Turbulent Times: Investigating Temporal Choices In Wartime

by

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LIST OF ABBREVIATIONS

TD Temporal Discounting

FWB Financial Well-Being

MH Mental Health

AFU Armed Forces of Ukraine

MCQ Monetary Choice Questionnaire

OLS Ordinary Least Squares

CHAPTER 1. INTRODUCTION

Picture a high school graduate confronted with 2 options: searching for a job or pursuing education. The former offers immediate financial gratification: from having pocket money to a full-fledged salary. The latter, however, promises no short-term financial benefit, but has huge potential after 2-3 years of diligent studies. Of course, his decision dependents on many factors like performance on the test, the financial situation of his family, individual ambitions, and cognitive abilities, and many of these are challenging to quantify, yet they, all in their own way affect his decision to ultimately pursue studies. This decision — whether to get a small benefit now or delay for a potentially greater reward later — encapsulates the concept of temporal discounting.

Fast-forward five years, this very same not-so-hypothetical student finds himself finishing his studies, working full-time, and contemplating what to do in five to ten years: choosing a career, starting a family. His decision is inherently rooted in dichotomy between present and future, except now the country is ravaged by war. Now, the conundrum isn't merely a question of weighing present against future gains. It's a poignant reflection: should he invest in a potentially non-existent future or live in the present? Should he continue renting a flat or take out the mortgage, knowing about the danger of indiscriminate bombing? Should he start a family, knowing that his job isn't secure? Should he plan ahead, knowing that he can be conscripted? These are harsh questions, and millions of Ukrainians are faced with them each and every day.

Knowing how and through which mechanisms war affects an individual's preferences can help deal with negative effects experienced now and after the conflict is over. In the present study we study how different war experiences affect individuals' time preferences, and whether there is an indirect relationship between war experiences and time

preferences. Specifically, we hone in on the roles of negative financial shocks and mental health outcomes as potential mediators in this relationship.

Negative financial shock puts constraints on an individual's ability to plan for the future, often forcing them to make choices that cater to pressing necessities rather than long-term commitments. On the other hand, worsened mental and physical health and other psychological trauma leads to costly, suboptimal decision-making long after the traumatic experience has passed. While these repercussions of war may initially seem overshadowed by the direct effects in the immediate aftermath, in the long run, they are part of what determines when and how recovery occurs. If war experiences change people's preferences, it will also change the effects of policies implemented on behalf of those people.

To answer this question of war effect on individual's time preferences and the mechanism of this effect, we have gathered survey data (N=1056) from a representative sample of Ukrainians, calculated the temporal discounting (TD) score – a measure of time preferences, and anomalies of rational choice following (Ruggeri et al., 2022), estimated models of direct effects of war experiences on TD and its anomalies, then of direct effect of individual's financial well-being (FWB) on TD, and mental-health (MH) on TD. Lastly, we combine these results and estimate the indirect effect of war experiences on TD via negative financial shock and worsened mental health.

We find that bombing, property damage and confidence loss, because of conflict, have direct significant relationship with temporal discounting, however the direction of this is determined by gender with women being more impatient than men, on average. Debts, number of sources of income were positively associated with patience, even more than many war-related experiences. Contrary to our expectations, we find no significant indirect relationship between time preferences and war experiences and provide explanations to both significant and not significant result.

CHAPTER 2. LITERATURE REVIEW

Temporal Discounting

Temporal discounting[1] is the current relative valuation placed on receiving a good or some cash at an earlier date compared with receiving it at a later date (Loewenstein & Prelec, 1992). Discounting is a fundamental aspect of preferences for understanding behavioral changes, because the extent to which individuals discount the future and whether they discount in a time-consistent fashion is an important determinant of their life outcomes (Frederick & Loewenstein, 2002). Temporal discounting is used as a measure of self-control and patience, and greater/smaller rate of temporal discounting is indicative of lower/greater self-control and patience. Increased impatience has been shown to predict both low savings and investment (Newell & Juha, Siikamäki, 2015) and poorer dietary choices (Brownback et al., 2023), smoking (Lawless et al., 2013), low credit scores (Newell & Juha, Siikamäki, 2015), and poor overall health outcomes (Della Vigna & Malmendier, 2006).

Economic theory views preferences as stable and non-changing (Stigler & Becker, 1977), and studies by (Drichoutis & Nayga, 2022; Meier & Sprenger, 2015) find that time preferences are rather stable. A study by (Drichoutis & Nayga, 2022) have looked at dynamics of temporal discounting before and during COVID-19 pandemic - negative shock - and have also found no changes in discounting rates. (Krupka & Stephens, 2013), using a panel data from Seattle and Denver Income Maintenance Experiment find the opposite effect and attributes changing time preferences to changes in the inflation rate and changes in household labor market outcomes - income and hours worked. Similar result has been found by (Haushofer & Fehr, 2019), who find that negative income

[1] In behavioral economic literature there are multiple names for the same phenomena: temporal discounting, delay discounting, intertemporal discounting. Present paper uses these interchangeably.

shocks increases time discounting, and that they specifically exacerbate present bias, the tendency to overvalue the present relative to the future. However, it's worth noting that time preferences are stable to some extent, but they may be influenced by exogenous factors of market circumstances and emergencies.

Notwithstanding that researchers find conflicting results, temporal discounting is a real phenomenon and it is present to various extents in all developed and developing countries (Ruggeri et al., 2022). Discrepancies may arise because there is no agreed-upon measure of temporal discounting and there are different aspects (sometimes referred to as anomalies of rational choice (Loewenstein & Prelec, 1992)) to it. Most studies try to measure indifference points by asking respondents a battery of questions with varying amounts and time periods - an approach popularized in a seminal paper (Kirby & Petry, 2004) - which results in a discount scores at which individual is indifferent between immediate and later amount.

More recent studies recognize the need to look at multiple aspects of temporal discounting to better capture individual's time preferences. These anomalies are sign effect, absolute magnitude effect, delay-speedup asymmetry, and present bias (Loewenstein & Prelec, 1992; Ruggeri et al., 2022; Scholten & Read, 2013):

- Sign effect or gain-loss asymmetry occurs when gains are discounted more than losses, despite the differences (real and relative) are constant. For example, preferring to receive 2000 UAH now over 2600 UAH in 3 months, but also preferring to pay 2000 UAH now over paying 2600 UAH in 3 months.
- Absolute magnitude is an increased preference for delayed gains when values become substantially larger, even when relative differences are constant (for example, preferring 2000 UAH now over 2600 in 3 months and prefer 12600 UAH in 3 months over 10000 now).

- Delay-speedup asymmetry is observed when delayed option is framed as added value individual chooses an immediate, smaller gain, but prefers the larger, later amount if an immediate gain is framed as a reduction (for example, prefer to receive a gain of 2000 UAH rather than wait 3 months for an additional 600 UAH and prefer to wait for 3 months to receive 2600 UAH rather than to pay 600 UAH and receive the gain now).
- Present bias is observed when lower discounting over a given time interval when the start of the interval is shifted to the future (for example, preferring 2000 UAH now over 2600 UAH in 3 months and prefer 2600 UAH in 6 months over 2000 UAH in 3 months).

Many studies on time and risk preferences deal with hypothetical situations (Johnson et al., 2020), as using actual monetary rewards is neither feasible nor economically optimal. The criticism that this approach gets is that people can be framed to answer a specific way or that these answers don't translate to actual real-life choices. Which is a reasonable objection, however there are studies on temporal discounting that are empirical that replicate the findings of survey-based studies. For example, (Yao et al., 2012) uses consumer's data to identify the discount rate by imputing the utility/profits using decisions made in a context in which the future is inconsequential, and (Voors et al., 2012) conducted a series of field experiments, implementing games to determine risk, time, and social preferences.

Concluding this section, we can say that temporal discounting is a well-documented phenomenon that shows how people discount future outcomes. Both hypothetical and empirical studies (field experiments) show, all in different ways, that individual's time and risk preferences vary over time and are affected by life experiences. While many of these findings arise from relatively benign contexts, there remains a pressing question, especially for Ukraine: How do these preferences evolve in the face of profoundly

destabilizing events like armed conflicts or natural disasters? We present an overview of literature on temporal discounting and emergencies at once.

Temporal Discounting and War

Papers that study time and risk preferences in conflict are rather scarce, focus mainly on risk preferences[2], and provide conflicting findings. For instance, some studies have documented a surge in risk-seeking behavior in contexts ranging from property damage during the 2011 Australian floods floods (Page et al., 2014); evacuations after Hurricane Katrina (Eckel et al., 2009); to community deaths during conflict in Burundi (Voors et al., 2012). On the other hand, other research underscores a swing towards risk aversion in turbulent situations. (Callen et al., 2014) found that individuals who were exposed to violence[3] in Afghanistan, when primed to recall fear, showed an increased preference for certain options. Similarly, (Blumenstock et al., 2021) finds that people expecting violence hold more cash and are less likely to adopt and use mobile money; and (Callen, 2015) shows that exposure increases patient behavior. These studies provide a background and suggest potential ways in which military conflict can affect individual time preferences.

Military conflicts can affect an individual's time preferences in many ways, including, but not limited to, negative financial shock, physical injury, or worsened mental health. Any or all of these potential consequences can make an individual impatient and focused only on the present.

[2] The relationship between risk preferences and time preferences is disputed, some studies find that they are highly correlated (Beine et al., 2020; Willinger & Bchir, 2013), but a recent metastudy (Johnson et al., 2020) concludes that this relationship is not as strong. Our study doesn't specifically study individual's risk preferences, but still considers findings on risk preferences as relevant to our research.

[3] Literature on armed conflict usually refers to the negative events happening with a person as exposure to violence. In our paper we use exposure to violence and war experiences interchangeably.

There are no questions regarding conflict's impact on objective financial well-being (FWB) both on an economy and an individual level. There is, however, a subjective FWB - subjective perception or evaluation of financial circumstances (Mathew et al., 2022) - which is equally important in determining individual's FWB. Studies that explore negative income shock's effect on FWB find a positive association. (Ruggeri et al., 2022) indicates that anyone facing a negative financial environment - even with a better income within that environment - is likely to make decisions that prioritize immediate over future and uncertain. Similar result is found by (Mellis et al., 2018) who asked participants to think about neutral (job transfer) or negative income shock (losing job) before completing a task on delay discounting, and (Bufe et al., 2022) who, using data from two-wave survey, find that experience of an income shock between survey waves was associated with a large decline in subjective FWB, while the experience of an expense shock was associated with a more modest decline.

On conflict's impact on mental health the psychology literature is also very clear - large negative events have deleterious effect on individual's mental health (Kurapov et al., 2023; Miller & Rasmussen, 2010). Individuals exposed to violent conflict may experience a range of health-related problems, including disruptions to social systems and networks, as well as physical and psychological harm (for brief review see (Singh et al., 2021)). In the aftermath of conflicts, stress and trauma persist and have the potential to alter individuals' perceptions and decision-making processes. In line with this, there are studies that show that temporal discounting is positively associated with poorer mental (Lawless et al., 2013).

