Evacuation Behavior: Lessons for and From the War in Ukraine

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Abstract

Evacuations from natural disasters or war zones can save thousands of lives. While there is a substantial amount of literature on evacuation behavior in the context of natural disasters, the literature on evacuations from conflict zones is scarce. In this paper, we examine the existing literature on evacuation behavior, including our own studies conducted during the ongoing war in Ukraine. Most (but not all) of the findings from the natural disaster evacuation literature seem to be applicable to evacuation from war zones.

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1 Introduction

Evacuation is one of the most basic protective actions in times of emergency. It consists of moving people from at-risk to safe areas during times of danger. This danger can arise from natural disasters, such as floods, hurricanes, earthquakes, volcanic eruptions, or from armed conflicts.

Despite the efforts of government authorities to prompt people to evacuate, a significant portion of the population consistently fails to comply with evacuation recommendations and orders. The results are hundreds of preventable deaths in the US alone (Noe et al., 2013). Most of the literature focuses on hurricanes, flooding, and wildfires (e.g. R. M. Stein, Dueñas-Osorio, & Subramanian, 2010; Charnkol & Tanaboriboon, 2006; Thiede & Brown, 2013), whereas relatively little is known about evacuation behavior in the context of war.

Wars are distinct from other types of disasters for a variety of reasons. One key difference is that, while natural disasters are the result of natural activities, wars are the results of human activities (Meyers, 1991).[1] The decision to evacuate during a natural disaster is typically a short-term solution that usually lasts only a few days or weeks, in contrast, in a war, evacuation may entail leaving everything behind for an indefinite period of time. Additionally, people tend to perceive risks and their own agency differently. They might, for instance, perceive the danger of drowning very differently from that of being tortured or raped. They might also think that they have a larger influence on the risks to their lives in case of war, if, for instance, they can submit to the occupiers. Finally, evidence suggests that intentional human violence has a substantially different effect on mental health compared to natural disasters: human-made disasters (e.g. mass violence, terrorism, etc.) tend to have a stronger impact on mental health compared to natural disasters (for a review of the literature see Goldmann & Galea, 2014).

The largest and most severe ongoing conflict at this moment is the Russo-Ukrainian war. The full-fledged invasion started in the early hours of the February 24, 2022 (however, the relationship between Ukraine and Russia has been particularly tense since 2014 when Russia annexed Crimea and occupied parts of the Donbas, which has since been governed by Russian proxies). The Russian army attacked from several directions. From the north towards Kyiv, from the northeast towards Kharkiv, and from the east and south towards Mariupol, Zaporizhzhia, and Kherson. By April 6, however, due to their unsuccessful attempts to take Kyiv, the Russian military withdrew their forces from the nothern part of Ukraine to redeploy them in Donbas and other occupied territories. In early Fall 2022, Russia left Kharkiv oblast and in November, the western side of the Dnipro river and with it the city of Kherson. As they withdrew, Russian forces left behind a trail of evidence of mass murders and

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[1]What does and does not constitute a disaster has been a source of debate within the literature (for a summary see Quarantelli, 1998).

indiscriminate civilian killings. Some of these cases have been documented by international reports (Office of the United Nations High Commissioner for Human Rights, 2023). Since then, intense fighting has occurred, particularly in Eastern and Souther Ukraine, with limited advances by Russian forces. Furthermore, rockets and drone attacks have been targeting all areas of Ukraine leaving the country without a stable supply of electricity.

According to the United Nations High Commissioner for Refugees (UNHCR) more than eight million people have fled the country, while almost five million people are internally displaced as of February 15, 2023.[2] No official evacuation order was issued by the central authorities at the beginning of the war, possibly due to the fact that the invasion was mostly unexpected.[3] In fact, in our sample, when asked about it, 72% of the respondents said that they were not expecting a direct Russian attack. However, by the end of July 2022 the government had asked civilians to leave the Eastern part of the country aiming to evacuate 200,000 people to safer places. Evacuees were given 2,000-3,000 hryvnia (about €50-€80, which is about a quarter of the average monthly wage in Ukraine) upon arrival and registered as internally displaced persons to be eligible for continued monthly payments. In many cases, those who refused to evacuate were required to sign a paper saying they understand the risks and take responsibility for themselves and their dependents (Hyde, 2022). This has been a source of great debate among the Ukrainian population, especially when children are involved. For instance, proponents have argued that the children of individuals living close to the front lines should be taken away by social services if their parents refuse to evacuate. Oftentimes the decision not to leave their homes means that these individuals need to be protected at great risk for themselves and the volunteers who need to come to the rescue.

