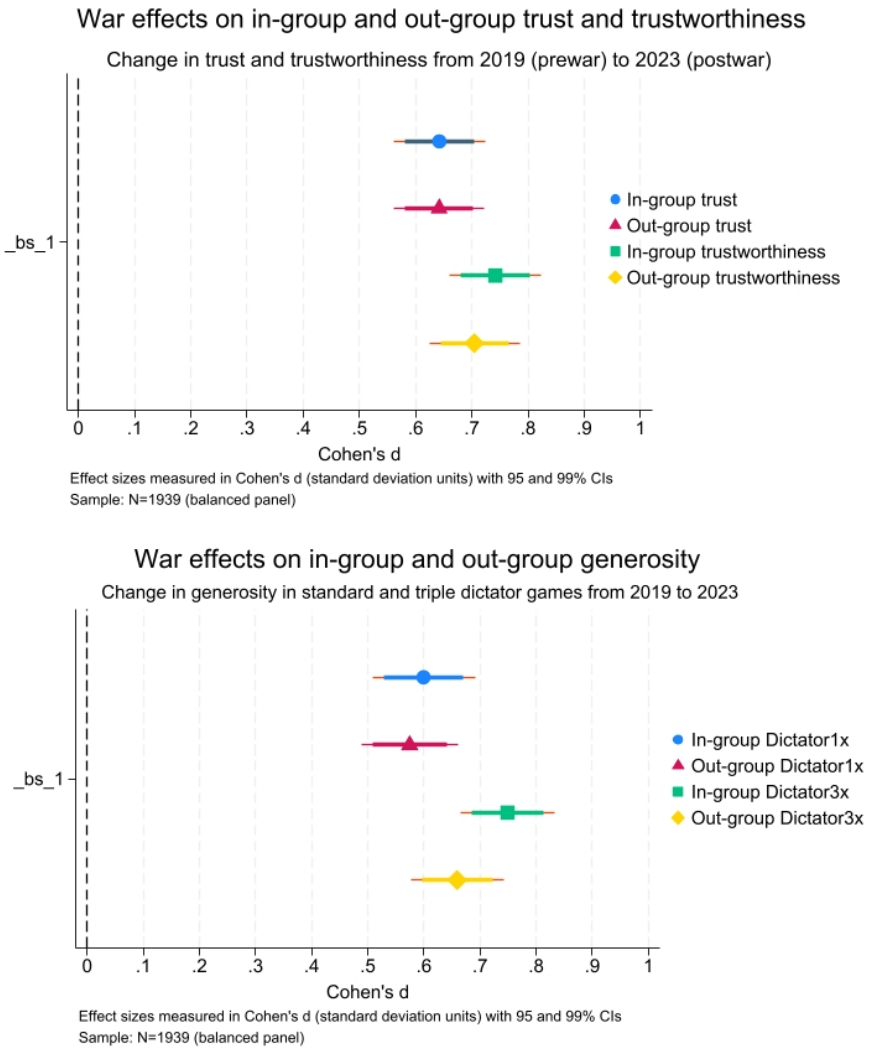

Fig. 7 Changes in In-group and Out-group Trust, Trustworthiness, and Generosity Before and After the War, measured as Cohen's d (SD units).

Figures 8a and 8b present cumulative probability distributions for the in-group and out-group average shares returned by trustee subjects in the trust game in 2019 and 2023 based on the strategy method.[7] The graphs illustrate that the shares returned in 2019 stochastically dominate the shares returned in 2023 both in the in-group and out-group framing conditions. In other words,

[7]The strategy method implies that they had to respond to how much they would return given all alternative amounts they could potentially receive from the trustors. An average share is then calculated for each trustee across all these amounts. When the real game was identified, they had to stick to the share they had stated up-front as the amount to be returned to the trustor given the amount received.

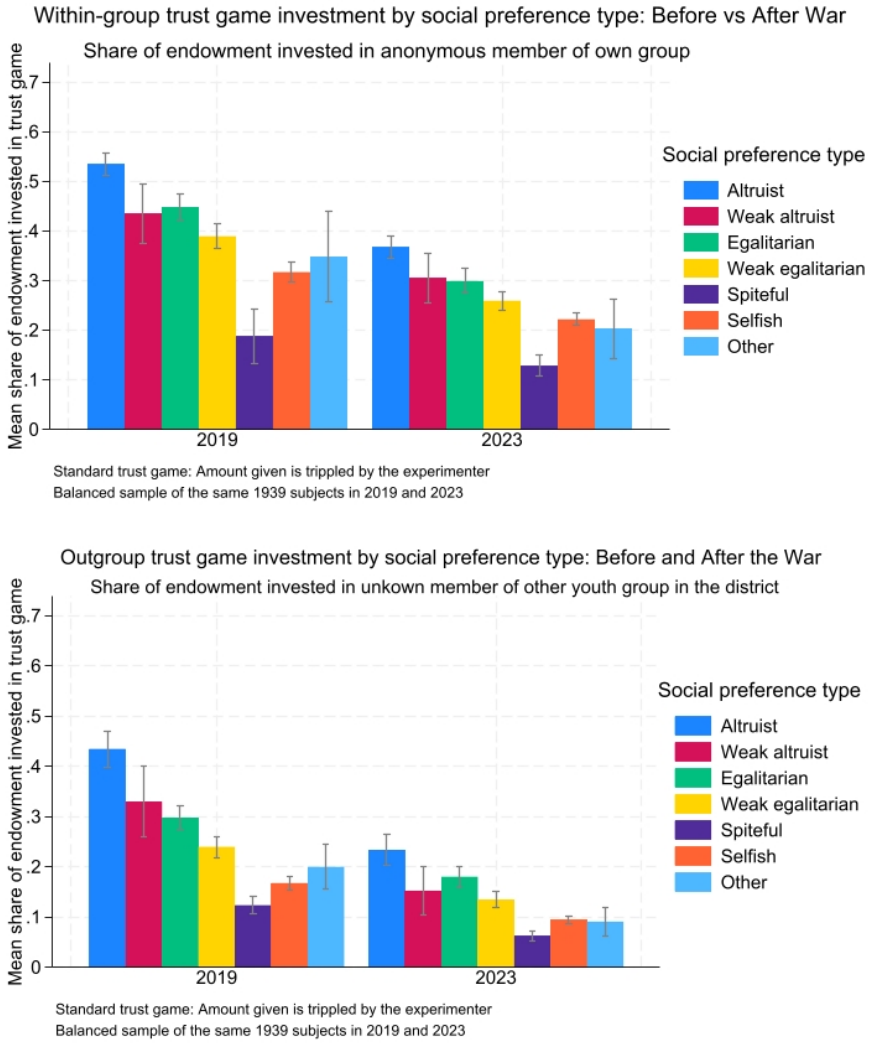

Fig. 8 In-group and Out-group Trust by In-group and Out-group Social Preference Type Before and After the War

trustworthiness within business groups and districts has substantially declined along the whole distribution.

In order to inspect the variation in trustworthiness across social preference types, Figures 9a and 9b present the in-group cumulative average shares returned by social preference type in 2019 (Figure 9a) and 2023 (Figure 9b). These graphs show that the spiteful and the altruistic types form the lower and upper distributions, with the egalitarian types close to the altruists and the selfish closer to the spiteful. When comparing Figures 9a (2019) and 9b (2023), one can see that all types have shifted to the left from 2019 to 2023

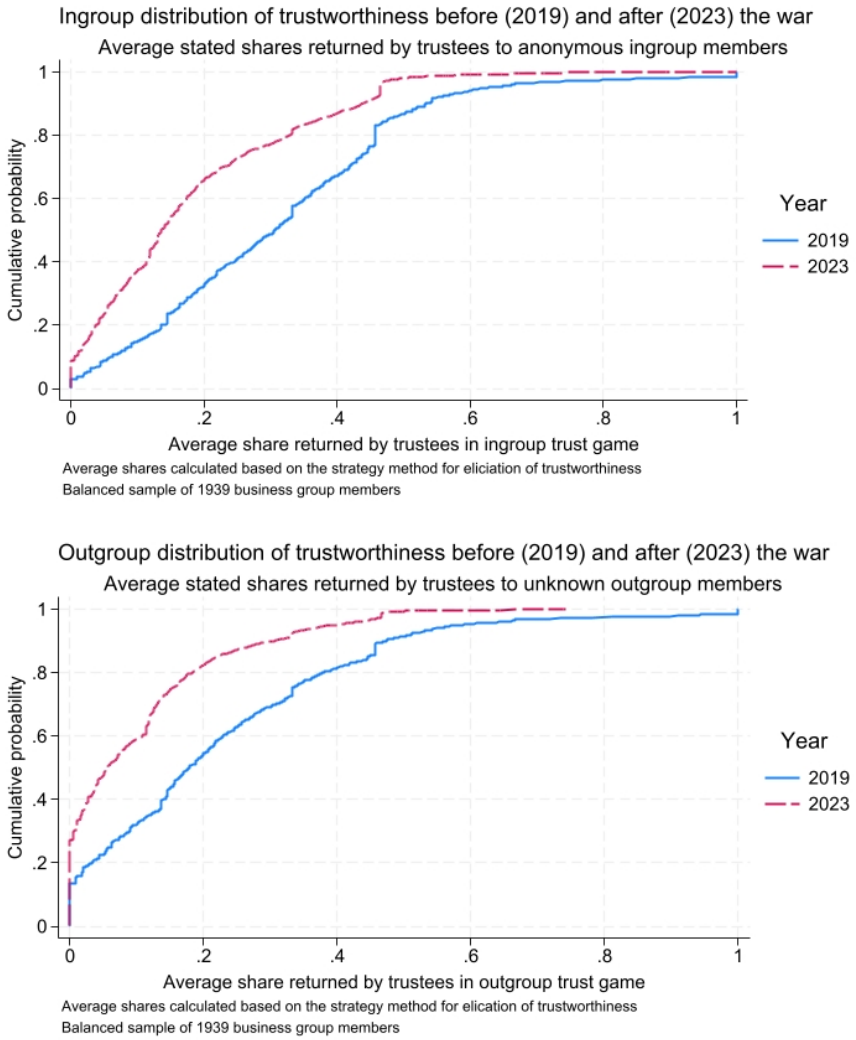

Fig. 9 a) In-group and b) Out-group Trustworthiness Cumulative Distributions Before and After the War

and become less trustworthy, while the internal ranking of the distributions in each year is quite stable.

Figures 10a and 10b show the same pattern for out-group trustworthiness across social preference types in 2019 and 2023. We also see that higher shares returned nothing in 2023 than in 2019.

Figures 11a and 11b present the relative changes in a) in-group and b) out-group trust and trustworthiness from 2019 to 2023 by social preference type. The changes are measured in SD units for the normalized measures of the changes in trust and trustworthiness from 2019 to 2023. The comparisons are

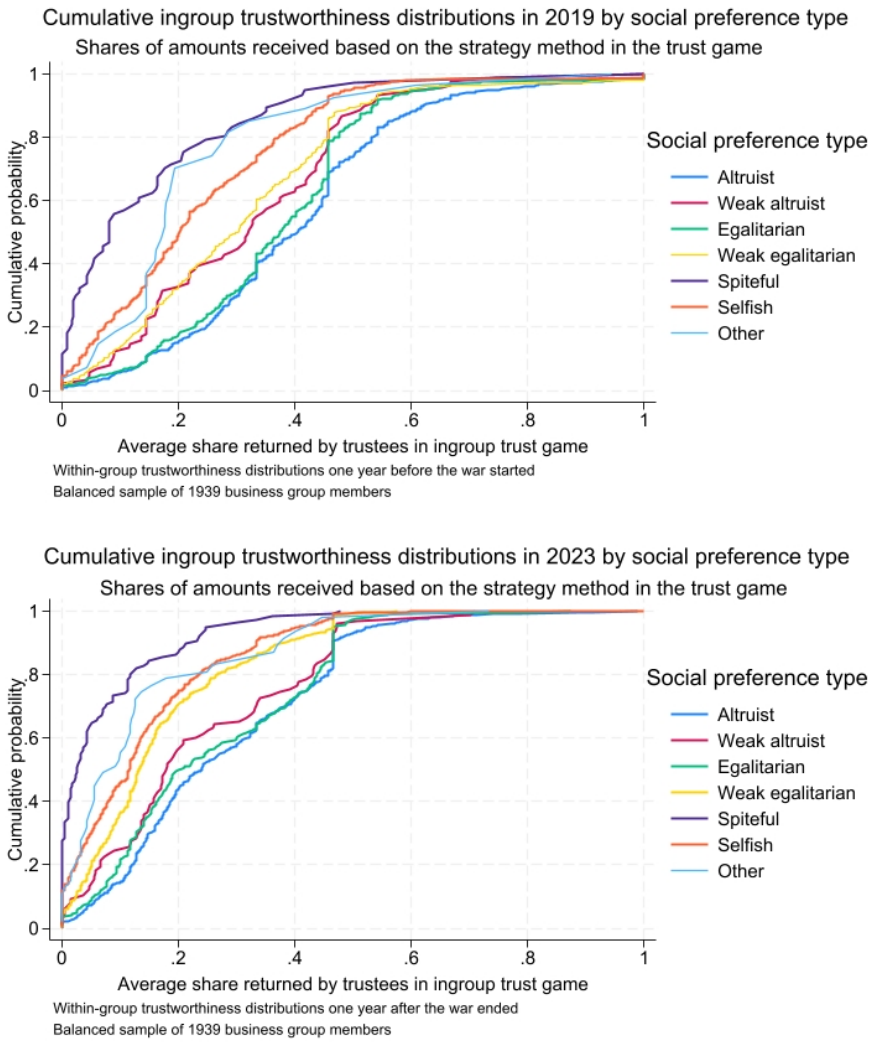

Fig. 10 In-group Trustworthiness Cumulative Distributions by Social Preference Type a) Before and b) After the War

based on the prewar identification of in-group and out-group social preference types. The graphs show a systematic pattern across social preference types. The largest relative reduction in trust and trustworthiness is for altruists and egalitarians in the out-group context, but the tendency is the same in the in-group context. We note from Figures 2a and 2b that the proportion of subjects belonging to these categories was most reduced from 2019 to 2023. The relative changes we see in this graph are due to a combination of the changes in social preference type distributions and changes in trust and trustworthiness within