Having these two additional perspectives on financial outcomes and mental health are crucial in our study, as our contribution will lie in combining these aspects in explaining war's influence on time preferences of affected individuals. We aim to discern whether specific experiences of war influence an individual's time preferences and identify the mechanisms through which exposure to violence shapes these preferences.

CHAPTER 3. METHODOLOGY

There are several channels through which war experience could affect individual preferences. One plausible channel would be through a large negative shock to wealth or income, which in turn would alter preferences. Another channel, from the psychology literature, would be through worsened mental and physical health, which are often associated with higher discounting rates. Any or both possibilities could affect an individual's preferences. A range of research gives the expectation that war experiences could affect preferences in these ways. Here, we review the literature as we describe our predictions for the war's effects on preferences.

H1. Exposure to war is positively associated with temporal discounting

First is that individual preferences are affected in many ways in which person "experiences" war. For example, physical damage to oneself, family, or friends; property damage; loss of a relative or a close one; living in fear, witnessing death, suffering, forced evacuation, blackouts etc. All these manifestations may have a different impact on an individual's decision-making.

We expect that there be an association between temporal discounting, namely present bias, and property damage, as suggested by (Page et al., 2014); a strong association between physical damage and loss of a close person with risky behavior (Bucciol & Zarri, 2015), despite the finding of weak or insignificant relationship by (Imas et al., 2015) and (Voors et al., 2012). Also, we suspect that people who had to evacuate/living under occupation or are currently (as of September 2023) living in regions close to the frontline will have a higher discounting score than the residents in remote and relatively safer regions.

To measure temporal discounting, we mostly follow (Ruggeri et al., 2022), in which not only the temporal discounting is measured, but its anomalies: sign effect (gain/loss asymmetry), magnitude effect, delay/speedup asymmetry and present bias.

The procedure is as follows. All participants begin with choosing either approximately 10% of the national monthly household income average immediately, or 130% of that value in 3 months. This translated into 2000 UAH immediately or 2600 UAH in 3 months. Participants who chose the immediate option are shown the same option set, but the delayed value was now 135% (2700 UAH). If they continued to prefer the immediate option, a final option offers 140% (2800 UAH) as the delayed reward. If participants chose the delayed option initially, subsequent choices are 125% (2500 UAH) and 120% (2400 UAH). This progression is then inverted for losses, with the same values presented as payments, increasing for choosing delayed and decreasing for choosing immediate. Finally, the original gain set was repeated using 50% of the average monthly income to represent higher-magnitude choices. See Table 1. for example-questions. A full list of questions is available in Appendix A.

Assessing temporal choice patterns was done in three ways. First, the three baseline scenarios determine preferences for immediate or delayed gains (at two magnitudes) and losses (one). Second, the share of participants who exhibited the theoretically described anomaly for each anomaly scenario was calculated. Finally, we computed a discounting score for each participant based on responses to all choice items, ranging from 0 (always prefer delayed gains or earlier losses) to 17 (always prefer immediate gains or delayed losses)[4]. The score then represents the consistency of discounting behaviors.

In measuring war experience we consider Ukrainian context and importance of capturing self-assessment of these experiences: "Have you suffered from the following as a result

[4] Our approach to scoring follows the paper by (Ruggeri et al., 2022), the specifics can be found in the original paper.

of your experiences?". We use 2 multiple choice questions adapted from the survey (Fleeing Ukraine: Displaced People's Experiences in the EU, 2023) by adding questions related to relative's involvement in active combat and on evacuation[5]. Some of these questions might be sensitive to respondents, that is why a disclaimer was shown before they can see the questions, and upon seeing can choose not to answer.

Table 1. An example of time preference elicitation questions

Option A	Option B
Get 2000 UAH right now	Get 2600 UAH in 3 months
Get 2000 UAH right now	Get 2700 UAH in 3 months
Get 2000 UAH right now	Get 2800 UAH in 3 months
Pay 2000 UAH right now	Pay 2600 UAH in 3 months
Pay 2000 UAH right now	Pay 2700 UAH in 3 months
Pay 2000 UAH right now	Pay 2800 UAH in 3 months
Get 10000 UAH right now	Get 13000 UAH in 3 months
Get 10000 UAH right now	Get 13500 UAH in 3 months
Get 10000 UAH right now	Get 14000 UAH in 3 months

[5] There were several attempts to study war-related experiences. Most recent one by (Trujillo et al., 2021) studies Armed Combat Experience with yes/no questions about direct and indirect extreme experience. (Karam et al., 1999) acknowledges the importance of accounting for frequency and intensity of war-related experiences, relatedness to victim, and witnessing the event, despite its superiority in measuring war experiences, its size is too large for the purposes of the current study.

To study exposure to violences direct effect on temporal discounting we use two regressions: (1) for discounting score, and (2) for anomaly. The key assumption underlying our empirical approach is that war experiences across individuals are exogenous with respect to individual time preferences. And that a certain war-related experience is independent of one another – random. For example, hearing sirens and physical injury are assumed to be independent.

$$E[TD_i \mid War_i,\ C] = \widehat{\beta_0} + \widehat{\beta_1} War_i + \widehat{\beta_2} C + \epsilon, \quad (1)$$

$$logit[P(Anomaly_i \mid War_i,\ C)] = \widehat{\beta_0} + \widehat{\beta_1} War_i + \widehat{\beta_2} C + \epsilon, \quad (2)$$

where TD_i is temporal discounting score of an i^{th} individual, War_i – a vector of dummies for war experiences of an i^{th} individual, C – controls: age, gender (male = 0, female = 1), and dummy for living in oblasts where fighting took place or is taking place now.

More formally our hypotheses can be stated as:

$$H_0: \beta_1 = 0; \quad H_A: \beta_1 > 0$$

H2. Negative financial shock is positively associated with discounting

War brings about destruction. Even people not directly affected by war (not involved in combat or experiencing daily bombing), may suffer from its consequences. In terms of market outcomes, it can translate to increased taxes, reduced job opportunities, higher prices for goods and services, emotional distress from news coverage, and potential displacement if hostilities reach their region.

According to (*KIIS Report: Dynamics of Self-Assessment of the Family's Material Situation after the Russian Invasion*, 2023) subjective evaluation of Ukrainian's FWB – "do I have enough

money to?" - has barely changed and is on the pre-invasion level, despite the overall decline in objective FWB – people accumulating debts, job loss, destruction of property. This could have several explanations:

- community FWB has decreased more than individual FWB, because everyone experiences blackouts, cuts in salaries, damages due to russian aggression[6]. (M.O. & Ya.Ye., 2021) supports this claim.
- received social support, which is consistent with (Cherry & Gibson, 2021) and results of (Voors et al., 2012), who find the rise of pro-social behavior in the aftermath of an emergency.

In the present study, we expect that negative evaluation of one's own FWB will be a strong predictor of temporal discounting. We also hypothesize that objective FWB is also a strong predictor of individual's discounting, as suggested by (Epper et al., 2020), and individuals with outstanding debt will exhibit steeper discounting, as per (Ikeda & Kang, 2015).

To measure FWB, we use both objective and subjective aspects. Subjective FWB is evaluated with 2 self-reported variables. The first is how has the individual's FWB changed since February 24th, 2022, with 5 levels from "Significantly worsened" to "Significantly improved". The second one is expectations of the individual about future FWB with the 5 levels from "Will be much worse than right now" to "Will be much better than right now". Objective FWB is measured as the self-reported individual and household monthly income, primary and secondary sources of income, and having debts.

This distinction between objective and subjective FWB is needed because income alone doesn't reflect how financially secure an individual is. Real income can fluctuate, because

[6] That is if it is just me who got poorer than I would significantly change my financial attitudes, if everyone (around me) became poorer than I wouldn't feel it as strongly - they have it just as bad after all.

of uncertain and changing economic situations. Expectations are more sensitive to the arrival of new information about the conflict (including the news from frontline, influence of propaganda, information warfare, etc.) and may shape the financial decisions of individuals. This approach should capture multiple aspects of FWB and provide robust estimation of its effects on temporal discounting.

Testing these hypotheses involves the estimation of two equations: (3) for temporal discounting score and (4) for anomalies.

$$E[TD_i \mid FWB_i,\ C] = \widehat{\beta_0} + \widehat{\beta_1} FWB_i + \widehat{\beta_2} C + \epsilon, \quad (3)$$

$$logit[P(Anomaly_i \mid FWB,\ C)] = \widehat{\beta_0} + \widehat{\beta_1} FWB_i + \widehat{\beta_2} C + \epsilon, \quad (4)$$

where FWB_i is a vector of ordinal and dummy variables of financial well-being of an i^{th} individual, C – controls: sources of income.

H3. Poor mental health is associated with higher discounting

Military violence doesn't just affect the mental health of civilians living in conflict zones (Cesur et al., 2013), but also of those who experience it through daily stressors such as changes in physical health and financial situation, the destruction of social networks and the mass displacement of the civilian population (Miller & Rasmussen, 2010).

Worsened mental and physical health and other psychological trauma has been shown to affect behavior and lead to costly, suboptimal decision-making long after the traumatic experience has passed. These and other second-order repercussions of exposure to violence are likely dwarfed by the direct effects in the immediate aftermath (Rybinska et al., 2023). Research in psychology has demonstrated that exposure to violence and other trauma has complex, deleterious effects on both mental and physical health (Osokina et

al., 2023). Consistent with the research we hypothesize that poorer mental health will be associated with steeper discounting (Löckenhoff et al., 2011).

Self-reported mental health is measured with three items from SF-12 (Ware et al., 1996), a widely used and well-validated measure, which is widely used in behavioral sciences (Löckenhoff et al., 2011). We use three Likert-type items related to mental health: "In the last 4 weeks, how often have you been feeling blue/calm/full of energy?"

Two models are used to estimate the coefficients: (5) for temporal discounting score, (6) for anomalies.

$$E[TD_i|\, MH_i,\ C] = \widehat{\beta_0} + \widehat{\beta_1} MH_i + \widehat{\beta_2} C + \epsilon, \tag{5}$$

$$logit[P(Anomaly_i \mid MH,\ C)] = \widehat{\beta_0} + \widehat{\beta_1} MH_i + \widehat{\beta_2} C + \epsilon, \tag{6}$$

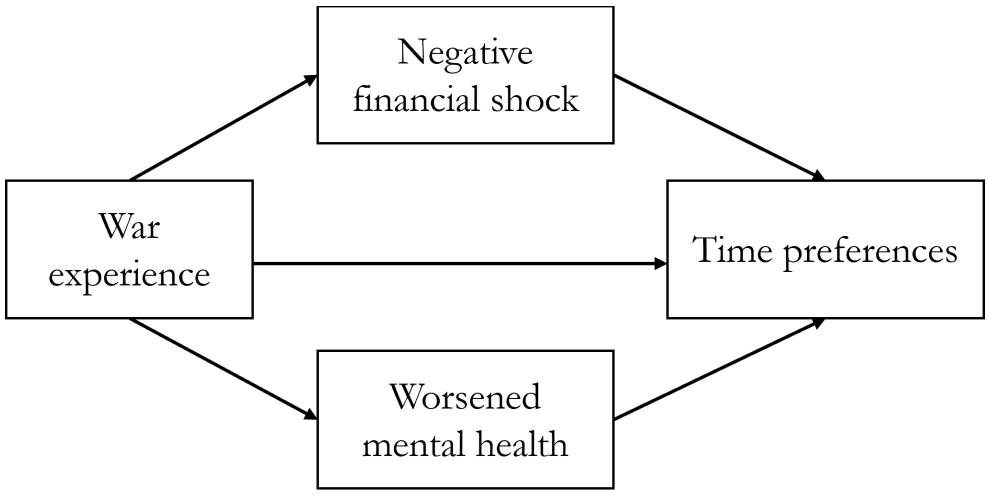
where MH_i is a vector of mental health-related questions of an i^{th} individual, and C – controls: living apart or together with family, having children.