Understanding evacuation behavior in times of war is still relevant for the ongoing evacuations in the east of Ukraine. Furthermore, evacuations might become relevant again if Russia launches new attacks from the south or the north. In general, it is also important to understand evacuation behavior in times of war for other ongoing and future armed conflicts. While the war in Ukraine is currently the largest and most severe war, there are more than 50 further active armed conflicts in the world (Roser, Hasell, Herre, & Macdonald, 2022).

In this article, we discuss findings on evacuation behavior during wars, including our own research conducted during the ongoing Russo-Ukrainian war. We start by reviewing the literature on evacuation behavior during wars. We then review the results of our study on the determinants of actual evacuation behavior based on a sample of about 2,000 Ukrainians from the Eastern regions (the ones most affected by the war). We also provide an overview of the results of our experimental study, which asked subjects to evaluate different evacuation messages based on perceived effectiveness. Finally, we review the literature on evacuation

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[2]The UNHCR's Ukraine refugee data can be found here: `https://data.unhcr.org/en/situations/ukraine`.

[3]Residents of some cities report having received a message or having talked to volunteers asking them to leave for safer areas. Nonetheless, the initiative remained autonomous.

behavior during natural disasters. In the concluding section, we briefly summarize to what extent the results from the natural disaster evacuation literature can be applied to war situations.

2 Evacuation Behavior During Wars

The evidence from earlier wars is either very limited or outdated. Some papers focus on World War II (Crosby, 2021; Welshman, 1998), whereas others look into more recent conflicts, such as the Second Lebanon War, but use a small sample and contact the potential respondents after more than one year since the events have passed (Gidron, Peleg, Jaffe, & Shenhar, 2010). Limited data available from Israel suggests that students exposed to rocket attacks experience the same level of recalled fear and anger regardless of whether they evacuated or not (Shahrabani, Benzion, Rosenboim, & Shavit, 2012).

Given that evacuation behavior varies depending on individual characteristics, understanding the nature, timing and determinants of evacuation decisions during wars is important to help authorities become more effective in facilitating evacuation. A theoretical framework presented by Savage (2016) sheds light on how factors like uncertainty, type of war, risk perception, social norms, and behavioral biases can influence decision-making in extreme environments. Although the study lacks empirical findings, it offers valuable insights into how these components may shape behavior in war zones. The study argues that under significant uncertainty and time pressure due to extreme situations, people are more prone to deviate from rational behavior displaying present bias and status quo bias.[4] In this context, risk attitudes and perceptions are crucial factors in determining whether or not to leave a war zone. Panic may also arise, causing individuals to act impulsively and flee when it's not safe, or stay and wait for additional information before making a decision. Due to the high emotional intensity of the experience, it is challenging to get a complete picture of this decision-making process. Overall, this might help explain some of the behaviour observed during the Russo-Ukrainian war and other armed conflicts.

3 Evidence From the War in Ukraine

To the best of our knowledge, the only scientific evidence concerning evacuation behavior during the Russo-Ukrainian war comes from our own research (Martinez et al. (2022) and Martinez et al. (2023)). This evidence is based on a survey and a survey experiment, con-

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[4]The concept of status quo bias was first introduced by Samuelson and Zeckhauser (1988). It consists in the generalised preference to stick with one's own current situation, as opposed to changing the course of action even when it's beneficial. Present bias refers to the tendency to give more weight to a payoff that is closer in time when considering trade-off between two future moments as described by O'Donoghue and Rabin (1999).

ducted with approximately 2,000 respondents coming from the areas of Ukraine that were most affected by the conflict. At the time at which the survey was run, the sample contained both subjects who had evacuated (either abroad or within the country) and subjects who had not evacuated.

3.1 Determinants of actual evacuation decisions

The non-experimental part of the survey contained a vast array of questions including demographics, family context, risk assessments, and items comparing behavior before and after the invasion began.