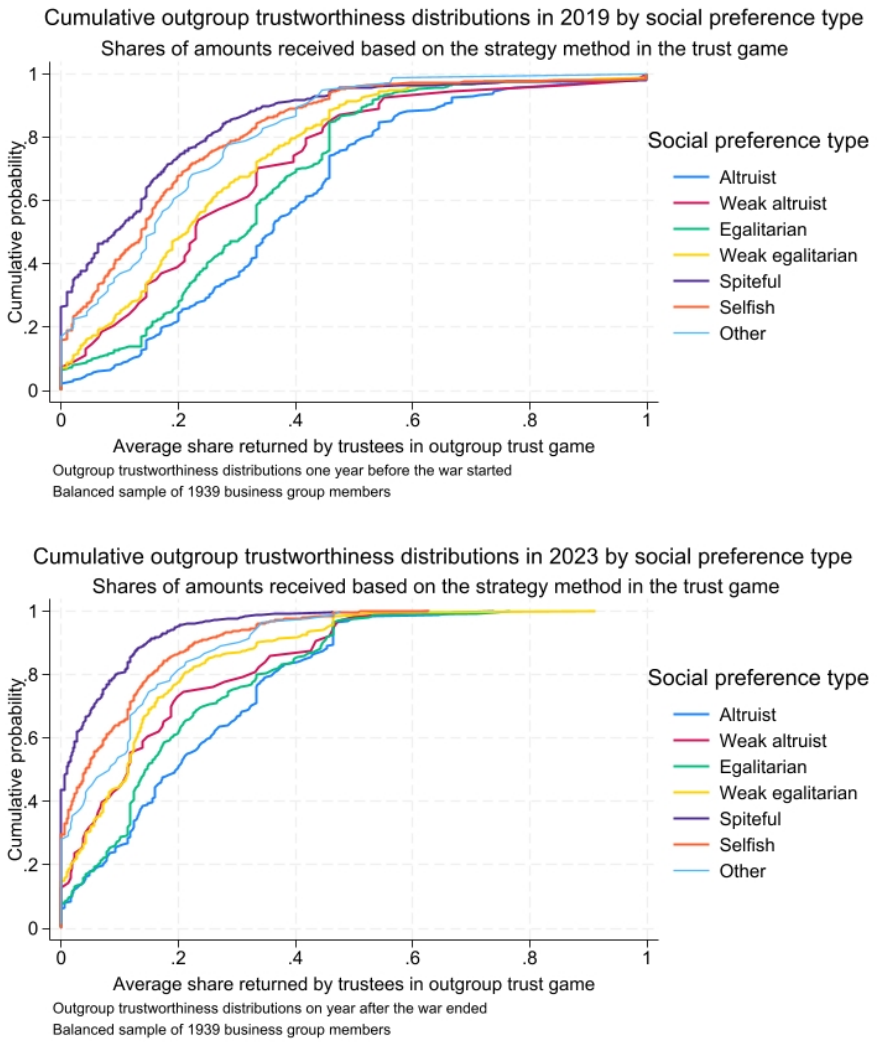

Fig. 11 Out-group Trustworthiness Cumulative Distributions by Social Preference Type a) Before and b) After the War

each social preference type (captured in Figures 7a and 7b for trust and in Figures 9a, 9b, 10a, and 10b for trustworthiness.

5.3 Parametric models

We will focus on the main results based on the balanced panel of 1939 subjects for which we have complete data from 2019 and 2023. The attrition analyses are found in Appendix A. We used Inverse Probability Weighting to correct for attrition bias in all the parametric models for the balanced sample.

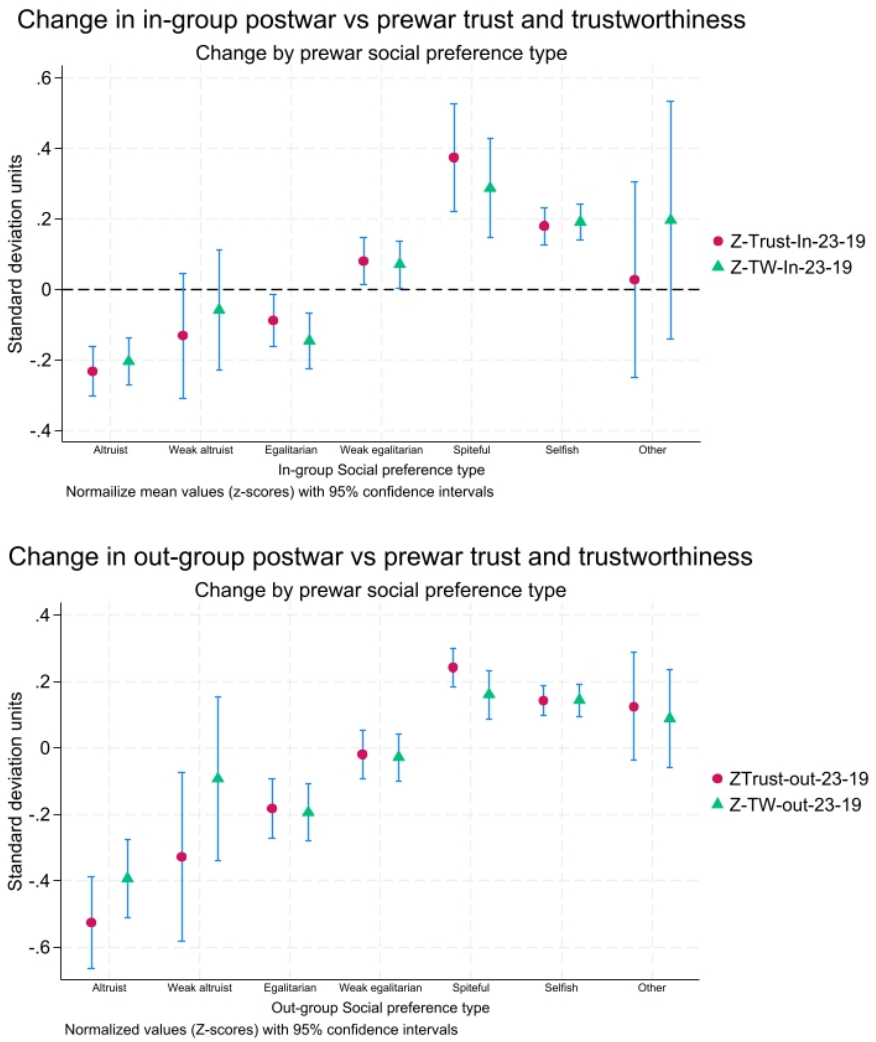

Fig. 12 Change in a) In-group and b) Out-group Trust vs. Trustworthiness by prewar Social Preference Type

5.3.1 Postwar outcome models

In Appendix B, we present models that best fit with previous studies that related variation in individual war exposure to postwar experimental outcomes to capture war impacts on social capital. Tables B2 and B3 find a significant positive correlation between the group-level war exposure index and in-group and out-group generosity. In contrast, few of the individual war exposure variables were significant. Similarly, the group war exposure index was associated with a stronger in-group and out-group norm to reciprocate in Table B4, while

the significant results were mixed in signs. However, very little of the variation in these outcome variables was "explained" by the war incidence variables, as seen by the low R-squared values in these models. We should also note that the significant normalized war index variable in Tables B2-B4 was associated with normalized changes in the outcome variables. The significant parameters were below 0.1 SD unit. These must be considered as moderate war impacts in the direction of higher generosity and stronger norms to reciprocate in communities and groups more exposed to war incidents.

Tables B5 and B6 contain similar models for in-group and out-group trustworthiness and trust. The group-level war exposure index results are similar in size and direction to Tables B2-B4. In addition, the subject-level violence exposure variable is highly significant and has negative signs in all the models. This may indicate that exposure to violence has made the exposed subjects 0.20-0.27 SD less trustworthy and 0.16-0.19 less trusting compared to those who have not been directly exposed to violence during the war. It may be surprising that the group-level war exposure index and the subject-level violence exposure point opposite directions. These results were robust to the addition of additional subject and group characteristics.

5.3.2 Robustness check: DiD Learning Effects Models

Can the year effect in the balanced panel models partly be because the same subjects participated in the same experiments in 2019 and have learned from the same experience? We investigate this using the unbalanced panel with additional subjects in 2019 and 2023. To test for a panel sample treatment effect, we include the 2023-year*panel interaction to test for such a panel learning or attrition effect. These models are presented in Appendix C, Tables C7-C9. Table 7 indicated that out-group generosity was significantly lower among panel subjects than others. Nevertheless, the 2023-year effect was highly significant and much larger and is most likely a strong negative total war effect on generosity. Therefore, the reduction in generosity from 2019 to 2023 can partly be explained as a panel learning effect in the out-group context but not in the in-group context.

We found very few signs of learning or selection effects among panel subjects for the reciprocity norm and expected returns models in Table C8. However, the out-group reciprocation norm was significantly reduced in 2023 compared to 2019. In Table C9, we found significantly lower levels of trustworthiness among panel subjects independent of round, which could be a selection effect. This selection effect could not explain the large reductions of about 0.7 SD units for trustworthiness and about 0.5-0.6 SD units for trust from 2019 to 2023. We are inclined to attribute these as total war effects in terms of substantial reduction in trustworthiness and trust in both in-group and out-group contexts.

5.3.3 Balanced Panel Models

In the balanced panel models, we include subject-level experimental variables from both rounds and use trustworthiness and trust as the key dependent variables. We include the war exposure variables as time-invariant and the year dummy variable. We assess how the coefficients on the year dummy change when the war exposure variables are included. We suggest this may say something about how much of the total war effect can be captured using subject—and group-level differential exposure to war incidents. In addition, we include a variable for subject-level asset losses during the war. As additional controls for wealth or poverty and group and member characteristics, we include time-invariant prewar asset and livestock endowment variables, prewar business group performance characteristics, subjects' formal positions in the groups (board members, leaders), and basic subject characteristics (age, gender, education). Table D10 in Appendix D contains the main regression results for in-group and out-group trust and trustworthiness. The war exposure variables' signs, significance, and parameter sizes were similar to the earlier models. Still, we note that the size of the year dummy variable remains large. We interpret this result as indicating that the variation in the specified types of war exposure only captures a small part of the total war effect on trustworthiness and trust. The inclusion of the additional controls resulted in many of them being significant. Overall, the R-squared for the models remained low, in the range of 0.11-0.15 across the models, see Table D10.

Based on the idea that our experimental social capital variables are interrelated and respond differently to war exposure, we included these additional experimental variables as multiple correlations to assess whether their inclusion could explain more of the variation in trustworthiness and trust and reduce the coefficients on the year dummy variable. We have included the in-group and out-group social preference type vectors, the reciprocity norm vectors, the expected returns vectors, and the generosity variables. At the same time, we have retained all the variables in Table D10. The results are presented in Tables D11 and D12 in Appendix D.

The first thing we note from these new models is that the coefficients on the year dummy have been substantially reduced, but they remain highly significant and negative. The R-squared values for the new models have increased substantially to the range of 0.44-0.56. Trustworthiness and trust are, as we expected, correlated with social preference type, reciprocity norms, expectations about the behavior of others, and generosity of subjects. By allowing the experimental variables to change from 2019 to 2023, we have captured more social capital changes that may result from the war. But can we do even better and explain more of the unexplained part of the changes in trustworthiness and trust from 2019 to 2023? We suggest we capture more of the within-social-reference-type and within-reciprocity-norm changes from 2019 to 2023 by interacting these with the year dummy. We present the key variable results of such models in Figures 12 (in-group and out-group trustworthiness) and 13

(in-group and out-group trust). The full model results are presented in Tables D13-D15 in Appendix D.

The main interesting results in these new models are the interaction effects and the almost elimination of the remaining "unexplained" part on the year dummy by attributing it to subjects with strong reciprocity norms and other-regarding preferences. We especially note that the within-moral-norm trustworthiness and trust have been substantially reduced from 2019 to 2023. Similarly, altruists and egalitarians have become significantly less trusting in 2023 compared to 2019, both in the in-group and out-group settings. We propose that these models help us decompose some of the war effects on social capital in our study areas and reveal interesting heterogeneity in social capital. The results also help us identify changes in this heterogeneous social capital due to this devastating war. We see a particular decline in trustworthiness and trust among the subjects that, before the war, had the strongest norms to reciprocate and the strongest other-regarding preferences.