H4. The relationship between war experiences and temporal discounting is mediated by mental health and negative financial shock

Hypothesis 1 aims to establish whether there is a direct effect of war exposure on TD. However, even if there is a direct relationship, it would still be unclear if it is a direct effect, or there are other factors that are being influenced that in turn change individual's time preferences. We explore 2 possible pathways: a direct effect of negative financial shock, and worsened mental health on TD in Hypothesis 2 and 3, respectively. Now, we want to know if there is an *indirect effect* of war experiences on TD through aforementioned paths. The graphical representation of our hypothesized indirect relationship can be seen in Figure 1.

There are many approaches to mediation analysis, depending on types of variables, and number of mediators (Fiedler et al., 2011; Hayes, 2022; VanderWeele, 2016). The one of interest to us is mediation analysis with multiple moderators (VanderWeele & Vansteelandt, 2014).

Figure 1. Proposed mediation model of the War experience and Time Preferences



In estimation of indirect effects we use a regression based approach for multiple mediators (VanderWeele & Vansteelandt, 2014), which involves the following steps:

Step 1: Conduct a simple regression analysis for the outcome (TD)

$$E[TD_i \mid War_i,\ FWB_i,\ MH_i,\ C] = \widehat{\theta_0} + \widehat{\theta_1} War_i + \widehat{\theta_2} FWB_i + \widehat{\theta_3} MH_i + \widehat{\theta_4} C \quad (7)$$

Step 2: Conduct separate regression for each of the mediators

$$E[FWB_i \mid War_i,\ C] = \widehat{\beta_0} + \widehat{\beta_1} War_i + \widehat{\beta_2} C,\ \ for\ \ i = 1, \dots, K. \quad (8)$$

$$E[MH_i \mid War_i,\ C] = \widehat{\beta_0} + \widehat{\beta_1} War_i + \widehat{\beta_2} C,\ \ for\ \ i = 1, \dots, K. \quad (9)$$

The controlled direct, natural direct and indirect effects are then given by:

$$\text{Direct effect} = \widehat{\theta_1}(War_i - War_i^*)$$

$$\text{Indirect effect} = [\widehat{\beta_1}\,\widehat{\theta_2} + \widehat{\beta_2}\,\widehat{\theta_3}](War_i - War_i^*)$$

since our independent variable War is binary, the explanation of (War_i - War_i^*) is simply the difference between experiencing a certain event or not.

Direct effects are simply the coefficient for the War experience (exposure) in the model with all mediators. Indirect effect is the sum over the various mediators of the product of the coefficient for the exposure. Significant indirect effect would suggest of a causal chain from exposure (war experiences) to outcome (time preferences) through mediators (negative financial shock, worsened mental health).

Before estimating the effects, there are several strong assumptions which must be met to casually interpret direct and indirect effects. First assumption is control must be made for exposure-outcome confounding (Assumption 1). Since majority of conflict happened in oblasts bordering Russia (Donetsk, Luhansk, Kharkiv, Zaporizhzhia, Kherson, Mykolaiv, Odessa, Sumy, Chernihiv, and Kyiv oblast), people living there have experienced disproportionally more than individuals in western oblasts, that is why we will control for these oblasts in our models.

Second assumption is that, because with direct and indirect effects we are also drawing conclusions about the effects of the set of mediators, FWB and MH-related variables, on the outcome, TD score, control must be made for mediator-outcome confounding (Assumption 2). In the case of FWB and TD, potential confounders are individual monthly income and number of sources of income. The rationale is that people who are relatively well-off, have multiple sources of income, can mitigate the negative effects of war by evacuating from danger zones, using savings, or affording housing in safer areas. While people with relatively low income might not have a safety pillow and will value

smaller-sooner gains more than those more financially stable. And for MH and TD - potential confounder is age.

Third assumption is that because mediation analysis is essentially about the exposure changing the mediator (and that change in the mediator affecting the outcome), control must also be made for exposure-mediator confounding (Assumption 3). Controls for Assumption 1 covers this assumption.

Finally, for standard estimates to be interpreted as direct and indirect effects, there should be no mediator-outcome confounder that is itself affected by the exposure (Assumption 4) (VanderWeele, 2016). This assumption is hard to meet, because we don't have information from before the war on individual's health and financial circumstance.

These are strong assumptions; however, they should hold in our case, with exception of Assumption 4, because we control for potential confounders. Estimation was done using R statistical software, *tidyverse* package (Wickham et al., 2019) was used for data preparation and visualization, *mediation* package (Tingley et al., 2014) - for mediation analysis.

CHAPTER 4. DATA

Data was collected from September 25th to September 29th, 2023, via Gradus app. Respondents, living in cities with population of over 50 thousand from Ukraine-controlled territories, were offered monetary rewards – bonuses - for successful completion of the survey. At the beginning, they answer a set of questions about their geographic location, and then proceed to adaptive monetary choice questionnaire (MCQ) – questions on TD, then questions on financial circumstances and well-being, followed by questions about mental health and war experiences. The survey ends with a set of socio-demographic questions.

Control Variables

Because the number of factors that affect individuals is so vast and complex, we chose the once that can have a significant effect on their actions. For example, individuals who had a car, disposable income, and/or small children, were more likely to have evacuation plan (Martinez et al., 2022) during the first stage of full-scale invasion. That is why we supplement the usual questions on age and gender, education, and sources of income, with questions about marital status, children, city of residence before and after the start of the full-scale invasion.

Data was gathered from a diverse sample of adult Ukrainians: 604 female respondents, 453 – male. Age breakdown: 18-24 (N=78), 25-34 (N=278), 35-44 (N=359), 45-54 (N=243), 55-60 (N=98). Most (N=602) have higher education, with some holding PhDs (N=16). Others completed high school (N=112) or technical training (N=239).

On the sources of income: 628 have a full-time job as a main source of income, 53 – own a business. Many people in our sample either don't have a main source of income

(N=124) or rely on government payments (for IPDs, unemployment pay) (N=68), pension or savings (N=65), or help from close relatives (N=84). It's worth noting that individuals often have more than one income source. For instance, they might receive financial support from family. In our group, 690 have no secondary income, 215 have part-time jobs, and 55 get additional government payments such as unemployment and disability.

A lot of Ukrainian men were forced to live separately from their families, women and children moved to the safer western oblasts, while men remain and defended their cities. This separation can have an impact on individuals' wellbeing, so we have multiple questions on family and children. The majority are married and are living with their spouse (N=550), much less are married but living separately (N=62). Of those without a partner 232 are single (unmarried), 89 are divorced, 26 are widowed. 430 respondents have underaged children, 229 have adult children, 75 have both underaged and adult, and 9 are expecting a baby. Of those with underaged children 447 live together, and 37 live separately from their children.

Lastly, war has a geographic side to it, as people in eastern and southern regions have suffered disproportionally more than western regions, which could on its own explain their behavior. That is why we included a set of questions with the aim to determine geographic location before 24th of February 2023, whether the individual had moved and where, and where are the at the time of a completing a survey. As expected, the majority were from Kyiv city (N=244) and other big cities: Dnipro, Lviv (both N=77), Zaporizhzha (N=75), and Kharkiv (N=76). After the war broke out 729 have stayed in their cities, 327 have either left and already returned (N=250) or never returned (N=77). Of those who have left their cities 67 have moved within their oblast, 187 - to another oblast, and 73 – abroad. Not surprisingly people were moving to safer western regions: Lvivska (N=25), Ivano-Frankivska (N=19), Khmelnytska (N=17), Zakarpatska (N=16). Of those who moved abroad, 24 went to Poland, 16 to Germany, and others Europe.

Table 2. Summary statistics of socio-demographic variables

Variable	N	Mean (Proportion)
Demographic		
Age	1056	39.68
Gender (Female = 1)	1056	0.428
Education		
Incomplete secondary	27	0.025
Completed secondary	112	0.106
Secondary technical	239	0.226
Incomplete higher	60	0.056
Higher	602	0.570
Scientific degree	16	0.015
Primary source of income		
Student stipend, grant	12	0.011
Pension	65	0.061
State assistance	68	0.064
Paid employment	628	0.594
Own business	43	0.040
Assistance from close relatives	84	0.079
Currently, I have no source of income	124	0.117
Other	32	0.030
Secondary source of income		
Student stipend, grant	13	0.012
Pension	27	0.025
State assistance	55	0.052
Part-time job	215	0.203
Rental	48	0.045
Investments + Other	70	0.066
No secondary source of income	690	0.653

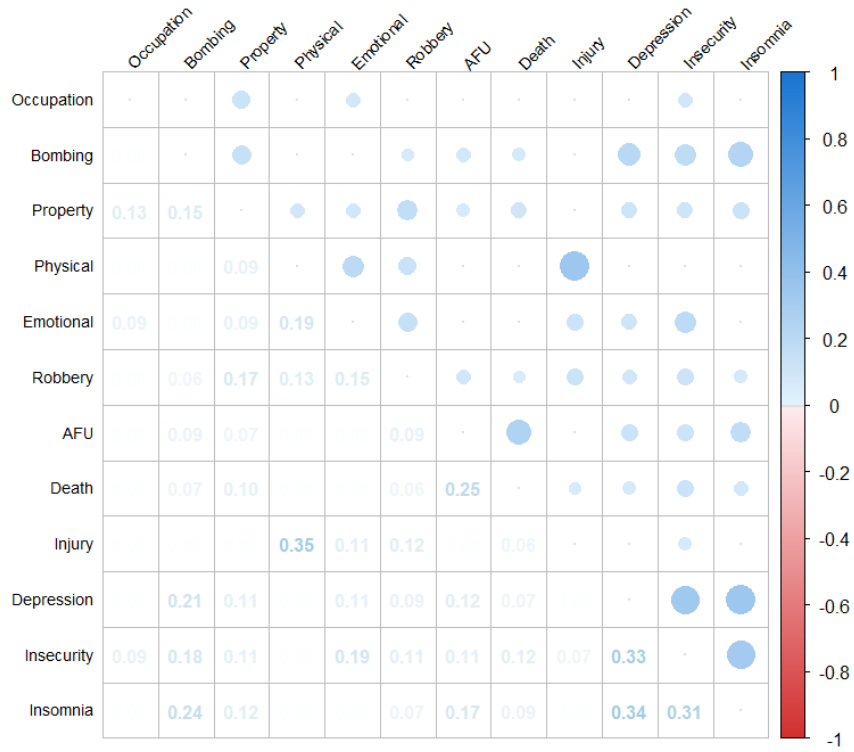
War Experiences

A preliminary inspection of war-related experiences (Table 3) shows that the overwhelming majority has, in one form or another, experienced bombings (N=686), have a relative or a friend serving in AFU (N=345), or relative or a friend has deceased fighting (N=226). And because of these experiences many suffered from depression (N=649), confidence loss (N=517), and problems with sleep (N=715). Some have indicated sustaining injuries (N=227), and much less have reported experiencing physical violence with or without weapons (N=14), which could mean that majority hasn't been directly threatened with physical violence, but rather have suffered from injuries that may or may not be due to military activity.