Those who took precautions for a possible evacuation before the war started were more likely to vacate their houses and relocate to a safer place. Such precautions (which we also call an own or personal evacuation plan) consisted of having a method of transportation available, an approximate route to take, and a possible place to stay in case of emergency. This can be seen in Figure 1, which shows the effect of having had a personal evacuation plan on the actual evacuation decision, jointly with the effect of individual's risk perceptions (that is, if individuals considered a particular situation as threatening).

The revealed evacuation behavior also seems to be connected with the perception of some risks but is not fully explained by them. All respondents were presented with six possible scenarios and had to evaluate them for possible risks. For five situations, over 50% of the respondents marked them as risks. Only a possible occupation of the settlement by the enemy's army was perceived as a risk by a mere 41% of respondents, and to a larger extent by those who left. The perceptions of a risk of being killed or of a possible food shortage are clearly associated with higher probabilities of evacuating. At the same time, the variation in the perception of a risk of illegal actions, such as being raped, robbed, or beaten, and the variation in the perception of being buried under the rubble of one's own home, did not differ enough to explain variation in the evacuation behavior. Interestingly, the risk of violent acts (including rape or beating beaten) was perceived as relatively low (about 47% of females and 58% of males perceived this risk), whereas the risk of a collapsed house was the highest, both for those who evacuated and those who stayed (about 82%). Finally, the risk of utilities cut off was not considered as the most important by those who left compared to those who stayed. To conclude, even though a situation was perceived as risky, not all perceived risks had an equally large effect on the evacuation decision.

Going back to the positive effect of the pre-existing plan, we analyze which characteristics are related to having a plan in the first place. The results are shown in Figure 2. Females were less likely to have a pre-existing evaluation plan compared to males. This is also related to the fact that females were less likely to expect the invasion in the first place (63% of males vs 78% of females thought that the invasion would not happen). Owning a car or possessing sufficient
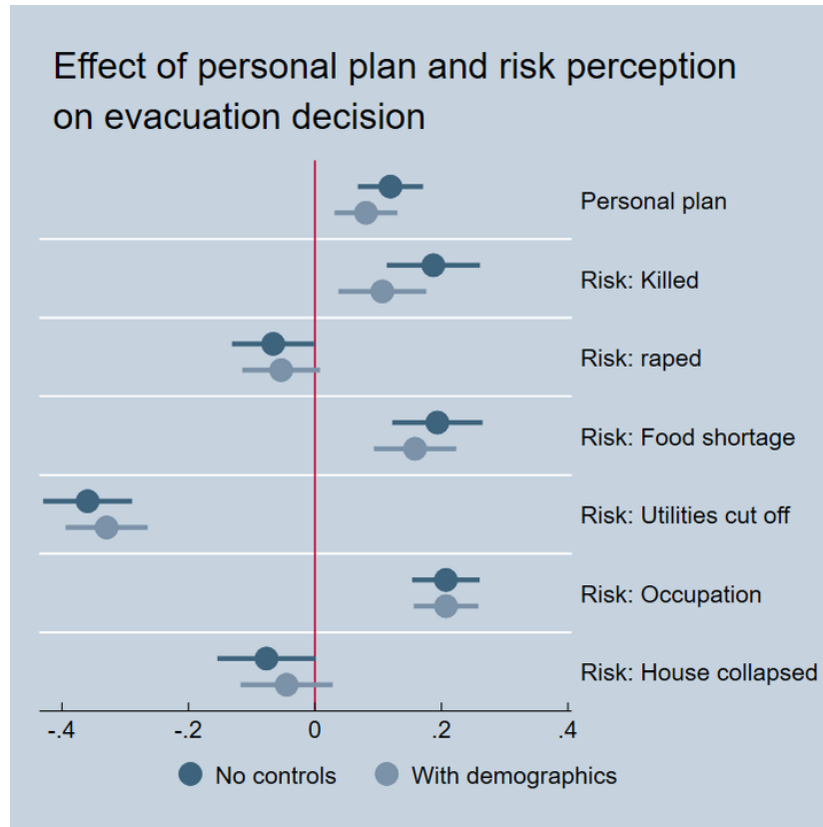
Figure 1: Determinants of the Decision to Evacuate. The coefficients shown are the average marginal effects calculated after probit regression analysis (with and without demographic control variables). Source: Martinez et al. (2023).

disposable income makes it more likely to have a plan. Also, having dependent children in the household makes it more likely to take precautions for an evacuation (although not, or hardly, statistically significant), while being married or the level of education have no or very little effect. The availability of a plan is the main channel through which these characteristics are related to the actual evacuation decision.