5.4 Change in Social Capital and System of Equations Models

Tables E16-E17 present the first system models for the joint estimation of out-group and in-group social capital variables. Table E16 contains the individual war exposure and group war exposure index variables. The results are inconsistent with those in the previous single-equation models. Therefore, these variables do not provide robust evidence of the war's impacts.

The out-group reciprocity norm in 2023 strongly correlates with the reciprocity norm in 2019. Still, the decline in the reciprocity norm is strongest for those with the stronger reciprocity norm in 2019. Out-group trustworthiness and trust have declined the most for those with the strongest reciprocity norm in 2019 but remain higher for those who still expressed a strong reciprocity norm in 2023. Out-group changes in trustworthiness and trust are significantly more negative among those classified as out-group altruists and egalitarians in 2019. We also see a more negative change in trustworthiness and trust among those with higher expected returns in the trust game (higher expected trustworthiness) in 2019. For the in-group change in trustworthiness, we see a similar pattern for the social preference types, and out-group and in-group changes in trustworthiness are strongly positively correlated. For the in-group change in trust, we also see a more negative change for those who were altruists in 2019 than selfish types and a strong positive correlation with the out-group change in trust and in-group change in trustworthiness.

Furthermore, for those with the highest prewar in-group expected trustworthiness, we see a more negative change in in-group trustworthiness and trust. These subjects were overly optimistic about the prewar trustworthiness of others and exhibited a bigger negative change in their trustworthiness than others with lower prewar expected trustworthiness. Finally, we have included two variables for the median number of group meetings that group members participated in in 2020 (prewar) and 2023 (postwar). If in-group social capital

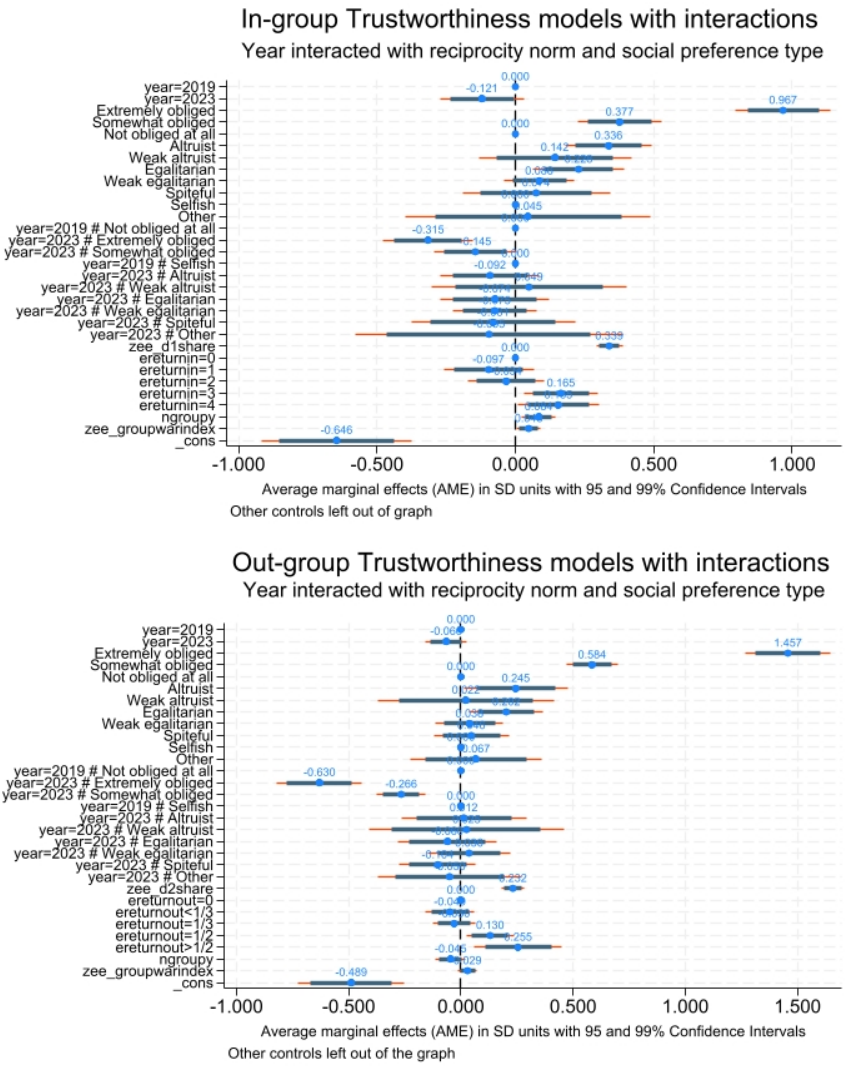

Fig. 13 In-group and Out-group Trustworthiness models with year interactions with reciprocity norm and social preference type

depends on the intensity of within-group interactions, these variables may pick up this. We only find that the number of business group meetings in 2020 was positively and significantly correlated with a change in out-group trustworthiness. However, the number of postwar meetings was not positively associated with an in-group change in trustworthiness and trust.

The system models above did not include the generosity variables. We may consider generosity an important component that explains trustworthiness and trust in a society. As a robustness check of the findings in the previous system

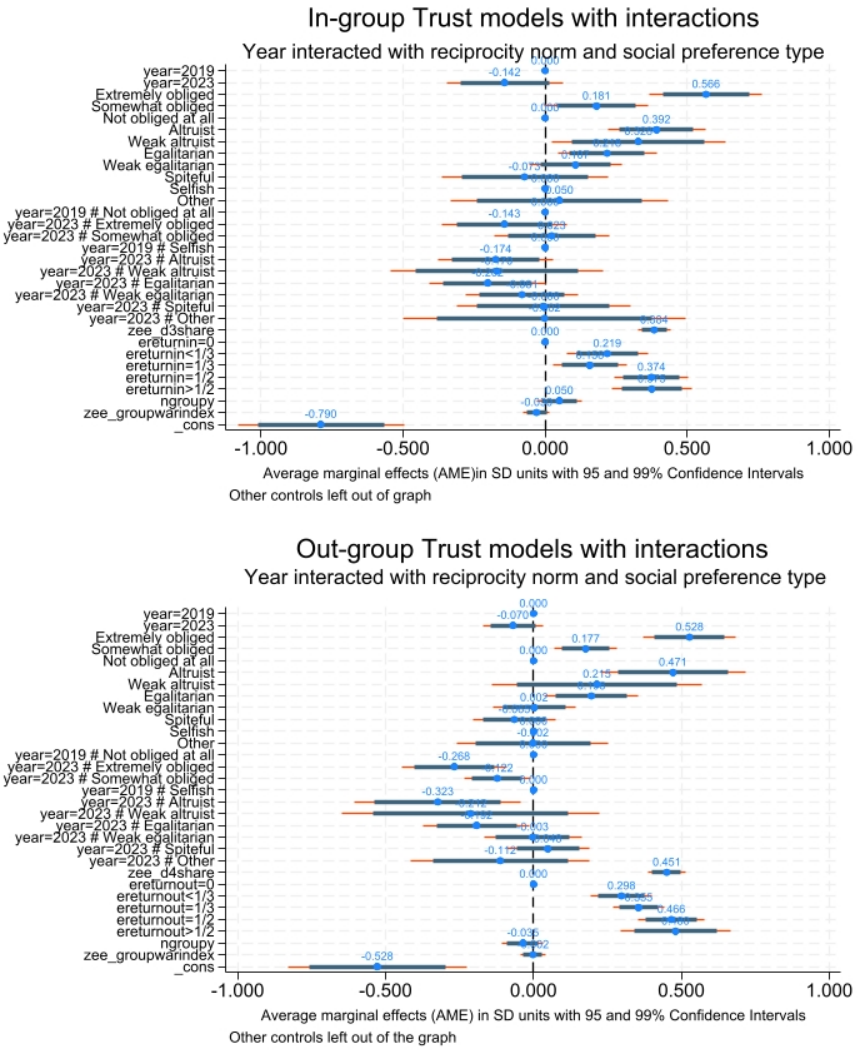

Fig. 14 In-group and Out-group Trustworthiness models with year interactions with reciprocity norm and social preference type

models, we have run system models for the out-group social capital variables that include the standard and triple dictator games, linking the standard dictator game change in generosity variable to out-group change in trustworthiness and the triple dictator game change in generosity variable to out-group change in trust. The results are presented in Tables E18 and E19 in Appendix E.

Table E18 for the group-level war index indicates that more war-exposed groups have had a less negative change in out-group reciprocity norms and generosity. Those who were more generous in 2019 also experienced the largest

decline in generosity from 2019 to 2023. However, the predicted changes in generosity variables are positively correlated with the change in trustworthiness and trust, showing that generosity is an important driver of trustworthiness and trust. Including the generosity variables did not change our conclusions regarding the importance of the reciprocity norms or the variation across social preference types regarding their associations with the changes in trustworthiness and trust from 2019 to 2023. These results, therefore, remain robust.

5.5 Group meeting activity, group performance, and war effects

Table 4 assesses whether group meeting activity just before and after the war correlated with prewar group performance indicators, member characteristics, and business group characteristics. In addition, we assess whether postwar group meeting activity was affected or correlated with the subject—and group-level war exposure variables.

The model for group meetings in 2020 shows that groups with more group work activities in 2019 also had more group meetings in 2020, that group leaders had more meetings than other members, that female members participated in more meetings, and that groups located in Degua Tembien district had more meetings than groups located in other districts.

The model for group meetings in 2023 shows a positive correlation between the number of group meetings in 2020 and 2023. More active groups before the war were also more active after the war. Groups that spent more time on land conservation in 2019 also had more group meetings after the war. On the other hand, groups that had been more exposed to war incidents (group level index) had significantly fewer meetings the first year after the war. Members who had been directly exposed to violence during the war participated in significantly fewer meetings the first year after the war. There were significantly fewer meetings in the Degua Tembien district in 2023, while this district had the most group meetings before the war. We are not sure about the reasons for this. The tendency was the opposite in the Adwa district, where group meetings were significantly higher after the war.

6 Discussion

6.1 Hypothesis tests

We briefly summarize the findings for the hypothesis tests.

The first hypothesis we want to test relates to the survival of the youth business groups and whether their performance before the war has been important for their survival and re-establishment of group activity after the war. We proposed that high-trust groups (before the war) have been more able to survive (hypothesis H1). Our analyses revealed a similar degree of reduction in trust in the in-group and out-group contexts. This indicates that in-group

Table 4 Factors correlated with group meeting activity before and after the war

VARIABLES	(1) Group meetings 2020	(2) Group meetings 2023
Group meetings 2020		0.088***
		(0.018)
Business group type, Base=Irrigation		
Livestock	-0.582	0.313
	(0.784)	(0.512)
Perennials	-0.240	-0.075
	(0.893)	(0.550)
Beekeeping	-1.334*	0.288
	(0.785)	(0.507)
Group size 2019	-0.061	0.100
	(0.129)	(0.099)
Group board member, dummy	-0.769	0.110
	(0.725)	(0.310)
Group leader or vice leader, dummy	2.018**	-0.186
	(0.858)	(0.347)
Z-TW-in-19	-0.250	0.088
	(0.380)	(0.151)
Z-trust-in-19	-0.505	-0.140
	(0.351)	(0.129)
Out-group trust19	1.762	
	(1.581)	
Total work days last month 2019	0.111***	0.011
	(0.032)	(0.016)
Group workdays land conservation 2019	0.018	0.035**
	(0.037)	(0.015)
Leader satisfaction score 2019	1.012	0.657
	(0.828)	(0.522)
Performance business group score 2019	1.737	0.114
	(1.898)	(1.151)
Performance group member score 2019	-1.443	2.693*
	(2.164)	(1.373)
Social relations in group, score 2019	1.758	0.678
	(1.260)	(0.728)
Kill threat		0.073
		(0.243)
Harassment		0.689
		(0.612)
Raped		0.947
		(0.820)
Violence		-0.856***
		(0.300)
Looting		0.142
		(0.268)
Starvation		0.066
		(0.538)
Wounded		-0.093
		(0.558)
Zgroupwarindex		-0.791***
		(0.201)
Age	0.054*	-0.023
	(0.028)	(0.015)
Female, dummy	2.015***	-0.241
	(0.698)	(0.353)
Education, years	0.028	-0.050
	(0.074)	(0.034)

Cluster-robust standard errors in parentheses, clustering on groups
*** p<0.01, ** p<0.05, * p<0.1 . Attrition correction with IPW.