Table 3. Descriptive Statistics of War Experiences

	Female (N)	Male (N)	Total (N)
Have you experienced?			
Occupation	14	15	29
Bombing, shooting	401	285	686
Property damage	71	46	117
Physical violence	5	9	14
Emotional violence	58	41	99
Robbery	33	39	72
Relative in AFU	201	144	345
Perish	127	99	226
Decline to answer	105	79	184
Have you suffered from any of the below after the start of full-scale invasion?			
Physical injury	11	16	27
Depression	406	243	649
Insecurity	309	208	517
Insomnia	715	274	715
None of the above	35	46	81
Decline to answer	36	44	80

Figure 2. Correlation matrix of war experience questions



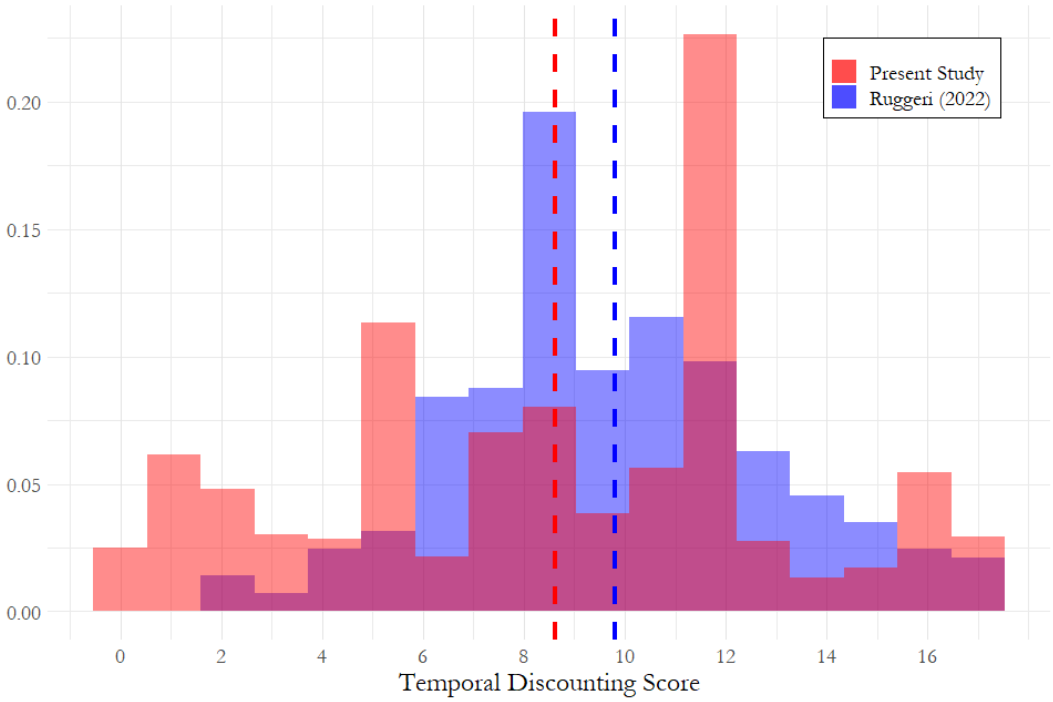
War experiences are correlated but not too strongly, the stronger we find is between experiencing physical violence with or without weapons and suffering from physical injuries, because of war experiences. We had an idea to create an Intensity score to identify those who have been affected by multiple war-related experiences, but Cronbach alpha is low (α=0.38), so we will proceed with using dummies for each experience. Responders were asked about war duration expectations: most anticipate years of active warfare (N=377), some expect it to end by 2024 (N=277), others were uncertain (N=291), and a some even offered exclusive insights[7].

[7] One respondent elaborated: "Рік чи півтора - війна лише в Україні, потім війна зсунется до Європи, далі - ядерний конфлікт та крах путінизма, потім - у росії багаторічна громадянська війна із роспадом цієї держави".

Temporal Discounting

Temporal discounting (TD) scores represent the consistency of preferences. People who prefer immediate smaller gains and larger later losses will have a score of 0, while those preferring delayed options have a score of 17. While the notion behind TD may be clear, ability to quantify it may not be so. To put our results in perspective, we compare (Figure.3) the distribution of our TD scores with pre-war Ukrainian sample (N=269) from the article by (Ruggeri et al., 2022)[8].

Figure 3. Comparison of Distributions of Temporal Discounting Score

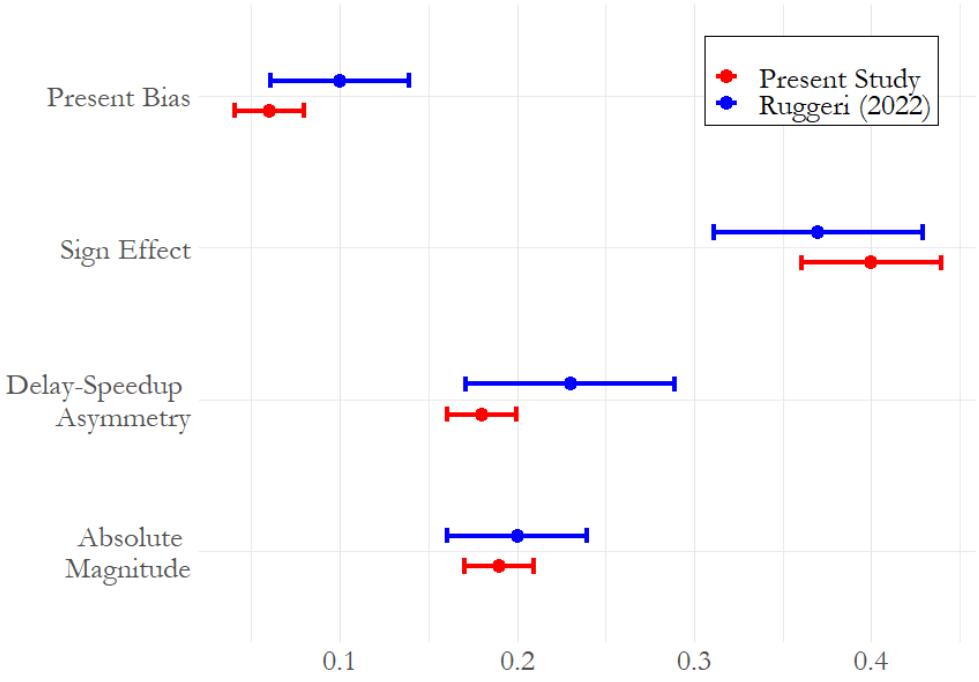


[8] In original study (Ruggeri et al., 2022) temporal discounting score is from 0 to 19. This comparison is for 17 questions that are the same in two surveys.

On the first inspection we see that our sample is very spread out with many individuals on both ends of the spectrum, which indicates rather consistent time preferences – either preferring sooner or delayed options - compared to the original study, where a lot of responses are centered around median.

Inconsistent time preferences can be understood as an individual's anomalous behavior. For example, switching to an opposite option when the sign is flipped (sign effect), changing a preference when the choice is between larger amounts (absolute magnitude). In our sample we observe anomalies: present bias (μ =0.06, se=0.01), sign effect (μ=0.4, se=0.02), delay-speedup asymmetry (μ=0.18; se=0.01), and absolute magnitude (μ =0.19, se=0.01).

Figure 4. Comparison of Anomaly Prevalence

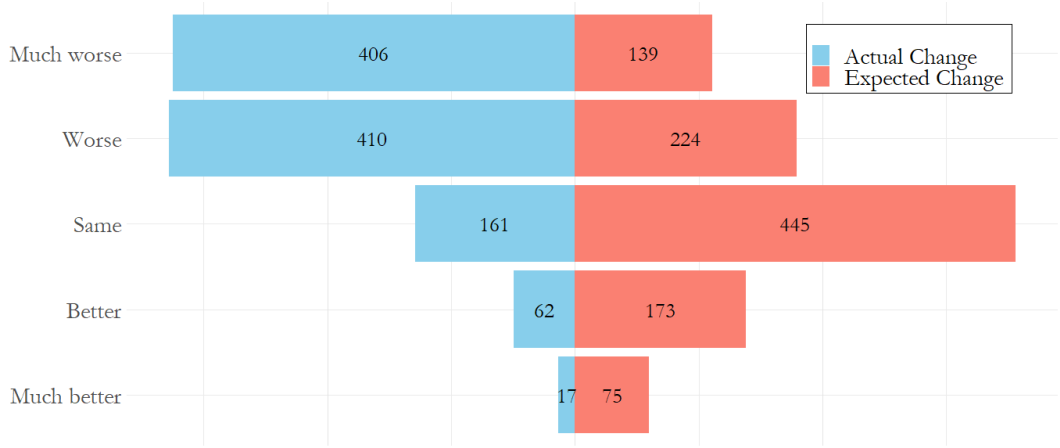


Financial Well-being and Mental Health

Financial Well-being questions included those on subjective evaluation and objective (monthly income) evaluation of one's circumstances. Subjective FWB consists of two items (Figure 5): "How has your FWB changed since the start of the full-scale invasion? (blue bars)" and "How do you expect your financial situation will change in the next 12 months? (red bars)?

The majority indicate deterioration of their financial situation (N=816), smaller share of respondents reports no changes (N=161), and for tiny share the situation improved (N=79). Individuals were more optimistic about their expectations: 248 expect improvement to 363, who expect the situation to worsen, with the majority now expecting no changes (N=445).