Whether people made any preparations for a possible evacuation is strictly related to their perceived likelihood that the war would happen in the first place. In turn, these expectations were related to religion (whether a subject is affiliated with the Russian Orthodox Church as opposed to the Ukrainian one), language spoken at home before the invasion (Russian or Ukrainian), gender, and age. For example, we observe that people who spoke Ukrainian before the war (and thus were in minority in most regions in our analysis) perceived the scenarios as riskier than Russian-speaking, and also they were more likely to leave their homes. However, the evidence is quite weak in the regression context due to insufficient sample size and requires further analysis.

Only about 23% of our subjects reported having received an official evacuation message. Conditional on having a personal evacuation plan, having received an official evacuation
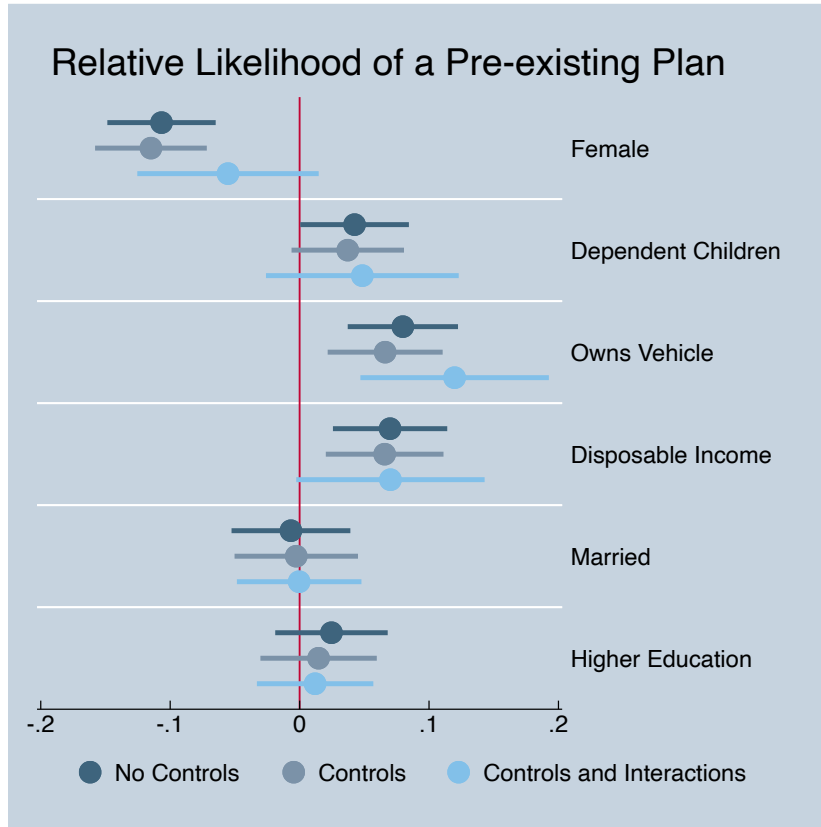
Figure 2: Determinants of Having a Personal Pre-existing Evacuation Plan. Source: Martinez et al. (2022).

order does not increase the likelihood of evacuation. The reason is that these individuals already intended to leave, so it does not alter their evacuation decision. What the data tells about the evacuation decision itself is that it is mostly taken together with relatives, and it is made very quickly (often on the same day or the day before the evacuation).

3.2 Experimental analysis of nudges with text messages

In the survey experiment, we analyzed the effectiveness of the use of different text-based alerts in prompting people to evacuate. We varied two treatment dimensions in a 2X2 between-subjects design. First, we varied the framing of the messages prompting evacuation. These framings consisted of: a neutral control framing, framing focusing on the chance of saving one's life when leaving (Gain of Life), framing focusing on the dangers of dying when staying (Loss of Life), framing focusing on the deterioration of living conditions when staying, and one focusing on the positive externalities when evacuating as leaving improves the opportunities for Ukrainian soldiers to defend the territory (Military Effectiveness).