Table 5 Factors correlated with group meeting activity before and after the war, continued

VARIABLES	(1) Group meetings 2020	(2) Group meetings 2023
District, Base=Raya Azebo		
Degua Tembien	2.647***	-1.528**
	(0.979)	(0.768)
Seharti Samre	0.121	-1.139
	(0.936)	(0.739)
Adwa	-0.713	1.816***
	(0.786)	(0.697)
Constant	0.292	-11.261***
	(6.167)	(4.214)
Observations	1,821	1,821
R-squared	0.044	0.157

Cluster-robust standard errors in parentheses, clustering on groups
*** p<0.01, ** p<0.05, * p<0.1 . Attrition correction with IPW.

trust was not more labile than out-group trust. This may be because the groups continued to function as important social networks for the groups during the war. In Table 4, we assessed factors correlated with group meeting activity before and after the war. The level of in-group trust before the war was not strongly associated with the group meeting activity just before or after the war. Other factors besides in-group trust appear more important for group meeting activities. We have, therefore, to reject our hypothesis H1.

Based on our findings, we must reject hypotheses H2a-2e. The war has not enhanced the social capital of any form that we captured with our experiments. The results imply that we cannot reject hypothesis H3. The war has resulted in a decay in social capital within the business groups and the broader communities (districts). The war has resulted in lower levels of generosity, weakened reciprocation norms, and lower trustworthiness and trust. Among the subject-level war incidence exposure variables, violence was the type of incidence most significantly associated with trustworthiness and trust, and it was highly significant and with a negative sign, e.g., in Tables B5 and B6 in Appendix B. The sign remained negative for the violence variable in the balanced panel models in Tables D10 and D12, but they were not always significantly different from those not exposed to violence. The other subject-level war exposure variables gave less robust results. The group-level war exposure index gave predominantly a result in the opposite direction. Groups with more exposure to war incidents tended to be slightly more generous (Tables B2, B3, and E18). Such groups were also more trustworthy and trusting (Tables B5, B6, and D10), but these results were not robust in the estimated system models. Measured in SD units, this across-group war exposure effect was small compared to the total war effect on trustworthiness and trust. The group war exposure effect on trust and trustworthiness observed in the single equation models (Tables B5, B6, and D10) may have been indirect in the form of lower erosion of the reciprocity norm and strengthening out-group generosity, see Table E18.

Our hypothesis H4 stated that the collapse of youth business groups during the war had harmed other-regarding preferences within groups (H4a), norms to reciprocate (H4b), in-group and out-group generosity (H4c), reduced expected returns in the trust game (H4d), and reduced trustworthiness and trust (H4e). However, the in-group results were not very different from the out-group results. We saw a similar decay in the different types of social capital both in the in-group and out-group contexts, and the in-group social capital remained significantly higher than the out-group social capital after the war. The business groups remained important social networks for their members during the war. By the time of our postwar survey and experiments, more than 80% of the groups had restarted their meetings. They planned to restart their joint business activities and saw them as important sources for their future livelihoods. Table 4 revealed that the restart and intensity of group meetings in 2023 were significantly (at the 1% level) lower for groups with a higher war exposure index and group members exposed to violence during the war and significantly higher (at the 1% level) for groups with more meetings just before the war. It was also higher for groups that invested more in land conservation before the war. We had informal information that many groups invested in protecting their joint land resource during the war, even though their production had collapsed. We, therefore, reject hypotheses Ha-He. The within-group social capital remains higher than in these societies in general, and most groups see their business groups as an important source of future livelihood. They are preparing to restart their business activities.

6.2 Comparing our results with previous studies

Our study is unique compared to earlier studies as we have much richer prewar social capital variables for a large sample that allows us to dig deeper into the heterogeneity of social capital and how it has changed when we compare the prewar and postwar social capital measures based on experimental designs for a large balanced sample (N=1939) that allowed us to split the sample into social preference types, norms to reciprocate, trustworthiness expectations, and measure generosity, trustworthiness and trust with incentivized experiments. We have not been able to identify any previous studies that have been able to do this. Most previous studies have relied on survey data only or have only used incentivized experiments to measure other-regarding preferences or trust at some point after the war. Bauer et al. (2016) provides a very good review of earlier studies and carried out a meta-analysis of the previous studies that used similar outcome measures. These studies relied on differential war incidence exposure, especially violence exposure, to identify war impacts.

Contrary to our study, their meta-analysis found that violence exposure strengthened cooperation and political engagement, and this tendency increased with time after the war. Exposure to violence pointed in the opposite direction in our study. They did not find any significant impact on trust. The effect sizes in their meta-study must be considered small ($\leq$0.2 SD units), and our estimates for the violence and group war exposure index were similarly

small. However, our total war effect sizes measured as changes in the social capital variables from before the war till a year after the war were substantially larger, 0.6-0.7 SD units, on average. Our heterogeneity analyses revealed even bigger reductions for some reciprocity norms and social preference types. A war will likely result in large spillover effects on subjects not directly affected by specific war incidents. The small war effect sizes we identified based on differential exposure to a vector of subject-level war incidence categories relative to the significant changes we observed in social capital measures before versus after the war represent strong evidence of such strong spillover effects. We have uncovered that the war, to a varying degree, has changed the reciprocity norms, the distribution of social preference types from more altruistic and egalitarian towards more selfish and even spiteful types, and even those who remained more altruistic and egalitarian after the war had become less trustworthy and trusting after the war. We regard this as strong evidence of the erosion of social capital within these communities and business groups.

6.3 Limitations

We recognize several important limitations of our study. First, our study cannot be used to investigate parochial changes regarding attitudes towards outside ethnic groups. Second, we measured the social capital variables only once, quite soon after the war ended, and we cannot say anything about how these measures will change with time after the war. Third, we should be careful with the causal interpretations related to our results. The experimental variables are endogenous and correlated, and we need to interpret their relations as multiple correlations rather than pure causal mechanisms. Still, our study provides interesting new insights into the heterogeneity in social capital and how this heterogeneity has changed with the exposure to such a devastating war. Fourth, we cannot also rule out that the loss of the war by TPLF may have negatively affected the within-community social capital after the war. The loss of the war may contribute to larger postwar uncertainties. The social capital in a population group that won a war is likely higher than in a population group that lost a war.

7 Conclusions

Our study of the devastating 2020-2022 war in the Tigray region in northern Ethiopia investigates how the war has affected the social capital from 2019 to 2023 based on standardized incentivized experiments for a balanced sample of 1939 rural subjects belonging to 238 local business groups. We have measured within-business group and within-district distributions of social preference types, reciprocity norms, expected trustworthiness, generosity, trustworthiness, and trust. We interviewed all the subjects about their direct exposure to different types of war incidence exposure including killing threats, harassment, rape, violence, looting, starvation, and having been wounded. We also used these exposures to create a business group-level average war exposure index.

The previous literature studying war impacts relies on differential exposure to war violence, particularly to quantify war impacts on various social capital measures. Several studies jointly analyzed in a meta-study by Bauer et al. (2016) have found that exposure to war violence may enhance individuals' social cooperation and political participation after a war. The standardized positive effect sizes they measured were small ($\leq$0.3 SD units).

In contrast, our study finds fairly large negative effect sizes from the war (0.6-0.75 SD units) on several social capital measures (generosity, trustworthiness, and trust), using standardized incentivized experiments for the same balanced sample (N=1939) in both rounds. The war incidence exposure variables correlated, to a very limited extent, with the large changes in the social capital measures we revealed. Our diverse social capital measures allowed us to attribute larger changes in social capital measures to specific social preference types (altruists and egalitarians) and to subjects with strong norms to reciprocate before the war. We both found a significant reduction in the proportions of these types in the sample after the war and a more substantial reduction in generosity, trustworthiness and trust within these types.

Overall, the devastating war in Tigray has contributed to a decay in within-society social capital that contradicts the findings in some previous studies. We cannot be sure about the reasons for this. One issue is whether using within-society differential exposure to war incidents can capture the total war effects. Our study indicates that the spillover effects from war are large, and differential exposure to war incidents can only explain a minimal share of the total change in the social capital variables in our study.

Finally, we found that although most of the business groups had to close down their business activities during the war, they continued to represent an important social network for the members during the war. More than 80% of the groups had restarted regular meetings and planned to reopen their businesses when we visited them less than a year after the war ended. Although the within-business group social capital also had eroded during the war, it remained significantly higher within groups than within districts. These findings attest to the resilience and sustainability of the business groups.

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Appendix A Test and control for attrition bias

Out of the 2425 subjects covered in 2019, we found 1939 in 2023. This implies an attrition rate of 20.0%. In Appendix Table 1, we test for possible attrition bias by regressing the attrition dummy on a range of subject characteristics obtained in the 2019 survey and experiments. These include classification of social preference type, risk tolerance, gender, age, education, asset endowment index, and livestock endowment. For the business groups, we included dummies for the main production activity, group size, satisfaction/performance scores for group leaders, members, and the group as a whole, and members' assessment scores for the social relations in their group. We also included two dummies to determine whether the subjects were group board members or leaders. We tested two alternative models, one with district (*woreda*) fixed effects and one with community (*tabia*) fixed effects. The latter model resulted in the loss of a couple of groups due to collinearity. We used the first model to generate an inverse probability weight (*ipw*) variable to control attrition bias. This was done by generating the predicted outcome from the full model, running a new model with only the insignificant variables from the first model, and making a second prediction. The *ipw* variable is generated by dividing the second predicted variable by the first predicted variable. Weighted regressions will give more weight to observations more likely to have been dropped from the sample.

Risk tolerance, education, the group board member dummy, and district dummies were significant. The group leader dummy was also significant after removing the group board dummy and was therefore also removed in the second regression before prediction. Group board members and leaders and more risk-tolerant subjects were less likely to have dropped out, while subjects with more education were more likely to have dropped out. Attrition was highest in Raya Azebo district. We note that none of the group performance variables were significantly correlated with the likelihood of dropping out.

Appendix B Robustness check: Post-war outcome models

Tables B2-B7 present parsimonious models with the subject-level war exposure vector and the standardized aggregate index of war exposure at the group level as right-hand side variables for in-group and out-group generosity. Table B2 vs. Table B3 assesses whether multicollinearity between the war incidence dummy vector and the group-level normalized war incidence index (*Zgroupwarindex*) leads to the insignificance of variables in the standard dictator game models. The group-level war index variable remains significant when the individual dummy variables are included in Table B3. We, therefore, proceed with

Table A1 Attrition models

VARIABLES	attr1	attr2
Risk tolerance	-0.192**	-0.199**
	(0.091)	(0.091)
Social pref. type: Base=Altruist		
Weak altruist	-0.113	-0.120
	(0.169)	(0.185)
Egalitarian	0.101	0.071
	(0.091)	(0.096)
Weak egalitarian	-0.103	-0.086
	(0.088)	(0.093)
Spiteful	-0.192	-0.194
	(0.183)	(0.187)
Selfish	0.057	0.051
	(0.083)	(0.084)
Other	-0.251	-0.254
	(0.301)	(0.333)
Female, dummy	-0.104	-0.085
	(0.074)	(0.076)
Age, years	0.004	0.003
	(0.004)	(0.004)
Education, years	0.023**	0.020**
	(0.010)	(0.010)
Group size	-0.026	-0.042
	(0.026)	(0.027)
Business group type: Base=Irrigation		
Livestock	0.024	0.126
	(0.128)	(0.149)
Perennials	-0.153	0.054
	(0.151)	(0.166)
Beekeeping	-0.054	-0.186
	(0.116)	(0.172)
Asset endowment index	-0.021	-0.015
	(0.027)	(0.028)
Livestock endowment	-0.010	0.007
	(0.024)	(0.021)
Satisfaction with group leader	-0.037	-0.010
	(0.128)	(0.136)
Performance of group	0.051	-0.217
	(0.317)	(0.331)
Performance of group members	-0.123	-0.044
	(0.359)	(0.382)
Social relations in group	-0.223	-0.098
	(0.202)	(0.226)
Group board member, dummy	-0.202***	-0.194**
	(0.070)	(0.076)
Group leader, dummy	-0.122	-0.159
	(0.114)	(0.121)
District FE: Base=Raya Azebo		
Degua Tembien	-0.416**	
	(0.164)	
Seharti Samre	-0.302**	
	(0.153)	
Adwa	-0.409***	
	(0.148)	
Tabia Fixed Effects	No	Yes
Constant	1.092	0.281
	(0.793)	(0.798)
Observations	2,425	2,407

Cluster-robust standard errors in parentheses, clustering on groups.
*** p<0.01, ** p<0.05, * p<0.1

Table B2 War incidents and post-war in-group and out-group generosity

VARIABLES	(1) Zd1in	(2) Zd2out	(3) Zd1in	(4) Zd2out
Kill threat			-0.057	-0.001
			(0.042)	(0.041)
Harassment			0.177*	0.028
			(0.104)	(0.077)
Raped			0.034	0.023
			(0.165)	(0.147)
Violence			0.031	-0.037
			(0.070)	(0.057)
Looting			0.025	0.034
			(0.045)	(0.042)
Starvation			0.102	0.067
			(0.104)	(0.103)
Wounded			-0.082	-0.076
			(0.088)	(0.080)
Zgroupwarindex	0.048*	0.065***		
	(0.029)	(0.023)		
Constant	-0.322***	-0.301***	-0.411***	-0.376***
	(0.032)	(0.026)	(0.105)	(0.104)
Observations	1,939	1,939	1,939	1,939
R-squared	0.002	0.006	0.004	0.001

Cluster-robust standard errors in parentheses, clustering on business groups. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Models corrected for attrition with inverse probability weighting.

models that combine the dummy vector and the group-level war exposure index variables. This allows us to assess the effect or correlations of the outcome variables with the group-level severity of exposure while also allowing for subject-level variation of specific forms of exposure. The group effects variable may capture more spillover effects than the individual variables.