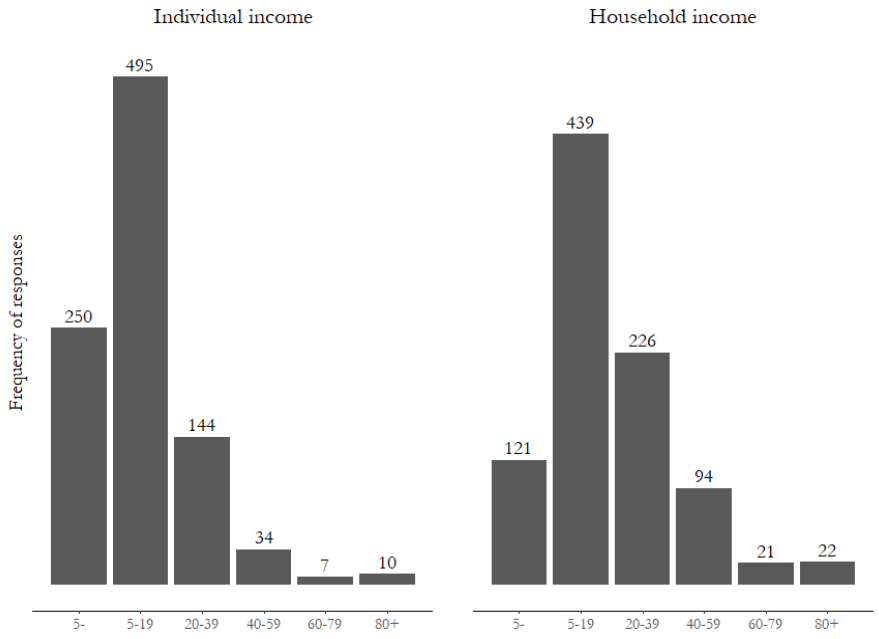
Figure 5. Distribution of answers to Financial Well-being questions



Objective FWB is assessed with individual and household monthly income, and presence and burden of debts. Most individuals (see Figure 6) earn less than 20,000UAH (N=745),

the situation improves for household income, majority now has 40,000 UAH monthly income (N=786). Out of the people whose individual income matches their household income (N=578), 272 are either single or in a relationship, but living apart. Speaking of debts, our respondents have outstanding debts (N=602), of these with small debts (N=269), medium debts (N=113), and large debts – taking a bigger half of monthly income to pay off (N=72).

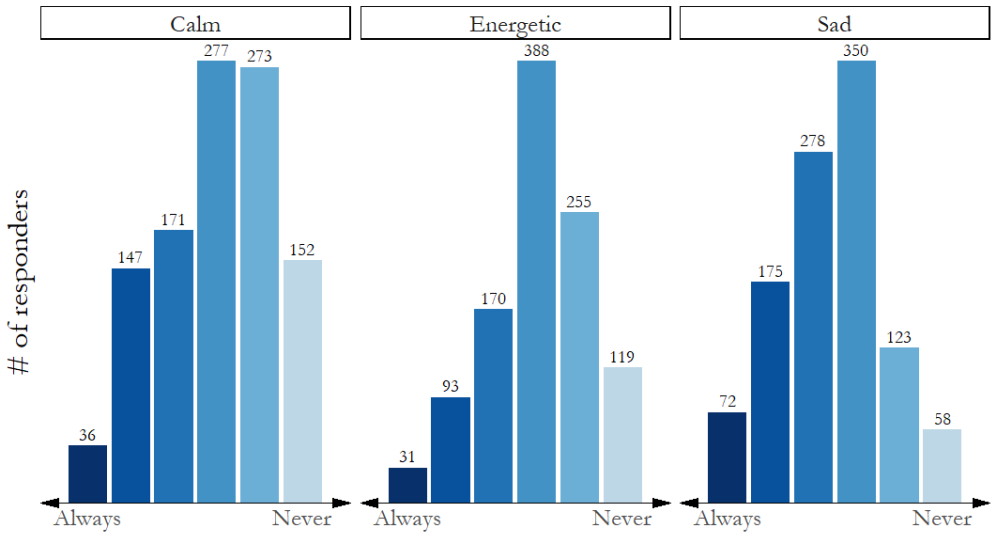
Figure 6. Distribution of Individual and Household income



Mental health questions are 3 items from SF-12 (Ware et al., 1996): "Have you been feeling calm/energetic/blue in the last 4 weeks?" Many (see Figure 7) reports not being calm (N=425) and more often sad than not (N=247). The distribution of calm and sad

can be seen to skew in opposite directions, which is a happy sign people understood the questions correctly.

Figure 7. Distribution of answers to Mental Health questions



Two FWB items are ordinal[9] with 5 levels from "Much better" to "Much worse" are centered around 0: -2 for "Much worse", +2 for "Much better". Three MH items have 6 levels from "All the time" to "Never": 0 – "All the time", 6 – "Never".

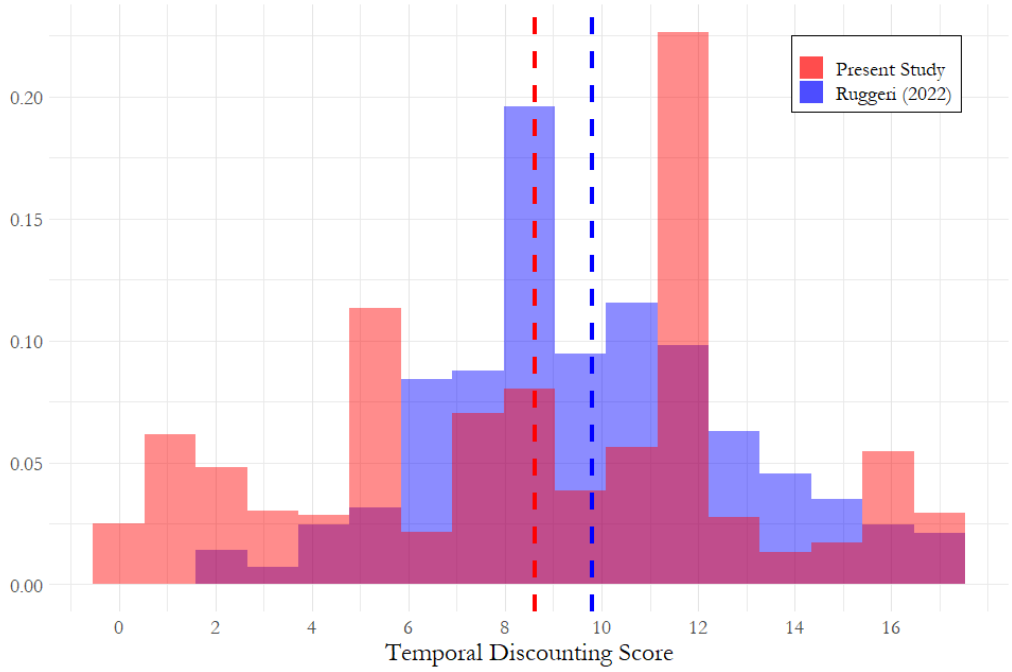
[9] With ordinal variables we make an important assumption that these categories are equally and continuously distributed, thus can be treated as a continuous (Robitzsch, 2020). To formally test these assumptions, we conduct a Likelihood ratio (LR) test (Orme & Combs-Orme, 2009), where we compare the performance of 2 models: complex and nested. In nested model ordinal variables are treated as continuous, in complex model ordinal variables are transformed into dummies. Results indicate that parsimonious models don't perform much worse than complex (p-value > 0.5), thus instead of spawning dozens of dummies we use ordinal variables and treat them as continuous. We provide test results in Appendix B.

CHAPTER 5. RESULTS

In this chapter we are providing results of our analysis with brief interpretation of both significant and non-significant results, and what they tell us about the relationship between war experiences and time preferences. Before we look at the results it is important to understand what anomalies and temporal discounting score represent.

Temporal discounting score measures the consistency of individual's time preferences: those who have 0 – always larger later gains and smaller sooner losses, 17 – always prefer smaller sooner gains and larger later losses. People on opposite ends have clearly defined preferences, but those in the middle have inconsistent choices – anomalies.

Figure 8. Comparison of Distributions of Temporal Discounting Score



Assuming that (Ruggeri et al., 2022)[10] sample is representative of Ukrainian pre-war population, and so is ours, we compare how the distribution of score is different. Our sample has much more people on the patient (left) side, and about the same number on the impatient (right) side. Assuming that war, in a broad sense, was the only shock, people became more patient, more forward-looking. Which goes against the common assumption that exposure to damaging events (natural disaster or military conflict) make an individual more impatient (Beine et al., 2020; Cassar et al., 2017; Voors et al., 2012). Perhaps individual-level data can shed some light as to why people have become more patient, despite the war.

Temporal Discounting and War Experiences

First, we test multiple hypotheses of the positive direct relationship between war experiences and TD (see Table 4).

One common experience for majority of Ukrainians is bombings, which we find to be moderately associated with TD (β=-0.070**) and its sign suggests that those who have experienced it on average prefer delayed options – a negative relationship between bombing and TD. Witnessing bombing and shooting isn't the same as getting affected by it. Bombing can be thought of as exposure to violence, which some other studies focus on, and it has been shown to make people more patient (Callen, 2015). Similar results are found for those who have problems with their confidence (β=-0.103***), yet the sign also points to increased patience. Bombings and confidence loss don't carry the actual damages to the person, then, maybe, something that implies incurred damages will show positive association with TD.

[10] There is a criticism (Ghai et al., 2023) of the undertaken approach, that suggest that samples may not be representative in the study by (Ruggeri et al., 2022).

Table 4. Relationship between war experiences and temporal discounting and anomalies

	Score‡	Present bias†	Absolute magnitude†	Sign effect†	Delay-speedup†
		War experience			
Occupation	0.010	1.616	**3.370*** **	1.140	2.174*
	(0.031)	(1.277)	(1.388)	(0.449)	(0.925)
Bombing	**-0.070****	0.777	1.096	0.826	1.343
	(0.033)	(0.225)	(0.196)	(0.116)	(0.254)
Property damage	0.053	2.052*	0.604*	1.057	1.183
	(0.032)	(0.848)	(0.178)	(0.224)	(0.305)
Physical violence	0.001	1.607	1.089	0.923	2.194
	(0.033)	(1.539)	(0.791)	(0.533)	(1.641)
Emotional violence	0.013	1.021	0.777	0.961	0.930
	(0.032)	(0.486)	(0.235)	(0.220)	(0.276)
Robbery	0.057*	0.967	1.267	1.372	1.187
	(0.032)	(0.555)	(0.403)	(0.354)	(0.388)
Relative in AFU	0.024	0.835	1.398*	0.904	1.099
	(0.032)	(0.263)	(0.244)	(0.130)	(0.200)
Loss of a relative	-0.029	0.820	0.805	0.868	0.900
	(0.032)	(0.299)	(0.168)	(0.142)	(0.190)
		Effects on wellbeing			
Injury	-0.007	2.051	1.299	1.535	0.315
	(0.033)	(1.566)	(0.664)	(0.654)	(0.256)
Depression	-0.002	0.647	0.722*	0.787*	0.882
	(0.034)	(0.194)	(0.130)	(0.144)	(0.165)
Confidence loss	**-0.103*****	0.804	0.876	0.925	0.944
	(0.034)	(0.244)	(0.154)	(0.131)	(0.170)
Insomnia	0.022	1.000	1.255	0.957	1.099
	(0.034)	(0.311)	(0.242)	(0.146)	(0.220)
		Controls			
Region war	-0.012	**0.452*****	1.075	1.039	0.851
	(0.032)	(0.131)	(0.178)	(0.137)	(0.145)
Age	0.043	0.991	0.990	1.002	1.013
	(0.031)	(0.014)	(0.008)	(0.006)	(0.008)
Gender (Male = 1)	**-0.097*****	0.713	0.850	0.886	0.747*
	(0.032)	(0.206)	(0.142)	(0.117)	(0.130)
Constant	-0.000	0.228***	0.353***	0.879	0.127***
	(0.031)	(0.134)	(0.128)	(0.0256)	(0.049)
N	1056	1056	1056	1056	1056
R^2 *(Adjusted* R^2*)*	0.034 *(0.016)*				
Log Likelihood		-222.616	-501.340	-702.333	-481.626
F-statistic	**2.135*** (df=15;1040)**				

Note: Score represents the stability of time preferences (individuals always preferring delayed options have a score of 17, while those preferring sooner options have a score of 0). Reporting standardized errors *p<0.1; **p<0.05; ***p<0.01. ‡OLS – reporting slopes and standardized errors; †Logit regression – reporting odd-ratios and standard errors.