The second treatment dimension concerned whether the messages contained information about a government-organized evacuation plan (i.e., that this opportunity exists, when and

where the buses leave, and the phone number to reserve a seat). This is in line with previous evidence suggesting that evacuation plans increase intentions to evacuate by reducing uncertainty (Lazo, Bostrom, Morss, Demuth, & Lazrus, 2015). Figure 3 shows the evaluation of the effectiveness of the different messages by the survey participants, on a scale from 1 to 10. We can observe that the inclusion of information about the government-provided plan was the most critical factor affecting the effectiveness of the messages, while the framing did not play an important role. Furthermore, the differential perception of the messages is mainly driven by women. A detailed description of the experiment (including additional and more detailed results) can be found in Martinez et al. (2022)
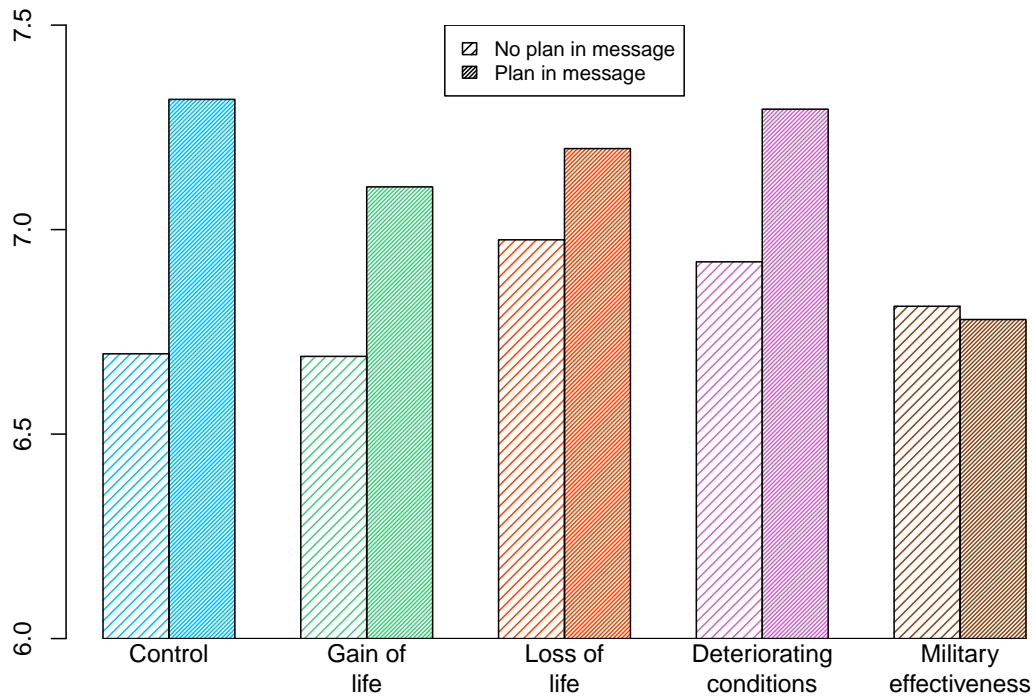

Figure 3: Mean Evaluated Effectiveness of Evacuation Messages. Source: Martinez et al. (2022).

4 Evidence on Evacuation Behavior During Natural Disasters

In this section, we briefly review the existing evidence on evacuation behavior during natural disasters. There is no clear consensus as to what constitutes a disaster (Quarantelli, 1998).

However, it is common to classify disasters based on the agent responsible, either as the result of natural phenomena or human behavior (Brown & Goldin, 1973; Schorr, 1987). The literature on disaster studies dates back to the 1950s, initially as part of the research funded by the U.S. military (Williams, 1954; Merton & Nisbet, 1976). This paper mainly relates to the strands of research examining the determinants of evacuation behavior and the effectiveness of evacuation messages.

Given the vast amount of literature on evacuation behavior, it would not be feasible to provide a comprehensive overview of everything published so far within such a limited space. Therefore, we decided to focus on a few key areas, such as why individuals choose to evacuate or not when advised to do so (Sorensen & Mileti, 1988). Many different dimensions have been identified, including the identity of the sender and the receiver of the evacuation message, the situational and social factors (for an overview see Sorensen, 2000). Other factors include previous experience of a disaster, the perception of the safety of the location and their expectations about living conditions after evacuation (Buylova, Chen, Cramer, Wang, & Cox, 2020; Arlikatti, Lindell, Prater, & Zhang, 2006; Burnside, Miller, & Rivera, 2007; Heijmans, 2001).