Table B3 shows the interesting finding that the standardized index is significant and has a positive sign in all four models. The coefficients on the war index variable increased when the individual exposure vector was included (Table B2 vs B3). In comparison, we see no systematic pattern in the individual exposure variables across these four models. This may imply that the individual psychology is variable while the average group effect is more systematic and goes toward higher in-group and out-group generosity with stronger war exposure in relative terms.

In Table B4, we have assessed the correlations between the war incidence variables and the norm to reciprocate in the trust game (Models 1 and 2) and the expected return in the trust game (Models 3 and 4) variables. Note that the norm to reciprocate variable is a three-level indicator (1=strong norm to reciprocate, 2=intermediate norm to reciprocate, 3=no obligation to reciprocate). This implies that a higher value is associated with a weaker norm. In contrast, the expected returns variable is constructed such that a higher value is associated with a higher expected return. These variables (*Zrecipnormin,*

Table B3 War incidents and post-war in-group and out-group generosity in standard and triple dictator games

VARIABLES	(1) Zd1in	(2) Zd2out	(3) Zd3in	(4) Zd4out
Kill threat	-0.078*	-0.027	-0.047	-0.008
	(0.043)	(0.042)	(0.040)	(0.040)
Harassment	0.157	0.002	0.204**	0.011
	(0.106)	(0.079)	(0.094)	(0.084)
Raped	0.022	0.007	0.060	0.094
	(0.164)	(0.145)	(0.152)	(0.171)
Violence	0.016	-0.056	-0.127*	-0.091
	(0.069)	(0.057)	(0.068)	(0.057)
Looting	-0.027	-0.034	-0.052	-0.071*
	(0.049)	(0.047)	(0.044)	(0.043)
Starvation	0.088	0.048	-0.069	-0.110
	(0.104)	(0.102)	(0.112)	(0.107)
Wounded	-0.114	-0.118	-0.011	-0.078
	(0.090)	(0.080)	(0.093)	(0.078)
Zgroupwarindex	0.065**	0.084***	0.045*	0.066***
	(0.033)	(0.028)	(0.027)	(0.023)
Constant	-0.352***	-0.301***	-0.246**	-0.164
	(0.110)	(0.108)	(0.115)	(0.114)
Observations	1,939	1,939	1,939	1,939
R-squared	0.007	0.008	0.009	0.008

Cluster-robust standard errors in parentheses, clustering on business groups. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Models corrected for attrition with inverse probability weighting.

Zrecipnormout, Zereturnin, Zereturnout) are normalized with mean zero and standard deviation equal to one.

Table B4 indicates negative correlations between the group-level war exposure index and the reciprocity norm, possibly indicating that the norm to reciprocate has been strengthened in groups with stronger exposure to war. In the in-group model, individual exposures to violence and harassment point in the same direction, while kill threats point significantly in the opposite direction.

For the expected returns models, individual exposures to harassment, violence, and starvation were associated with higher expected returns in the in-group model, while the index variable was insignificant. In the out-group model, only the index variable was significant and with a positive sign. These results may indicate that more exposure to the war is associated with higher expected trustworthiness.

Table B5 assesses the correlations between the war incidence variables and the post-war in-group and out-group trustworthiness (Models 1 and 2) and trust (Models 3 and 4) variables. These variables are normalized like the other outcome variables. Table B5 shows significant positive relationships between

Table B4 War incidents and post-war in-group and out-group norm to reciprocate and expected return in the trust game

VARIABLES	(1) Zrecipnormin	(2) Zrecipnormout	(3) Zereturnin	(4) Zereturnout
Kill threat	0.151***	0.059	-0.016	-0.081
	(0.053)	(0.051)	(0.048)	(0.050)
Harassment	-0.222**	-0.061	0.256***	0.125
	(0.091)	(0.104)	(0.098)	(0.114)
Raped	-0.084	0.225	-0.070	-0.057
	(0.139)	(0.139)	(0.145)	(0.139)
Violence	-0.277***	0.104	0.441***	-0.004
	(0.071)	(0.074)	(0.080)	(0.080)
Looting	0.076	0.040	-0.044	-0.082
	(0.056)	(0.055)	(0.053)	(0.060)
Starvation	-0.132	-0.032	0.246**	-0.014
	(0.120)	(0.114)	(0.119)	(0.113)
Wounded	0.028	-0.068	-0.109	-0.076
	(0.113)	(0.117)	(0.107)	(0.120)
Zgroupwarindex	-0.061*	-0.072**	0.027	0.093***
	(0.034)	(0.033)	(0.029)	(0.029)
Constant	0.147	0.156	-0.298**	0.006
	(0.129)	(0.122)	(0.127)	(0.122)
Observations	1,939	1,939	1,939	1,939
R-squared	0.015	0.007	0.024	0.007

Cluster-robust standard errors in parentheses, clustering on business groups. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Models corrected for attrition with inverse probability weighting.

the group-level war incidence index variable and in-group and out-group trustworthiness. This contrasts the individual kill threat, violence, and looting variables, which are significant but with a negative sign.

The group war index variable is insignificant in the in-group trust model and positive and significant in the out-group model. Violence exposure is significantly negatively correlated with trust in both the in-group and out-group models. The contrasts between the average group and individual effects for trustworthiness and trust are noteworthy, and one should be careful with the interpretations. The question is also how robust the findings in these parsimonious models to the inclusion of additional control variables.

We include models with additional controls mimicking what has been done in earlier studies. We do this as an extra check of the robustness of our results and as a careful test of how our results compare to previously published studies that have dominated the literature studying war impacts on social preferences and trust. To test the robustness of the findings in the parsimonious models for trustworthiness and trust in Table B5, we included individual characteristics, group characteristics, and district dummy variables. The results for the group and individual war incidence variables in the parsimonious models in Table B5 do not deviate substantially from the results in Table B6, which contains

Table B5 War incidents and post-war in-group and out-group trustworthiness and trust

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-trust-in	(4) Z-trust-out
Kill threat	-0.092**	-0.079**	-0.000	0.009
	(0.040)	(0.038)	(0.040)	(0.039)
Harassment	0.046	-0.117**	0.113	-0.013
	(0.079)	(0.055)	(0.094)	(0.084)
Raped	-0.058	-0.023	0.164	0.098
	(0.117)	(0.109)	(0.154)	(0.167)
Violence	-0.269***	-0.203***	-0.171***	-0.191***
	(0.053)	(0.040)	(0.048)	(0.050)
Looting	-0.076*	-0.072*	-0.012	-0.029
	(0.046)	(0.038)	(0.045)	(0.041)
Starvation	-0.023	-0.025	-0.028	0.010
	(0.098)	(0.075)	(0.109)	(0.085)
Wounded	-0.116	-0.088	0.190**	0.042
	(0.097)	(0.071)	(0.095)	(0.074)
Zgroupwarindex	0.106***	0.102***	0.005	0.059**
	(0.027)	(0.023)	(0.028)	(0.026)
Constant	-0.237**	-0.224***	-0.293***	-0.302***
	(0.103)	(0.083)	(0.112)	(0.090)
Observations	1,939	1,939	1,939	1,939
R-squared	0.023	0.024	0.009	0.010

Cluster-robust standard errors in parentheses, clustering on business groups. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Models corrected for attrition with inverse probability weighting.

the additional control variables, indicating apparent robust results. Individual exposure to violence appears, therefore, to be associated with a lower level of in-group and out-group trustworthiness and trust after the war. However, groups with more war exposure appear to stick more together and become relatively more trustworthy and even more trusting in the out-group context. This indicates that local spillover effects may go in the opposite direction of the direct subject-level war exposure effects.

All the significant subject-level war incidence effects are below 0.3 standard deviation units. Their sizes are, therefore, similar but with opposite signs of the significant effect sizes that Bauer et al. (2016) found in their meta-study. Our finding of a group-level war exposure effect in the opposite direction indicates that spillover effects can potentially be very important and influence social capital in ways that may be hard to predict.

Appendix C Robustness check: Learning effects in the games?

We cannot rule out that the subjects who played the games in 2019 remember and learned something that influenced their decisions in 2023. We use a difference-in-difference (DiD) approach to these for such double participation

Table B6 War incidents and post-war in-group and out-group trust: With district FE

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-trust-in	(4) Z-trust-out
Kill threat	-0.102**	-0.087**	-0.009	0.001
	(0.041)	(0.039)	(0.041)	(0.039)
Harassment	0.049	-0.115**	0.119	-0.013
	(0.081)	(0.055)	(0.093)	(0.083)
Raped	-0.051	-0.020	0.159	0.092
	(0.115)	(0.106)	(0.152)	(0.166)
Violence	-0.273***	-0.207***	-0.164***	-0.190***
	(0.052)	(0.040)	(0.048)	(0.050)
Looting	-0.054	-0.065*	0.003	-0.022
	(0.046)	(0.038)	(0.047)	(0.043)
Starvation	-0.038	-0.026	-0.033	0.014
	(0.095)	(0.074)	(0.107)	(0.085)
Wounded	-0.133	-0.097	0.164*	0.026
	(0.098)	(0.073)	(0.095)	(0.074)
Zgroupwarindex	0.104***	0.101***	0.006	0.066**
	(0.029)	(0.026)	(0.032)	(0.031)
Female, dummy	-0.028	-0.006	-0.108***	-0.053
	(0.039)	(0.034)	(0.041)	(0.035)
Age, years	-0.003	0.002	-0.001	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Education, years	0.005	0.003	0.003	0.005
	(0.006)	(0.004)	(0.006)	(0.005)
Group size	-0.008	-0.009	-0.011	-0.008
	(0.013)	(0.010)	(0.011)	(0.010)
Business Group type; Base=Irrigation				
Livestock	0.009	0.001	0.040	0.002
	(0.064)	(0.053)	(0.062)	(0.053)
Perennials	-0.054	-0.012	0.087	0.075
	(0.103)	(0.086)	(0.090)	(0.087)
Beekeeping	0.111*	0.074	0.219***	0.165***
	(0.063)	(0.057)	(0.066)	(0.054)
Asset endowment index	0.009	0.005	-0.008	0.002
	(0.020)	(0.016)	(0.014)	(0.014)
Livestock endowment	-0.025*	-0.026**	-0.008	-0.025**
	(0.015)	(0.013)	(0.015)	(0.012)
District: Base=Raya Azebo				
Degua Tembien	-0.349***	-0.229***	-0.105	-0.170***
	(0.078)	(0.065)	(0.080)	(0.065)
Seharti Samre	-0.238**	-0.108	-0.089	-0.084
	(0.093)	(0.080)	(0.088)	(0.083)
Adwa	-0.192**	-0.134**	-0.113	-0.164**
	(0.079)	(0.067)	(0.081)	(0.072)
Constant	0.177	-0.060	-0.085	-0.212
	(0.198)	(0.158)	(0.205)	(0.179)
Observations	1,939	1,939	1,939	1,939
R-squared	0.044	0.038	0.028	0.029

Cluster-robust standard errors in parentheses, clustering on business groups. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Models corrected for attrition with inverse probability weighting.

Table C7 Dictator game DiD full sample models for panel*year effects

VARIABLES	(1) Z-Dict-1x-in	(2) Z-Dict-1x-out	(3) Z-Dict-3x-in	(4) Z-Dict-3x-out
2023.year	-0.509***	-0.403***	-0.678***	-0.486***
	(0.060)	(0.062)	(0.059)	(0.061)
2.panel	-0.090*	-0.025	-0.061	0.005
	(0.050)	(0.055)	(0.053)	(0.057)
2023.year#2.panel	-0.063	-0.147**	-0.025	-0.142**
	(0.066)	(0.068)	(0.065)	(0.067)
Constant	0.355***	0.283***	0.403***	0.300***
	(0.045)	(0.049)	(0.047)	(0.051)
Observations	4,952	4,952	4,952	4,952
Number of unique subjects	3,013	3,013	3,013	3,013

Cluster-robust standard errors in parentheses, corrected for clustering at business group level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

effects in our experiments. For the test, we rely on the responses of the attrited sample in 2019 and the new sample added in 2023. We run the simple linear DiD panel models testing for possible year*panel subject interactions for each experimental variable. The four dictator game models are presented in Table C7, the reciprocity norm and expected returns in the trust game in Table C8, and the trustworthiness and trust models in Table C9.

Table C7 shows strong negative year effects in all models. The table also indicates a potential panel "treatment" effect for the out-group models captured by the 2023*panel interaction variable. The panel subjects were significantly (at 5% level) less generous than the non-panel subjects in the 2023 sample in the out-group dictator games.

Table C8 finds a significantly (at the 1% level) weaker norm to reciprocate in the out-group setting in 2023, while the other changes from 2019 to 2023 were insignificant.

Table C9 demonstrates strong negative year effects (all highly significant) on trustworthiness and trust. The table also shows that panel subjects were significantly (at 5% level) less trustworthy than non-panel subjects; however, this effect was much smaller than the year effect.