We have property damage, physical injury, robbery, and loss of a relative, as well as relative serving in AFU, as experiences with more gravity for an individual. However, our hypothesized relationship between TD and some of them, namely, physical violence (β=0.001) and physical injury (β=-0.007) isn't significant. Property damage, despite having a positive sign, isn't significant (β=0.053). It is a better predictor of absolute magnitude anomaly (OR=0.604*): all else held equal, having damage done to one's property decreases the probability of observing anomaly in an individual by 39.6%, which means that if they prefer a certain (smaller sooner or larger later) option for certain amount, when we increase it, the preferences don't change.

Living under occupation (OR=3.370***) is both highly statistically significant with absolute magnitude and the effect is large. By and large, war experiences don't have a significant association with either TD score or anomalies, and our model's explanatory power (R^2=0.034) is low.

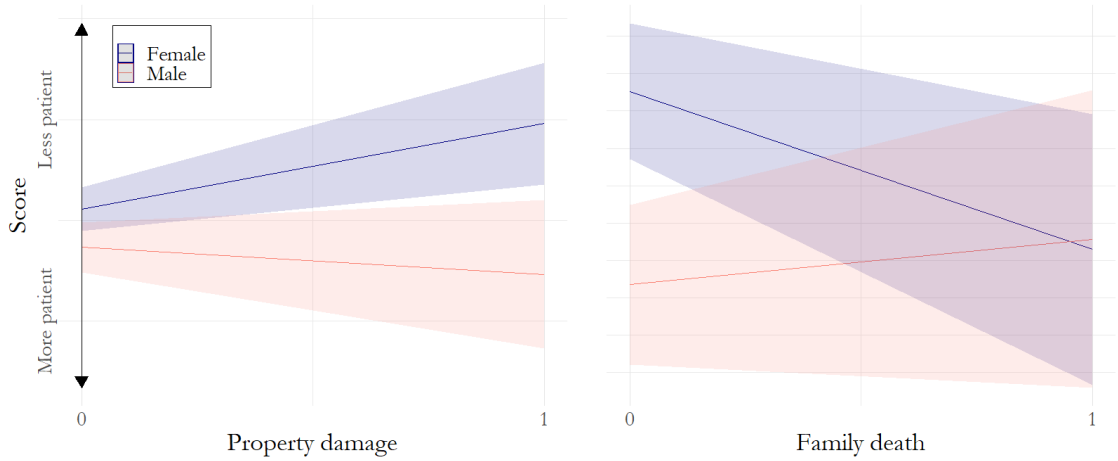
Seeing insignificant results, we decided to test interactions of war experiences with controls. And we have found gender to be not only strongly associated with TD score, but also its interaction with property damage (β=-0.448**), occupation (β=-0.628*) and relative's death (β=0.272*).

There seems to be a different effect each war experience affects TD depending on the gender. Women on average have higher discounting score (β=-0.097***) – more impatient. These differences amplify for some experiences. We have found opposite effect property damage has on men and women (Figure 9). Men appear to become more patient and, perhaps, calculating. Women, on the other hand, are more impatient.

The reversal happens for when there was a death in the family: women become, increasingly more patient, while men – impatient. Explanations of these results lie beyond

the scope of this paper, but they might be a useful reference for studies on gender differences in coping with traumatic experiences.

Figure 9. Differences in discounting for men and women



Temporal Discounting and Financial Well-Being

An alternative explanation to the direct influence of war is negative financial shock. We estimate the model of FWB questions on TD and anomalies. Results are reported in Table 5.

Change in of FWB since the start of full-scale invasion is also associated with TD score (β=-0.084**). Individuals whose FWB has significantly worsened have a TD score 0.168 higher than those whose FWB hasn't changed much, and 0.336 higher than those whose FWB has significantly improved. We reject the hypothesis of zero effect of negative financial shock on TD and accept the alternative: negative financial shock is positively associated with TD.

Negative financial shock can also be observed in individuals having to borrow money. Having debts is strongly associated with TD (β=-0.177***), and to a lesser extent with anomalies. A different measure of subjective FWB - financial expectations for the next 12 months – sheds some light on the forward–looking attitudes of individuals. We find that it is associated with absolute magnitude (OR=1.92***): those that expect that their financial situation will significantly improve are 92% more likely to display absolute magnitude anomaly. For TD score expectations appear to have no effect.

Table 5. Relationship between FWB questions on temporal discounting and anomalies

	Score‡	Present bias†	Absolute magnitude†	Sign effect†	Delay-speedup†
		Financial Well-Being			
Individual monthly income	-0.0000 (0.000)	1.000 (0.000)	1.000 (0.000)	1.000 (0.000)	1.000 (0.000)
Financial expectations	0.009 (0.033)	0.825 (0.122)	**1.292***** (0.108)	1.018 (0.069)	0.873 (0.076)
Change in financial situation	**-0.084**** (0.039)	1.052* (0.180)	0.969 (0.095)	0.914 (0.074)	0.897 (0.097)
Debts (Yes=0)	**-0.177***** (0.066)	0.606* (0.178)	0.848 (0.141)	1.261* (0.171)	0.675** (0.117)
		Controls			
Region war	-0.031 (0.066)	**0.442***** (0.134)	1.106 (0.185)	1.005 (0.136)	1.033 (0.180)
Sources of income	**-0.093**** (0.047)	1.187 (0.232)	0.953 (0.115)	0.908 (0.089)	0.943 (0.121)
Constant	0.178* (0.104)	0.084*** (0.036)	0.269*** (0.070)	0.595** (0.128)	0.270*** (0.075)
N	940	940	940	940	940
R^2 *(Adjusted* R^2*)*	0.024 *(0.018)*				
Log Likelihood		-191.772	-460.747	-625.289	-430.964
F-statistic	**3.866***** **(df=6; 933)**				

Note: Score represents the stability of time preferences (individuals always preferring delayed options have a score of 17, while those preferring sooner options have a score of 0). *p<0.1; **p<0.05; ***p<0.01. ‡OLS – reporting slopes; †Logit – reporting log-odds.

On way individuals safeguard their FWB is by having multiple sources of income. We find that each additional source of income is associated with a bigger preference for delayed options (β=-0.093***).

Overall, the model weakly explains (R^2=0.024) the variability in TD, and not all variables are good predictors of TD and anomalies. This low R^2 is emblematic of all of our models, but this is not a problem as our goal isn't to predict human behavior, but rather to assess whether specific explanatory variables have a significant effect on the dependent variable (Ozili, 2023).

Temporal Discounting and Mental Health

The second alternative determinant of TD is mental health. We fit the model, like the one for FWB questions (see Table 6).

We find that individuals feeling sad item from SF-12 is significant (β=-0.197*) at 10% level: each increase decrease in their subjective evaluation of their MH corresponds to 0.197 increase in TD score. Overall, MH variables perform the worst in explaining TD, as none of predictor variables are significant enough. Using dummies instead of treating ordinal predictors as continuous didn't produce any significant results. This will be discussed in recommendations. And even interactions with controls and war experiences don't yield significant results.

The only significant result here is control for married, living together – we hypothesized that living separately for spouses can be a source of stress, which will reflect in their answers – and we find that people who are married and living together have time preferences that are more forward-looking (β=-0.197**). No similar or opposite effect is found for married, living separately.

Table 6. Relationship between MH questions on temporal discounting and anomalies

	Score‡	Present bias†	Absolute magnitude†	Sign effect†	Delay-speedup†
		Mental Health			
Feeling calm	0.040	1.051	0.882	1.019	0.965
	(0.030)	(0.132)	(0.067)	(0.063)	(0.077)
Feeling energetic	0.009	0.835	1.069	0.936	1.107
	(0.032)	(0.112)	(0.089)	(0.062)	(0.097)
Feeling sad	-0.051*	0.902	1.069	0.975	0.967
	(0.029)	(0.111)	(0.079)	(0.058)	(0.073)
		Controls			
Married, living together	**-0.197****	0.810	1.176	0.774	0.867
	(0.081)	(0.272)	(0.251)	(0.127)	(0.181)
Married, living separately	-0.212	1.134	0.992	0.690	1.137
	(0.144)	(0.621)	(0.379)	(0.208)	(0.409)
Not married	-0.038	0.988	1.364	0.924	0.759
	(0.108)	(0.468)	(0.394)	(0.204)	(0.217)
Children (Have children = 0)	-0.121	0.649	0.681*	0.961	1.072
	(0.085)	(0.254)	(0.156)	(0.168)	(0.239)
Constant	0.134	0.143***	0.224***	0.969	0.208***
	(0.159)	(0.648)	(0.092)	(0.317)	(0.088)
N	1056	1056	1056	1056	1056
R^2 *(Adjusted R^2)*	0.020 *(0.013)*				
Log Likelihood		-230.849	-507.964	-706.694	-488.139
F-statistic	**3.020*** (df=7; 1048)**				

Note: Score represents the stability of time preferences (individuals always preferring delayed options have a score of 17, while those preferring sooner options have a score of 0). *p<0.1; **p<0.05; ***p<0.01. ‡OLS – reporting slopes; †Logit – reporting log-odds.

Mediation Analysis

We have thus far explored the direct effect of war experiences, financial circumstances, and mental health on TD. Now we combine these to test if the relationship between war experiences and TD is mediated by FWB and MH.

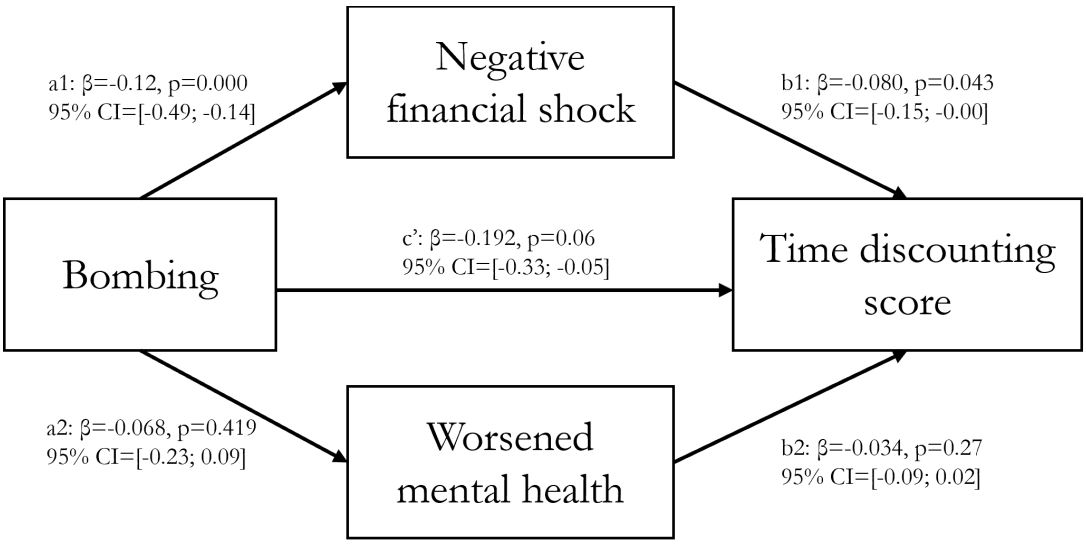
First, we estimate direct and indirect effects for each war experience through all mediators on TD. A significant indirect effect will indicate successful mediation, which we don't observe in our case. Only the direct effect of bombing on TD is statistically significant. So, we explore further estimating paths from exposure to mediators (a1, a2), from mediators to outcome (b1, b2) and direct effect (c') we already know. Figure 8 shows the coefficients and significance of each path. However, we don't find that indirect effects are any significant. a1b1: $\beta = 0.009$, $p=0.154$; and a2b2: $\beta = 0.002$, $p=0.516$.