We cannot rule out the fact that panel subjects have learned from their participation in the 2019 games. This may explain the lower level of out-group generosity and trustworthiness, but the lower in-group and out-group trustworthiness among panel subjects could also be a selection effect. We will use Inverse Probability Weighting to correct for possible attrition effects when we assess the war effects based on the balanced panel of subjects.

Table C8 Reciprocity norm and Expected returns DiD full sample models for panel*year effects

VARIABLES	(1) Zrecipnormin	(2) Zrecipnormout	(3) Zereturnin	(4) Zereturnout
2023.year	0.083	0.219***	-0.001	-0.052
	(0.060)	(0.060)	(0.060)	(0.060)
2.panel	0.025	0.072	0.021	-0.007
	(0.049)	(0.050)	(0.050)	(0.050)
2023.year#2.panel	0.094	0.099	-0.093	-0.114*
	(0.067)	(0.067)	(0.067)	(0.067)
Constant	-0.099**	-0.207***	0.020	0.077*
	(0.044)	(0.045)	(0.045)	(0.045)
Observations	4,952	4,952	4,952	4,952
Number of unique subjects	3,013	3,013	3,013	3,013

Cluster-robust standard errors in parentheses, corrected for clustering at business group level
Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table C9 Trustworthiness and Trust DiD full sample models with panel*year effects

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-trust-in	(4) Z-trust-out
2023.year	-0.707***	-0.688***	-0.567***	-0.522***
	(0.059)	(0.061)	(0.060)	(0.061)
2.panel	-0.123**	-0.133**	-0.037	-0.045
	(0.054)	(0.058)	(0.056)	(0.058)
2023.year#2.panel	0.014	0.026	-0.044	-0.079
	(0.065)	(0.067)	(0.067)	(0.067)
Constant	0.451***	0.445***	0.336***	0.333***
	(0.048)	(0.052)	(0.050)	(0.052)
Observations	4,952	4,952	4,952	4,952
Number of unique subjects	3,013	3,013	3,013	3,013

Cluster-robust standard errors in parentheses, corrected for clustering at business group level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Appendix D Balanced panel models with group and member variables

The following models allow us to inspect the size of the year effect in standardized SD units of the dependent variables as a first measure of the total war effect. We correct for attrition with IPW. We then introduce additional potential explanatory variables step-wise while we also inspect how their introduction changes the size of the coefficient on the year dummy variable. The

more it is reduced, the more we can attribute the war effect to the added explanatory (or control) variables:

a) Subject- and group-level war exposure variables,

b) Asset losses due to the war and pre-war asset control variables,

c) Pre-war business group performance indicators that may explain pre-war levels of in-group trustworthiness and trust,

d) The position of subjects in the business groups that may have effects on their in-group dependent variables,

e) Subject characteristics (age, sex, education).

The results of this model are presented in Table D10. Surprisingly, the war exposure variables at subject and group levels do not reduce the coefficients on the year dummy variable much in the trustworthiness models and the coefficients have even increased in the trust models. The coefficients on the individual and group exposure variables are quite close to those in Table B5. The results are surprising given that we in Table D10 also have included asset losses during the war and prewar asset endowment. While these variables also were significant, and were negatively correlated with trustworthiness and trust, the sizes of these coefficients were also small compared to the coefficient on the year dummy. Unsurprisingly, trustworthiness and trust were also significantly related to the business group performance and individual characteristics variables.

Next, we want to assess whether the changes in trustworthiness and trust may be explained by changes in the distribution of social preference types, the norm to reciprocate, expected returns, and the subjects' generosity. By including these variables, we hoped we could open more of the black box related to how the war may have affected social capital in our study. We build on the theoretical assumption that trustworthiness and trust are partly driven by generosity, reciprocity norms, expected trustworthiness (expected returns in the game), and the distribution of social preference types in our sample. As these social capital measures may have changed over time due to the war, we allow them to be correlated within each panel round as a first step towards identifying how they may be related and possibly can explain war impacts and reduce the coefficients on the year dummy variables. We retain all the variables from the previous Table D10. The new models are distributed over two tables, Table D11 and D12, to include all the results for all the variables. Table D11 contains most of the experimental variables and the year dummy. We see that the coefficients on the year dummy have been substantially reduced after introducing the experimental variables. Many of the experimental variables are highly significant and have large parameter values. Altruistic and egalitarian types are more trustworthy and trusting than the other social preference types. Strong norms to reciprocate are also associated with much higher trustworthiness and trust. These effects are strong in both the in-group and out-group experiments. Expected trustworthiness (returns in the trust game) influences trust and trustworthiness. Finally, generosity, as

Table D10 Trustworthiness and Trust Balanced Panel models

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-Trust-in	(4) Z-Trust-out
2023.year	-0.673***	-0.659***	-0.628***	-0.628***
	(0.030)	(0.030)	(0.032)	(0.033)
Zgroupwarindex	0.104***	0.094***	0.007	0.065***
	(0.023)	(0.023)	(0.022)	(0.023)
Kill threat	-0.073*	-0.080**	-0.002	-0.013
	(0.039)	(0.039)	(0.037)	(0.038)
Harassment	0.101	0.024	0.059	-0.022
	(0.070)	(0.069)	(0.074)	(0.072)
Raped	-0.053	0.001	0.093	-0.028
	(0.094)	(0.096)	(0.114)	(0.105)
Violence	-0.155***	-0.136**	-0.052	-0.071
	(0.056)	(0.055)	(0.055)	(0.055)
Looting	-0.051	-0.043	0.021	-0.017
	(0.040)	(0.039)	(0.039)	(0.039)
Starvation	-0.053	-0.018	-0.016	-0.025
	(0.074)	(0.070)	(0.088)	(0.081)
Wounded	-0.058	-0.053	0.158*	0.021
	(0.077)	(0.064)	(0.081)	(0.074)
Zwareffectassetloss	-0.039**	-0.031*	-0.011	-0.007
	(0.016)	(0.016)	(0.018)	(0.017)
Zdurassetno19	-0.052**	-0.060**	-0.046**	-0.026
	(0.026)	(0.025)	(0.023)	(0.022)
Ztlu19	0.020	0.027	0.044**	0.008
	(0.021)	(0.021)	(0.021)	(0.020)
Zleadersatisfact19	0.050**	0.037*	0.037*	0.016
	(0.022)	(0.021)	(0.021)	(0.020)
Zmperformanceyg19	-0.044*	-0.037	-0.053**	-0.039*
	(0.024)	(0.023)	(0.024)	(0.023)
Zmsocialrelaygmembers19	0.064**	0.062**	0.059**	0.061***
	(0.026)	(0.025)	(0.024)	(0.023)
Board member, dummy	-0.077**	-0.057	-0.092**	-0.049
	(0.039)	(0.040)	(0.040)	(0.039)
Group leader	0.036	0.070	0.123**	0.146**
	(0.057)	(0.056)	(0.057)	(0.059)
Non-groupy	-0.070**	0.060*	-0.112***	0.094***
	(0.031)	(0.031)	(0.032)	(0.032)
Age	-0.000	0.003*	0.001	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
Female, dummy	-0.109***	-0.080**	-0.207***	-0.175***
	(0.036)	(0.035)	(0.036)	(0.036)
Education, years	0.008*	0.008	0.011**	0.017***
	(0.005)	(0.005)	(0.005)	(0.005)
Constant	0.487***	0.224**	0.341***	0.086
	(0.113)	(0.112)	(0.130)	(0.124)
Observations	3,878	3,878	3,878	3,878
R-squared	0.143	0.126	0.119	0.113

Cluster-robust standard errors in parentheses, clustering on groups. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Attrition correction with IPW.

captured by the giving behavior in the standard and triple dictator games, is also strongly positively correlated with trustworthiness and trust.

Our descriptive analyses found a significant change in the distribution of social preference types (Figure 2) and reciprocity norms (Figure 3) from 2019 to 2023. We also found that trustworthiness and trust were reduced within each social preference type (Figure 8). We aim to explore these changes by including interactions between the year dummy, the social preference type, and the year and reciprocity norm types. Otherwise, we will keep the specifications as in the previous tables. The main results on the interaction effects and the other key variables of interest are presented in Figures D1 (in-group and out-group trustworthiness) and D2 (in-group and out-group trust). The full model results are presented across Tables D13, D14, and D15.

Table D13 shows that the coefficients on the year dummy (without the interaction effects) have come much closer to zero. The year interactions with the strong reciprocity norm dummies are highly significant and have negative signs in the trustworthiness models. This indicates a significant decay in the reciprocity norm even though they still claim it to be strong. While altruists and egalitarians were more trustworthy than the selfish types in 2019, this difference has been reduced and become insignificant in the trustworthiness models in 2023.

In the trust models, we also see a decay in the norm-to-reciprocate effect on trust from 2019 to 2023, and the same is true for altruists and egalitarians. We consider this evidence of the mechanisms of social capital change associated with the war. Other-regarding preferences have suffered, and so have the reciprocity norms.

Appendix E System Models with out-group and in-group change in trustworthiness and trust as dependent variables (2023-2019) normalized

To address the endogenous relationships between the norm to reciprocate, social preference type, generosity, expected trustworthiness, trustworthiness, and trust, we estimate systems models as a robustness check of the findings in the single equation models with endogenous right-hand side (RHS) variables. We build on the models developed by Holden and Tilahun (2021). We make two important extensions. First, we use the change in out-group and in-group trustworthiness and trust from 2019 to 2023 as the recursively dependent variables to utilize that we have a two-round panel. Second, we include the subject- and group-level war exposure variables in all equations in the system to better identify how such exposure may affect the different social capital variables.

The first system model estimates the reciprocity norm, trustworthiness, and trust models jointly in the out-group and in-group context in line with

Table D11 Trustworthiness and Trust Balanced Panel models

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-Trust-in	(4) Z-Trust-out
2023.year	-0.393***	-0.354***	-0.302***	-0.234***
	(0.024)	(0.024)	(0.029)	(0.026)
Non-groupy	0.087***	-0.043	0.052*	-0.032
	(0.026)	(0.027)	(0.029)	(0.025)
Social pref types: Base:	Selfish			
Altruist-in	0.291***		0.303***	
	(0.038)		(0.040)	
Weak altruist-in	0.163**		0.236***	
	(0.065)		(0.073)	
Egalitarian-in	0.190***		0.123***	
	(0.040)		(0.043)	
Weak egal.-in	0.046		0.058	
	(0.034)		(0.037)	
Spiteful-in	0.028		-0.072	
	(0.052)		(0.054)	
Other-in	-0.001		0.061	
	(0.082)		(0.093)	
Altruist-out		0.251***		0.320***
		(0.051)		(0.058)
Weak altruist-out		0.034		0.101
		(0.082)		(0.085)
Egalitarian-out		0.180***		0.118***
		(0.043)		(0.044)
Weak egal.-out		0.053		-0.006
		(0.035)		(0.033)
Spiteful-out		-0.008		-0.038
		(0.034)		(0.030)
Other-out		0.026		-0.070
		(0.064)		(0.059)
Reciprocity norm: Base:	Not obliged			
Extremely obliged-in	0.796***		0.492***	
	(0.046)		(0.049)	
Somewhat obliged-in	0.289***		0.189***	
	(0.038)		(0.043)	
Extremely obliged-out		1.150***		0.391***
		(0.055)		(0.040)
Somewhat obliged-out		0.430***		0.100***
		(0.029)		(0.027)
Expected return: Base:	E(ret.)=0			
E(return)-in$\prec$1/3	-0.109*		0.215***	
	(0.062)		(0.055)	
E(return)-in=1/3	-0.046		0.152***	
	(0.051)		(0.047)	
E(return)-in=1/2	0.151***		0.366***	
	(0.051)		(0.049)	
E(return)-in$\succ$1/2	0.135**		0.364***	
	(0.056)		(0.055)	
E(return)-out$\prec$1/3		-0.069		0.285***
		(0.042)		(0.040)
E(return)-out=1/3		-0.048		0.343***
		(0.037)		(0.036)
E(return)-out=1/2		0.092**		0.443***
		(0.045)		(0.047)
E(return)-out$\succ$1/2		0.225***		0.455***
		(0.076)		(0.072)

Cluster-robust standard errors in parentheses, clustering on groups. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Corrected for attrition with IPW.

Table D12 Trustworthiness and Trust Balanced Panel models, continued from the previous page

VARIABLES	Z-TW-in	Z-TW-out	Z-Trust-in	Z-Trust-out
ZDictator1x-in	0.340***			
	(0.018)			
ZDictator1x-out		0.243***		
		(0.020)		
ZDictator3x-in			0.385***	
			(0.021)	
ZDictator3x-out				0.463***
				(0.022)
Zgroupwarindex	0.048***	0.030*	-0.031*	-0.003
	(0.016)	(0.016)	(0.017)	(0.015)
Kill threat	-0.023	-0.031	0.038	0.028
	(0.029)	(0.027)	(0.028)	(0.025)
Harassment	-0.020	-0.068	-0.071	-0.091
	(0.060)	(0.057)	(0.061)	(0.056)
Raped	-0.125*	-0.025	0.008	-0.145***
	(0.069)	(0.071)	(0.077)	(0.051)
Violence	-0.225***	-0.063	-0.108**	-0.032
	(0.048)	(0.043)	(0.050)	(0.042)
Looting	-0.023	-0.021	0.038	0.024
	(0.029)	(0.027)	(0.030)	(0.027)
Starvation	-0.087	-0.023	-0.030	-0.012
	(0.053)	(0.057)	(0.067)	(0.068)
Wounded	-0.039	-0.063	0.172***	0.013
	(0.058)	(0.047)	(0.066)	(0.057)
Zwareffectassetloss	-0.007	-0.010	0.013	0.007
	(0.011)	(0.009)	(0.013)	(0.011)
Zdurassetno19	-0.046**	-0.050***	-0.045***	-0.016
	(0.019)	(0.017)	(0.017)	(0.015)
Ztlu19	0.031**	0.033**	0.053***	0.004
	(0.016)	(0.014)	(0.016)	(0.014)
Age, years	0.000	-0.000	0.003*	0.002
	(0.002)	(0.001)	(0.002)	(0.002)
Female, dummy	-0.039	0.008	-0.115***	-0.089***
	(0.027)	(0.025)	(0.030)	(0.026)
Education, years	0.006	0.003	0.008**	0.011***
	(0.004)	(0.003)	(0.004)	(0.003)
Board member, dummy	-0.028	-0.020	-0.059*	-0.035
	(0.030)	(0.029)	(0.032)	(0.028)
Group leader, dummy	-0.017	-0.010	0.082*	0.074*
	(0.041)	(0.036)	(0.044)	(0.039)
Zleadersatisfact19	0.033	0.022	0.022	-0.001
	(0.021)	(0.020)	(0.021)	(0.019)
Zmperformanceyg19	-0.037*	-0.028	-0.045**	-0.029
	(0.022)	(0.022)	(0.022)	(0.021)
Zmsocialrelaygmember19	0.052**	0.051**	0.046**	0.049**
	(0.025)	(0.024)	(0.023)	(0.021)
Constant	-0.475***	-0.299***	-0.694***	-0.418***
	(0.096)	(0.088)	(0.110)	(0.107)
Observations	3,878	3,878	3,878	3,878
R-squared	0.505	0.534	0.435	0.564

Cluster-robust standard errors in parentheses, clustering on groups . Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Corrected for attrition with IPW.

Table D13 Trustworthiness and Trust Balanced Panel models with year interactions with reciprocity norm and social preference type

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-Trust-in	(4) Z-Trust-out
2023.year	-0.121**	-0.066*	-0.142*	-0.070*
	(0.058)	(0.035)	(0.079)	(0.039)
Reciprocity norm	Base:Not obliged			
Extremely obliged-in	0.967***		0.566***	
	(0.066)		(0.076)	
Somewhat obliged-in	0.377***		0.181**	
	(0.058)		(0.071)	
Social pref types	Base=Selfish			
Altruist-in	0.336***		0.392***	
	(0.061)		(0.066)	
Weak altruist-in	0.142		0.328***	
	(0.106)		(0.118)	
Egalitarian-in	0.228***		0.218***	
	(0.063)		(0.067)	
Weak egal.-in	0.086*		0.107*	
	(0.049)		(0.063)	
Spiteful-in	0.074		-0.073	
	(0.103)		(0.113)	
Other-in	0.045		0.050	
	(0.171)		(0.148)	
2023.year#Extremely obliged-in	-0.315***		-0.143*	
	(0.062)		(0.084)	
2023.year#Somewhat obliged-in	-0.145**		0.023	
	(0.058)		(0.078)	
2023.year#Altruist-in	-0.092		-0.174**	
	(0.069)		(0.078)	
2023.year#Weak altruist-in	0.049		-0.170	
	(0.135)		(0.145)	
2023.year#Egalitarian-in	-0.074		-0.202**	
	(0.076)		(0.079)	
2023.year#Weak egal.-in	-0.075		-0.081	
	(0.059)		(0.076)	
2023.year#Spiteful-in	-0.081		-0.006	
	(0.114)		(0.118)	
2023.year#Selfish-in	0.000		0.000	
	(0.000)		(0.000)	
2023.year#Other-in	-0.095		-0.002	
	(0.187)		(0.192)	
Expected return Base:	E(ret.)=0			
E(return)-in$\prec$1/3	-0.097		0.219***	
	(0.063)		(0.055)	
E(return)-in=1/3	-0.034		0.158***	
	(0.054)		(0.049)	
E(return)-in=1/2	0.165***		0.374***	
	(0.051)		(0.050)	
E(return)-in$\succ$1/2	0.155***		0.375***	
	(0.057)		(0.054)	
zee_Dictator1x-in	0.339***			
	(0.018)			
zee_Dictator1x-out		0.232***		
		(0.019)		

Cluster-robust standard errors in parentheses, clustering on groups . Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Corrected for attrition with IPW.

Table D14 Trustworthiness and Trust Balanced Panel models with year and reciprocity norm and social preference type interactions, continued

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-Trust-in	(4) Z-Trust-out
Non-groupy	0.084***	-0.045*	0.050	-0.035
	(0.024)	(0.025)	(0.031)	(0.027)
Reciprocity norm	Base:Not obliged			
Extremely obliged-out		1.457***		0.528***
		(0.073)		(0.061)
Somewhat obliged-out		0.584***		0.177***
		(0.044)		(0.040)
Social pref types	Base=Selfish			
Altruist-out		0.245***		0.471***
		(0.090)		(0.095)
Weak altruist-out		0.022		0.215
		(0.151)		(0.137)
Egalitarian-out		0.202***		0.196***
		(0.063)		(0.061)
Weak egal.-out		0.038		0.002
		(0.058)		(0.054)
Spiteful-out		0.046		-0.065
		(0.065)		(0.053)
Other-out		0.067		-0.002
		(0.114)		(0.099)
2023.year#Extremely obliged-out		-0.630***		-0.268***
		(0.073)		(0.068)
2023.year#Somewhat obliged-out		-0.266***		-0.122***
		(0.042)		(0.043)
2023.year#Altruist-out		0.012		-0.323***
		(0.107)		(0.108)
2023.year#Weak altruist-out		0.025		-0.212
		(0.168)		(0.168)
2023.year#Egalitarian-out		-0.060		-0.192***
		(0.086)		(0.069)
2023.year#Weak egal.-out		0.036		-0.003
		(0.071)		(0.064)
2023.year#Spiteful-out		-0.104		0.048
		(0.065)		(0.054)
2023.year#Selfish-out		0.000		0.000
		(0.000)		(0.000)
2023.year#Other-out		-0.050		-0.112
		(0.124)		(0.116)
Expected return Base:	E(ret.)=0			
E(return)-out$\prec$1/3		-0.049		0.298***
		(0.042)		(0.040)
E(return)-out=1/3		-0.030		0.355***
		(0.037)		(0.034)
E(return)-out=1/2		0.130***		0.466***
		(0.041)		(0.044)
E(return)-out$\succ$1/2		0.255***		0.480***
		(0.075)		(0.071)
zee_Dictator3x-in			0.384***	
			(0.022)	
zee_Dictator3x-out				0.451***
				(0.024)

Cluster-robust standard errors in parentheses, clustering on groups . Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Corrected for attrition with IPW.

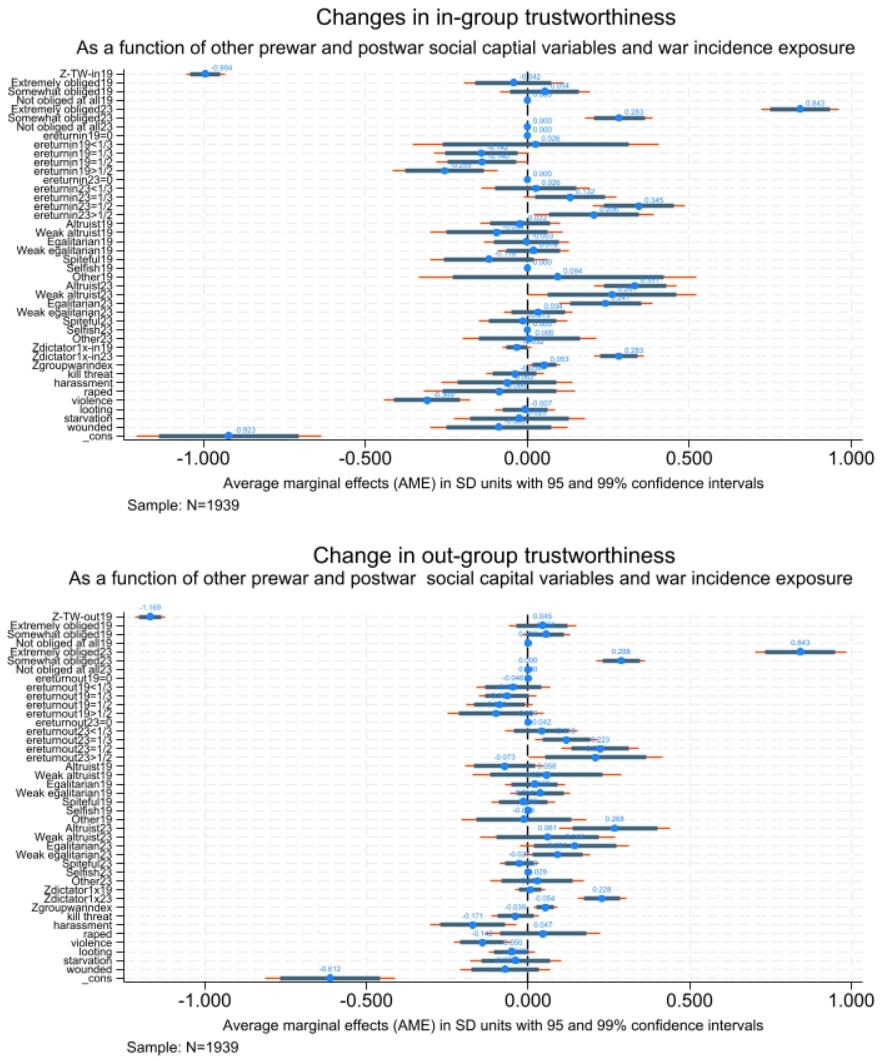

Fig. D1 Change in in-group and out-group Trustworthiness models with war incidence and social capital variables from 2019 and 2023

what was done by Holden and Tilahun (2021) but with the abovementioned changes.

The model results are presented in Tables E16 and E17. Overall, the results align with the main results in the single equation models for the social capital changes. However, we cannot say the same for the war incidence variables. Both signs and significance levels changed across models, indicating that they do not provide robust evidence of the war's impacts on the social capital variables.

The models above did not include the generosity variables from our experiments as we assumed that the social preference types captured generosity. However, the social preference types may capture other things than differences in generosity. To investigate a different out-group model system that includes the standard and triple dictator games. Both trustworthiness and trust may partly be explained by generosity. We suggest that the standard dictator game resembles the trustworthiness decision. In contrast, the triple dictator game is closer to the trusting decision where the amount received by the other party is tripled.

We included the number of group meetings in the business groups before (2020) and after (2023) the war to test whether they are correlated with reciprocity norms, trustworthiness, and trust. If in-group trust and trustworthiness are labile and dependent on the group activity, these variables can significantly correlate with trustworthiness and trust.

The results from this five-equation system are presented in Tables E18 and E19.

Appendix F Experimental protocol

Attached in separate file.

Supplementary information. Experimental designs are attached in a separate pdf-file.

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- Conflict of interest/Competing interests
  The authors declare no conflicts of interest.
- Ethics approval
  Funding was approved based on an independent assessment and approval of ethical standards being met by the project by a scientific committee. The School of Economics and Business at the Norwegian University of Life Sciences Ethics Committee has provided ethical approval based on the Pre-Analysis Plan for Ethical Approval (Holden et al., 2023).
- Consent to participate
  All subjects participating in the project participated voluntarily and were always asked about their willingness to participate after receiving information about what participation implied and that the project adhered to strict confidentiality and anonymity of individual information (informed consent).
- Consent for publication
  The article will be published as an open-access article as required by the funding institution.
- Availability of data and materials
  All (anonymized) data (STATA files) used in the paper will be made available upon publication of the article as supplementary information.
- Code availability
  All codes (Stata do files) used to analyze the data will be made available upon publication as supplementary files.
- Authors' contributions
- Data cleaning, organization, and analyses
  Stein T. Holden and Mesfin Tilahun. The first author made the initial experimental designs. Both authors collaborated on the field testing of the survey and experimental designs and the training of enumerators. The second author was responsible for data collection and organizing the survey and field experimental teams. The first author was in charge of data checking, and both contributed to data cleaning and organization. The first author made the econometric analyses and wrote the paper.