Table 7. Mediation analysis summary

Relationship	Direct Effect	Indirect Effect	Conclusion
Occupation > Mediators > TD	0.047 (0.201)	0.017 (0.027)	No mediation
Property damage > Mediators > TD	0.158 (0.106)	0.033 (0.021)	No mediation
Bombing > Mediators > TD	-0.192*** (0.070)	0.016 (0.010)	No mediation, but direct effect
Physical violence > Mediators > TD	0.571 (0.284)	0.027 (0.049)	No mediation
Emotional violence > Mediators > TD	-0.029 (0.112)	0.045 (0.029)	No mediation
Robbery > Mediators > TD	0.144 (0.134)	0.039 (0.032)	No mediation
Relative in AFU > Mediators > TD	0.036 (0.069)	0.001 (0.006)	No mediation
Relative death > Mediators > TD	-0.081 (0.079)	0.019 (0.013)	No mediation

Unfortunately, we don't have enough evidence to state that the relationship between war experiences and TD is mediated by negative financial shock (subjective evaluation) or worsened MH.

Figure 10. Paths significance for bombing > mediators > TD



Alternative Explanation

For results that we have found to be significant we need to show that the effect is not attributable to other consequences of war or war-related events. We address the following potential confounders: index of consumer prices and number of sirens for regions where the individual lives (as of September 2023)[11]. We include external data for each individual based on their oblast of living as of the time when taking the survey and add these two covariates to our models: sirens to direct effects of war experiences and MH models, and index of consumer prices to FWB on TD model. Sirens data can add the dimension of frequency that our data lacks. Sirens can also be a proxy for the number of bombings the individual has experienced, as well as number of sleepless nights because of dreary sound.

[11] Index of consumer prices comes from https://index.minfin.com.ua/ua/economy/index/inflation/, data for sirens from https://air-alarms.in.ua/en.

ΔCPI for the most recent month September 2023 shows us how the change in macroeconomic variable affects all individuals in the particular region.

Adding sirens data increases the effect of already significant bombing and confidence loss variables. However, the addition of sirens data may not improve the explanatory power of the model. However, for Hypotheses 2 and 3, FWB on TD and MH on TD, respectively, our covariates only add noise and don't' help explain the variability in TD scores.

In summing our results are robust to fixed region effects, however they might not be robust to individual-specific covariates that have been shown to be associated with TD: substance abuse, smoking, gambling, etc.

Table 8. Select results for robustness check of Hypothesis 1

	Score	
	Original	Sirens data
Sirens		0.00002 (0.00005)
Bombing	**-0.147**** (0.068)	**-0.193**** (0.076)
Robbery	0.227* (0.126)	**0.327**** (0.136)
Confidence loss	**-0.205***** (0.068)	**-0.202***** (0.075)
Region war	-0.024 (0.063)	0.027 (0.101)
Age	0.004 (0.003)	0.004 (0.003)
Gender (Male = 0)	**-0.196***** (0.064)	**-0.254***** (0.070)
Constant	0.051 (0.141)	0.009 (0.158)
N	1056	876
R^2 *(Adjusted* R^2*)*	0.030 *(0.016)*	0.039 *(0.022)*
F-statistic	**2.135*** (df=15;1040)**	**2.204*** (df=16;859)**

Note: Score represents the stability of time preferences (individuals always preferring delayed options have a score of 17, while those preferring sooner options have a score of 0). Reporting standard errors. *p<0.1; **p<0.05; ***p<0.01.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

Temporal discounting is a fundamental aspect of preferences for understanding behavioral changes, because the extent to which individuals discount the future and whether they discount in a time-consistent fashion is an important determinant of their life outcomes (Frederick & Loewenstein, 2002). In contexts where conflict permeates every aspect of one's life, and future is uncertain, individuals tend to place higher valuation on the present, and act impatiently (Beine et al., 2020; Cassar et al., 2017; Voors et al., 2012).

Our study shows the opposite effect. Individuals who have experienced who have experienced bombing and shooting are more patient. This could be because not every person who witnesses the explosions or hears gunshots is personally affected by it. Yet even this mere 'experiencing' indicates that war doesn't necessarily make people live in the moment, for tomorrow might not happen.

The true effect of war experiences on temporal discounting is hard to quantify, as there are both internal personality factors as well as external environmental factors that all at the same time affect an individual's decisions. And war complicates estimation further. However, we can discern the patterns and directions of war's effects on individual's time preferences.

We find, surprisingly, that having damage done to oneself, relatives, or one's own property despite having a deleterious, real effect on an individual, has no statistically significant effect on temporal discounting. The more pronounced relationships emerged from gender differences.

In our sample women, on average, tend to be more impatient. However, the nature of war experiences introduces nuances to this observation. For instance, when their property is damaged, women exhibit greater impatience, while men display more patience. Interestingly, this dynamic flips in cases involving a death in the family due to war, with women becoming more patient and men more impatient. With hundreds of thousands of Ukrainian men currently defending the country, many sacrificing their life for independence, women must become the man of their household – take responsibility for doing what the spouse used to help with and provide. Men, on the other hand, who lost a family member due to war, become more impatient. And, while we haven't studied it explicitly, we can suppose that alcohol abuse, that is highly correlated with higher discounting, can explain this difference.

Property damage increases patience in men and decreases in women. The idea that negative events make people, now that they have lost something, they start to count and analyze, figuring out best options get improve their dire circumstances – not the damage to property, but rather the thinking that it induces could explain why such a destructive event can make an individual focus on the future. In line with this we find that individuals with several sources of income are more patient – insurance of some income flow in case others disappear mirrors their time preferences.

What we find surprising in our results is that people living in bordering regions who objectively suffer much more from war via daily bombings and sirens don't differ significantly from those living in safer, western regions. This could have multiple explanations: one is that many people were displaced in the first months of war, and those who evacuated might have had risk and time preferences predictive of intention to migrate (Beine et al., 2020) – more impatient have left; another is that despite the geographic nature of conflict, many people suffer from it indirectly through news, interactions with veterans, IDPs (Coupe & Obrizan, 2016); and third is that Ukrainian

society is mobilized and many organization and individuals help those in need, thereby mitigating the negative repercussions of war.

We hoped to capture some of these mitigating, indirect effects of war on time preferences using mediation analysis but haven't found significant effects. Specifically, we had 2 categories of mediators: financial well-being and mental health. This was our main hypothesis that the war doesn't directly impact time preferences, it does so via negative financial shock (negative change in subjective evaluation of one's financial well-being) and worsened mental health. Failure to establish this relationship doesn't mean it is not there. Future studies should be more rigorous in measuring mental health of an individual with either complete metric like SF-12 (we only used 3 questions from it); should be more should employ a more rigorous estimation of war experiences, which has multiple dimensions: frequency, intensity, and severity (Karam et al., 1999; Trujillo et al., 2021); and use methods that will capture causal relationship – RCTs, two-wave surveys.

Besides contributing to the academic literature on temporal discounting in wartime, this paper provides one big policy implication. The deleterious effects of war, which impact individuals not only through the direct losses they inflict, like physical damage or seizure/destruction of business, but also through people's willingness to attempt new business ventures, to save, and to work cooperatively. This willingness must be harnessed and nurtured now, and especially post-conflict, to ensure the rapid recovery of affected regions. Policymakers must therefore prioritize not only physical and infrastructural repairs but also the creation of environments that foster entrepreneurial spirit, trust-building, and community collaboration.

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APPENDIX A

SURVEY

#	Question	
Q1	*Де Ви проживали до 24 лютого 2022 року?* (→ Q2)	
	Вінницька область	Одеська область
	Волинська область	Полтавська область
	Дніпропетровська область	Рівненська область
	Донецька область	Сумська область
	Житомирська область	Тернопільська область
	Закарпатська область	Харківська область
	Запорізька область	Херсонська область
	Івано-Франківська область	Хмельницька область
	Київська область	Черкаська область
	Кіровоградська область	Чернівецька область
	Луганська область	Чернігівська область
	Львівська область	АР Крим (→ end survey)
	м. Київ	Не проживаю зараз в Україні (→ end survey)
	Миколаївська область	
Q2	*Що найкраще описує Ваші дії після початку повномасштабного вторгнення 24 лютого 2022 року?*	
	Я залишився(лась) в своєму місті (те, в якому проживав до 24.02.2022) (→ TD1)	
	Я покинув(ла) своє місто (те, в якому проживав до 24.02.2022) і вже повернувся(лась) до цього міста назад (→ Q3)	
	Я покинув(ла) своє місто (те, в якому проживав до 24.02.2022) і НЕ повернувся(лась) до цього міста назад (→ Q3)	
Q3	*Куди Ви переїжджали після початку повномасштабного вторгнення (після 24 лютого 2022 року)? (якщо Ви переїжджали кілька разів, виберіть варіант, де Ви залишалися найдовше)*	
	В межах моєї області	
	В іншу область України (→ Q4)	
	За кордон (→ Q5)	

Q4	*До якої області Ви переїжджали після початку повномасштабного вторгнення (після 24 лютого 2022 року)?*	
	Вінницька область	Миколаївська область
	Волинська область	Одеська область
	Дніпропетровська область	Полтавська область
	Донецька область	Рівненська область
	Житомирська область	Сумська область
	Закарпатська область	Тернопільська область
	Запорізька область	Харківська область
	Івано-Франківська область	Херсонська область
	Київська область	Хмельницька область
	Кіровоградська область	Черкаська область
	Луганська область (→ end survey)	Чернівецька область
	Львівська область	Чернігівська область
	м. Київ	АР Крим (→ end survey)
Q5	*До якої країни Ви переїждали після початку повномасштабного вторгнення (після 24 лютого 2022 року?*	
	Польща	
	Німеччина	
	Чехія	
	Інша (напишіть)	
Q6	*Чи плануєте Ви повернутись в Україну?* (Q5 → Q6)	
	Так, планую	
	Ні, не планую	
	Ще не визначився(лась)	
	Далі Ви побачите ряд запитань, на які Вам потрібно буде обрати з двох варіантів той, який Вам найбільше підходить:	
TD1	*Що з цього Ви б обрали?*	
	Отримати 2 000 грн прямо зараз (→ TD2)	
	Отримати 2 600 грн за 3 місяці (→ TD4)	
TD2	*Що з цього Ви б обрали?*	
	Отримати 2 000 грн прямо зараз (→ TD3)	
	Отримати 2 700 грн за 3 місяці (→ TD4)	
TD3	*Що з цього Ви б обрали?*	
	Отримати 2 000 грн прямо зараз (→ TD6)	
	Отримати 2 800 грн за 3 місяці (→ TD6)	
TD4	*Що з цього Ви б обрали?*	
	Отримати 2 000 грн прямо зараз (→ TD6)	
	Отримати 2 500 грн за 3 місяці (→ TD5)	