Table D15 Trustworthiness and Trust Balanced Panel models with year and reciprocity norm and social preference type interactions, continued

VARIABLES	(1) Z-TW-in	(2) Z-TW-out	(3) Z-Trust-in	(4) Z-Trust-out
Zgroupwarindex	0.048***	0.029*	-0.030*	-0.002
	(0.017)	(0.017)	(0.018)	(0.016)
Kill threat	-0.026	-0.028	0.035	0.027
	(0.028)	(0.028)	(0.028)	(0.025)
Harassment	-0.020	-0.075	-0.072	-0.103*
	(0.058)	(0.054)	(0.065)	(0.053)
Raped	-0.131*	-0.045	0.001	-0.144**
	(0.071)	(0.076)	(0.074)	(0.056)
Violence	-0.222***	-0.068	-0.108**	-0.032
	(0.051)	(0.046)	(0.051)	(0.037)
Looting	-0.025	-0.020	0.035	0.021
	(0.027)	(0.027)	(0.030)	(0.026)
Starvation	-0.081	-0.019	-0.027	-0.008
	(0.058)	(0.062)	(0.064)	(0.071)
Wounded	-0.041	-0.055	0.171**	0.007
	(0.058)	(0.043)	(0.067)	(0.052)
Zwareffectassetloss	-0.005	-0.012	0.016	0.008
	(0.012)	(0.010)	(0.014)	(0.010)
Zdurassetno19	-0.042**	-0.045***	-0.042**	-0.012
	(0.020)	(0.017)	(0.017)	(0.016)
Ztlu19	0.027*	0.027**	0.048**	-0.001
	(0.015)	(0.013)	(0.019)	(0.014)
Zleadersatisfact19	0.021	0.011	0.018	0.004
	(0.021)	(0.017)	(0.019)	(0.016)
Zmperformanceyg19	-0.035*	-0.012	-0.042**	-0.010
	(0.020)	(0.016)	(0.017)	(0.013)
Zmsocialrelaygmember19	0.047**	0.027	0.040**	0.018
	(0.023)	(0.019)	(0.018)	(0.016)
Age, years	0.000	-0.000	0.003	0.002
	(0.002)	(0.001)	(0.002)	(0.002)
Female, dummy	-0.035	0.014	-0.112***	-0.085***
	(0.031)	(0.029)	(0.029)	(0.028)
Education, years	0.006	0.004	0.008**	0.011***
	(0.004)	(0.003)	(0.004)	(0.003)
Group board member, dummy	-0.029	-0.029	-0.060*	-0.040
	(0.030)	(0.028)	(0.034)	(0.028)
Group leader, dummy	-0.013	0.007	0.082*	0.080**
	(0.040)	(0.038)	(0.044)	(0.039)
Constant	-0.646***	-0.489***	-0.790***	-0.528***
	(0.105)	(0.092)	(0.113)	(0.116)
Observations	3,878	3,878	3,878	3,878
R-squared	0.509	0.547	0.439	0.572

Cluster-robust standard errors in parentheses, clustering on groups . Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Corrected for attrition with IPW.

Table E16 Out-group and in-group change in trustworthiness and trust: system models with predicted reciprocity norm in 2023 and number of group meetings in 2020 and 2023

VARIABLES	(1) Out-group Rnorm23	(2) Out-group ZΔTW	(3) Out-group ZΔtrust	(4) In-group Rnorm23	(5) In-group ZΔTW	(6) In-group ZΔtrust
Zgroupwarindex	-0.151***	0.035	-0.021	-0.032	-0.016	0.017
	(0.052)	(0.032)	(0.032)	(0.037)	(0.023)	(0.033)
Kill threat	0.068	0.013	0.031	0.197***	-0.022	0.003
	(0.061)	(0.060)	(0.055)	(0.067)	(0.035)	(0.051)
Harassment	-0.043	-0.220*	0.236**	-0.355***	0.148*	0.167*
	(0.122)	(0.124)	(0.109)	(0.131)	(0.090)	(0.098)
Raped	0.402**	0.114	0.422**	-0.314	0.069	0.062
	(0.168)	(0.147)	(0.195)	(0.212)	(0.112)	(0.159)
Violence	0.103	-0.136	-0.157*	-0.491***	-0.093	-0.073
	(0.087)	(0.121)	(0.081)	(0.098)	(0.060)	(0.078)
Looting	-0.023	-0.011	-0.007	0.059	0.024	-0.060
	(0.063)	(0.056)	(0.051)	(0.070)	(0.041)	(0.059)
Starvation	-0.064	-0.004	0.121	-0.133	0.062	-0.020
	(0.142)	(0.135)	(0.111)	(0.145)	(0.086)	(0.115)
Wounded	-0.009	-0.132	0.076	0.092	-0.089	0.083
	(0.133)	(0.111)	(0.102)	(0.130)	(0.084)	(0.107)
Out-group	Base:					
Reciprocity norm	No oblig.					
Strong norm19	-0.343***	-1.765***	-0.342***	-0.063	0.107	0.020
	(0.090)	(0.087)	(0.088)	(0.089)	(0.066)	(0.086)
Weak norm19	-0.352***	-0.704***	-0.129**	0.025	0.015	0.013
	(0.075)	(0.062)	(0.057)	(0.074)	(0.056)	(0.064)
Rnorm-out23, pred		-0.517***	-0.319***	1.329***	-0.069***	-0.026
		(0.035)	(0.040)	(0.048)	(0.025)	(0.033)
Out-group	Base:					
Social Pref. type	selfish					
Altruist19	-0.066	-0.352***	-0.677***			
	(0.094)	(0.098)	(0.122)			
Weak altruist19	-0.101	-0.251	-0.658***			
	(0.216)	(0.191)	(0.167)			
Egalitarian19	0.042	-0.311***	-0.213***			
	(0.084)	(0.078)	(0.081)			
Weak egal.19	-0.004	-0.075	-0.091			
	(0.081)	(0.066)	(0.073)			
Spiteful19	0.010	-0.111	0.110*			
	(0.080)	(0.079)	(0.059)			
Other19	0.103	-0.193	0.061			
	(0.193)	(0.147)	(0.124)			
Tabia FE	Yes					
Out-group	Base:					
Ereturn19	=0					
Ereturn19≺1/3		0.133	-0.537***			
		(0.089)	(0.088)			
Ereturn19=1/3		0.074	-0.578***			
		(0.072)	(0.072)			
Ereturn19=1/2		-0.168**	-0.745***			
		(0.077)	(0.092)			
Ereturn19≻1/2		-0.459***	-0.795***			
		(0.140)	(0.128)			

Cluster-robust standard errors in parentheses, clustering on groups. Significance levels:
*** p<0.01, ** p<0.05, * p<0.1. Attrition bias correction with Inverse Probability Weighting.

Table E17 Recursive System Models, continued

VARIABLES	(1) Out-group Rnorm23	(2) Out-group ZΔTW	(3) Out-group ZΔtrust	(4) In-group Rnorm23	(5) In-group ZΔTW	(6) In-group ZΔtrust
Groupmeetings20	0.005	0.014**	-0.004	-0.004	0.002	0.004
	(0.009)	(0.006)	(0.007)	(0.007)	(0.005)	(0.007)
Groupmeetings23		-0.005	-0.006	0.004	-0.010	-0.015*
		(0.008)	(0.008)	(0.009)	(0.006)	(0.008)
Enumerator FE		Yes				
ZΔTW-out, pred			0.348***		0.799***	
			(0.030)		(0.024)	
In-group Social Pref. type	Base: selfish					
Altruist19				-0.142*	-0.111**	-0.145*
				(0.082)	(0.046)	(0.077)
Weak altruist19				0.107	-0.211**	-0.389***
				(0.147)	(0.086)	(0.144)
Egalitarian19				-0.028	-0.186***	-0.077
				(0.082)	(0.053)	(0.078)
Weak egal.19				-0.152*	-0.050	-0.031
				(0.084)	(0.049)	(0.074)
Spiteful19				0.264*	0.176*	0.117
				(0.149)	(0.106)	(0.118)
Other19				0.347	-0.028	-0.224*
				(0.302)	(0.166)	(0.135)
ZΔtrust-out, pred					-0.008	0.458***
					(0.017)	(0.025)
In-group Ereturn19	Base: =0					
Ereturn19≺1/3					-0.067	-0.300**
					(0.161)	(0.125)
Ereturn19=1/3					-0.183***	-0.070
					(0.064)	(0.097)
Ereturn19=1/2					-0.334***	-0.282***
					(0.059)	(0.100)
Ereturn19≻1/2					-0.352***	-0.247**
					(0.068)	(0.114)
ZΔTW-in, pred						0.273***
						(0.029)
var(e.ZΔTW-out)						1.002***
						(0.054)
var(e.ZΔtrustout)						1.077***
						(0.057)
var(e.ZΔTW-in)						0.539***
						(0.033)
var(e.ZΔtrust-in)						1.014***
						(0.053)
Constant		1.743***	1.152***		0.297**	0.267
		(0.201)	(0.186)		(0.140)	(0.196)
Observations	1,939	1,939	1,939	1,939	1,939	1,939

Cluster-robust standard errors in parentheses, clustering on groups. Significance levels:
*** p<0.01, ** p<0.05, * p<0.1. Attrition bias correction with Inverse Probability Weighting.

Table E18 Out-group change in generosity, trustworthiness, and trust: system estimation

VARIABLES	(1) Out-group Rnorm23	(2) Out-group ZΔDict1x	(3) Out-group ZΔDict3x	(4) Out-group ZΔTW	(5) Out-group ZΔtrust
Zgroupwarindex	-0.152***	0.075***	0.060**	0.037	-0.008
	(0.052)	(0.029)	(0.024)	(0.032)	(0.028)
Kill threat	0.068	-0.024	-0.004	0.003	0.012
	(0.061)	(0.045)	(0.043)	(0.058)	(0.048)
Harassment	-0.043	-0.013	0.005	-0.227*	0.194**
	(0.122)	(0.083)	(0.088)	(0.123)	(0.091)
Raped	0.400**	-0.024	0.071	0.132	0.441***
	(0.168)	(0.147)	(0.176)	(0.137)	(0.159)
Violence	0.104	-0.042	-0.086	-0.121	-0.162**
	(0.087)	(0.062)	(0.061)	(0.116)	(0.075)
Looting	-0.022	-0.029	-0.073	-0.017	0.017
	(0.063)	(0.049)	(0.044)	(0.056)	(0.047)
Starvation	-0.060	0.052	-0.118	0.004	0.168
	(0.142)	(0.114)	(0.112)	(0.129)	(0.104)
Wounded	-0.009	-0.141	-0.097	-0.080	0.155*
	(0.133)	(0.086)	(0.084)	(0.105)	(0.093)
Out-group Reciprocity norm	Base: No oblig.				
Strong norm19	-0.343***			-1.558***	-0.243***
	(0.090)			(0.089)	(0.079)
Weak norm19	-0.353***			-0.608***	-0.059
	(0.075)			(0.063)	(0.052)
Rnorm23, pred				-0.361***	-0.128***
				(0.043)	(0.038)
Out-group Social Pref. type	Base: selfish				
Altruist19	-0.068	0.057	0.029	-0.208**	-0.424***
	(0.094)	(0.075)	(0.073)	(0.092)	(0.105)
Weak altruist19	-0.100	0.017	-0.064	-0.048	-0.353**
	(0.216)	(0.147)	(0.127)	(0.189)	(0.164)
Egalitarian19	0.041	-0.013	-0.074	-0.226***	-0.099
	(0.084)	(0.065)	(0.053)	(0.074)	(0.072)
Weak egal.19	-0.006	0.002	-0.019	-0.014	0.013
	(0.081)	(0.065)	(0.056)	(0.064)	(0.063)
Spiteful19	0.008	-0.016	-0.041	-0.148*	0.066
	(0.080)	(0.057)	(0.051)	(0.076)	(0.054)
Other19	0.104	0.014	-0.039	-0.159	0.120
	(0.193)	(0.126)	(0.117)	(0.140)	(0.124)
Tabia FE	Yes				
Zdictator1x19		-1.035***		0.076	
		(0.026)		(0.057)	
Zdictator3x19			-1.075***		0.166***
			(0.020)		(0.057)
ZΔdict1x, pred				0.279***	
				(0.043)	
ZΔdict3x, pred					0.503***
					(0.043)

Cluster-robust standard errors in parentheses, clustering on groups. *** p<0.01, ** p<0.05, * p<0.1. Attrition bias correction with Inverse Probability Weighting.

Table E19 Out-group change in generosity, trustworthiness, and trust: system estimation, continued

VARIABLES	(1) Out-group Rnorm23	(2) Out-group ZΔDict1x	(3) Out-group ZΔDict3x	(4) Out-group ZΔTW	(5) Out-group ZΔtrust
Out-group					
Base: Ereturn19=0					
Ereturn19≺1/3				0.179**	-0.442***
				(0.088)	(0.085)
Ereturn19=1/3				0.126*	-0.479***
				(0.070)	(0.069)
Ereturn19=1/2				-0.101	-0.607***
				(0.076)	(0.085)
Ereturn19≻1/2				-0.331**	-0.601***
				(0.135)	(0.120)
Enumerator FE				Yes	
ZΔTW, pred					0.215***
					(0.027)
var(e.ZΔdict1x)					0.736***
					(0.058)
var(e.ZΔdict3x)					0.627***
					(0.048)
var(e.ZΔTW)					0.930***
					(0.052)
var(e.ZΔtrust)					0.875***
					(0.048)
Constant		-0.315**	-0.144	1.490***	0.529***
		(0.126)	(0.123)	(0.174)	(0.149)
Observations	1,939	1,939	1,939	1,939	1,939

Cluster-robust standard errors in parentheses, clustering on groups. *** p<0.01, ** p<0.05, * p<0.1. Attrition bias correction with Inverse Probability Weighting.