TD5	*Що з цього Ви б обрали?*
	Отримати 2 000 грн прямо зараз (→ TD6)
	Отримати 2 400 грн за 3 місяці (→ TD6)
TD6	*Якби Ви мали заплатити за щось, щоб Ви обрали?*
	Заплатити 2 000 грн прямо зараз (→ TD9)
	Заплатити 2 600 грн за 3 місяці (→ TD7)
TD7	*Якби Ви мали заплатити за щось, щоб Ви обрали?*
	Заплатити 2 000 грн прямо зараз (→ TD11)
	Заплатити 2 700 грн за 3 місяці (→ TD8)
TD8	*Якби Ви мали заплатити за щось, щоб Ви обрали?*
	Заплатити 2 000 грн прямо зараз (→ TD11)
	Заплатити 2 800 грн за 3 місяці (→ TD11)
TD9	*Якби Ви мали заплатити за щось, щоб Ви обрали?*
	Заплатити 2 000 грн прямо зараз (→ TD 10)
	Заплатити 2 500 грн за 3 місяці (→ TD 11)
TD10	*Якби Ви мали заплатити за щось, щоб Ви обрали?*
	Заплатити 2 000 грн прямо зараз (→ TD11)
	Заплатити 2 400 грн за 3 місяці (→ TD11)
TD11	*Що з цього Ви б обрали?*
	Отримати 2 000 грн прямо зараз
	Отримати 2 600 грн за 6 місяців
TD12	*Що з цього Ви б обрали?* (TD11 → TD12)
	Заплатити 2 000 грн прямо зараз
	Заплатити 2 600 грн за 6 місяців
TD13	*Що з цього Ви б обрали?* (TD12 → TD13)
	Отримати 10 000 грн прямо зараз (→ TD14)
	Отримати 13 000 за 3 місяці (→ TD16)
TD14	*Що з цього Ви б обрали?*
	Отримати 10 000 грн прямо зараз (→ TD16)
	Отримати 13 500 за 3 місяці (→ TD18)
TD15	*Що з цього Ви б обрали?*
	Отримати 10 000 грн прямо зараз (→ TD18)
	Отримати 14 000 за 3 місяці (→ TD18)
TD16	*Що з цього Ви б обрали?*
	Отримати 10 000 грн прямо зараз (→ TD18)
	Отримати 12 500 за 3 місяці (→ TD17

TD17	*Що з цього Ви б обрали?*
	Отримати 10 000 грн прямо зараз (→ TD18)
	Отримати 12 000 за 3 місяці (→ TD18)
TD18	*Ви маєте право отримати 2000 грн прямо зараз. Однак, якщо Ви готові зачекати, Ви можете отримати додаткову суму. Що з цього Ви б обрали?*
	Отримати 2000 грн прямо зараз
	Зачекати 3 місяці та отримати 2000 грн плюс додаткові 500 грн
	Зачекати 6 місяців та отримати 2000 грн плюс додаткові 1000 грн
	Зачекати 9 місяців та отримати 2000 грн плюс додаткові 1500 грн
	Зачекати 12 місяців та отримати 2000 грн плюс додаткові 2000 грн
Q7	*Яке Ваше особисте основне джерело доходу?*
	Студентська стипендія, грант
	Пенсія або пенсійні накопичення
	Державна допомога (по безробіттю, інвалідності, ВПО)
	Оплачувана робота
	Власний бізнес
	Допомога від близьких родичів
	Інше (напишіть)
	На даний момент у мене немає жодного джерела доходу
Q8	*Чи є у Вас додаткові джерела доходу?*
	Студентська стипендія, грант
	Пенсія або пенсійні накопичення
	Державна допомога (по безробіттю, інвалідності, ВПО)
	Підробіток / додаткова робота
	Орендний дохід
	Інвестиції (акції, облігації, нерухомість тощо)
	Інше (напишіть)
	Немає додаткового джерела доходу
Q9	*Який Ваш індивідуальний середній місячний дохід у 2023 році (усі джерела)?*
	Менше 5 000 грн
	5 000 - 19 999 грн
	20 000 - 39 999 грн
	40 000 - 59 999 грн
	60 000 - 79 999 грн
	Більше 80 000 грн
	Не хочу відповідати

Q10	*Який Ваш сімейний середній місячний дохід у 2023 році (усі джерела)?*
	Менше 5 000 грн
	5 000 - 19 999 грн
	20 000 - 39 999 грн
	40 000 - 59 999 грн
	60 000 - 79 999 грн
	Більше 80 000 грн
	Не хочу відповідати
FWB1	*Які Ваші очікування щодо власного фінансового становища на наступні 12 місяців? Я очікую що…*
	Буде набагато гірше, ніж зараз
	Буде дещо гірше, ніж зараз
	Буде приблизно так само
	Буде дещо краще, ніж зараз
	Буде набагато краще, ніж зараз
FWB2	*Загалом, враховуючи вплив повномасштабної війни, як змінилося Ваше фінансове становище протягом війни, порівняно з початком 2022 року?*
	Суттєво погіршилось
	Дещо погіршилось
	Ніяк не змінилось
	Дещо покращилось
	Суттєво покращилось
FWB3	*Чи є у Вас наразі будь-які фінансові зобов'язання (оплата по кредиту, аліменти, штрафи, іпотека, розстрочка, кредитний ліміт тощо), які Вам необхідно сплатити?*
	Так, є (→ FWB4)
	Ні, немає
FWB4	*Яку частину Ваших місячних доходів Ви витрачаєте на виплату фінансових зобов'язань?*
	Меншу частину
	Половину
	Більшу частину
MH1	*Скільки часу протягом останніх чотирьох тижнів Ви почувалися спокійним(ою)?*
	Весь час
	Більшу частину часу
	Досить часто
	Іноді
	Меншу частину часу
	Зовсім не почувався(лась) спокійним(ою)

MH2	*Скільки часу протягом останніх чотирьох тижнів Ви почувалися сповненими енергії?*
	Весь час
	Більшу частину часу
	Досить часто
	Іноді
	Меншу частину часу
	Зовсім не почувався(лась) сповненим(ою) енергією
MH3	*Скільки часу протягом останніх чотирьох тижнів Ви почувалися пригнічено?*
	Весь час
	Більшу частину часу
	Досить часто
	Іноді
	Меншу частину часу
	Зовсім не почувався(лась) пригніченим(ою)
	Наступні запитання стосуються Вашого досвіду повномасштабної війни. Вони можуть бути досить чутливими для деяких людей. Ваші відповіді дуже важливі для нас, і якщо Ви не хочете відповідати на них, то можете обрати "Не хочу відповідати"
WAR1	*Виберіть усе, з чим Ви стикалися з початку повномасштабної війни?*
	Евакуація
	Життя на окупованій території
	Стрілянина / бомбардування / ракетні атаки
	Пошкодження власного майна внаслідок бойових дій
	Фізичне насилля зі зброєю або без неї
	Емоційне насилля (погроза фізичної розправи, приниження, залякування)
	Пограбування, крадіжка або шахрайство
	Служба близької людини у складі Сил оборони України (ЗСУ, Нацгвардія)
	Втрата близької людини (родича, друга) внаслідок військової агресії росії
	Не хочу відповідати
WAR2	*Чи страждали Ви від будь-якої з наведених нижче проблем, що виникли після початку війни в лютому 2022 року?*
	Тілесні ушкодження (поранення, переломи тощо)
	Депресія, тривога або панічні атаки
	Втрата впевненості в собі, відчуття вразливості
	Труднощі зі сном та / або концентрацією
	Жоден з вищеперелічених варіантів
	Не хочу відповідати

Q11	*На Вашу думку, як довго триватимуть активні бойові дії в Україні?*
	До кінця осені 2023
	До зими 2023-2024
	До кінця 2024 року
	Активні бойові дії розтягнуться на роки
	Інше (напишіть)
	Важко відповісти
	І наостанок декілька питань про Вас.
Q12	*Який Ваш сімейний статус?*
	Неодружений / незаміжня
	Одружений / заміжня і проживаю РАЗОМ з чоловіком / дружиною
	Одружений / заміжня і зараз проживаю з чоловіком / дружиною ОКРЕМО
	Цивільний шлюб
	Розлучений / розлучена
	Вдівець / вдова
	Не хочу відповідати
Q13	*Чи є у Вас діти?*
	Так, є тільки діти до 18 років (→ Q14)
	Так, є тільки повнолітні (старше 18 років) діти (→ end survey)
	Так, є як повнолітні, так і неповнолітні діти (→ Q14)
	Ні, але наразі очікуємо на появу (→ end survey)
	Ні, немає дітей (→ end survey)
Q14	*Чи проживаєте Ви разом зі своїми неповнолітніми дітьми?*
1	Проживаю разом з усіма своїми неповнолітніми дітьми (→ end survey)
2	Проживаю разом з деякими своїми неповнолітніми дітьми, не з усіма (→ end survey)
3	Не проживаю разом зі своїми неповнолітніми дітьми (→ end survey)
4	Інше (напишіть) (→ end survey)

APPENDIX B

Likelihood-ratio test for ordinal FWB variables

Variable	Nested model	Complex model
Individual monthly income	-0.000 (0.008)	
<5k UAH		0.157 (0.344)
5-19k UAH		0.099 (0.340)
20-39k UAH		0.004 (0.344)
40-59k UAH		0.021 (0.377)
60-79k UAH		-0.105 (0.510)
Financial expectations	0.008 (0.033)	
Expect much better		0.073 (0.155)
Expect better		-0.021 (0.096)
Expect worse		-0.079 (0.087)
Expect much worse		0.053 (0.111)
Change in financial situation	**-0.093** (0.039)**	
Changed for much better		-0.159 (0.315)
Change for better		-0.183 (0.315)
Change for worse		0.078 (0.103)
Chage for much worse		0.151 (0.109)
Constant	-0.056 (0.073)	-0.171 (0.346)
N	940	940
R^2 *(Adjusted R^2)*	0.012 *(0.009)*	0.015 *(0.001)*
F-statistic	**3.884*** (df=3;936)**	1.106 (df=13;926)

Notes: $\chi^2(10)=2.879$, p=0.985 which indicates that complex model doesn't perform significantly better than complex. Thus**,** we can treat FWB ordinal variables as continuous. We also conducted LR-test for similar model, but with MH ordinal variables: $\chi^2(12)=17.687$, p=0.119 which also isn't significant enough for us to conclude that complex model is better.