Most of the data has been gathered by examining communities that evacuated from specific disasters (Hurricane Katrina, Hurrican Ivan, floods in Batangan, etc.), and some of it by collecting responses about future threats from subjects living in at risk areas (coastal communities, volcanic areas, etc.) (.e.g. see Thiede & Brown, 2013; Charnkol & Tanaboriboon, 2006; Rød, Botan, & Holen, 2012; Medina & Moraca, 2016; Fischer, Stine, Stoker, Trowbridge, & Drain, 1995). When it comes to the demographics some consistent patterns emerge between studies. For instance, homeowners, pet-owners and older individuals are less likely to evacuate, however, analyses of other characteristics such as gender, income and education yield mixed results (for a literature review see Thompson, Garfin, & Silver, 2017). Subjective perceptions of risk are strongly correlated with evacuation behavior, sometimes even more strongly than official evacuation orders (R. M. Stein et al., 2010; R. Stein, Buzcu-Guven, Dueñas-Osorio, Subramanian, & Kahle, 2013; Ricchetti-Masterson & Horney, 2013). Finally, it is important to take into account the behavior of others, as individuals are more likely to leave if those around them evacuate the area, and vice versa (Udagawa et al., 2019; Urata & Hato, 2017).

The relationship between evacuation decisions and risk perception is complex. It is generally assumed that higher risk perception will lead to protective actions. However, studies suggest that this depends on many contextual factors (for an overview of the literature, see Wachinger, Renn, Begg, & Kuhlicke, 2013). Instruments, such as emergency warnings, are most effective at prompting evacuation behavior when those warnings are frequently repeated (Quarantelli, 1998), confirmatory in nature (Drabek & Stephenson III, 1971) and perceived by the public as credible (Perry, Lindell, & Greene, 1981). Previous literature has mostly

focused on the best way to present information so that people can understand it correctly and assess the risk appropriately (Wu, Lindell, & Prater, 2015). For instance, by modifying graphics in hurricane forecasts or showing pictures of hurricane damage and measuring evacuation intentions as a result (Burnside et al., 2007; Ruginski et al., 2016; Meyer, Broad, Orlove, & Petrovic, 2013). Robinson and Khattak (2010) tested the effectiveness of different messages, with the aim of avoiding traffic jams on evacuation routes. The authors find that providing more detailed information about routes increased the probability to detour.

Given the psychological content related to warning messages, in recent years, a few attempts have been made to combine this literature with the one on nudges (Thaler & Sunstein, 2009) with the aim of creating more effective evacuation messages. For instance, Ohtake, Sakata, and Matsuo (2020) uses nudge messages to encourage early evacuation and examines the results several months later to see how they translate into actual behavior. They find that messages using social norms with a loss framework was the most effective relative to a control used by local authorities in increasing intentions to evacuate to an evacuation point. Nonetheless, in the long term, the message that raised evacuation awareness and translated into higher stockpiling of food and water was the one using social norms with a gain framework. Mol, Botzen, Blasch, Kranzler, and Kunreuther (2021) relies on an online experiment to deliver social norms nudges finding that they do not significantly affect flood preparedness in the context of a flood risk investment game. Relying on the idea that individuals with more recent disaster experience tend to be more prepared (Guo & Li, 2016; Grothmann & Reusswig, 2006), a very recent strand of literature relies on virtual reality and serious gaming to make subjects experience natural disasters and learn the appropriate responses (e.g. Mol, Botzen, & Blasch, 2022; Nowak et al., 2020; Li, Liang, Quigley, Zhao, & Yu, 2017).

5 Implications for the War in Ukraine and Other Armed Conflicts

Most (but not all) findings from the natural disaster literature seem to carry over to the case of evacuation behavior during a war. In both cases, for instance, being female, owning a car, and having children increases the likelihood of evacuation. However, some findings do not seem to replicate.

In our research on evacuation messages, we did not observe any significant effects of the mere framing of the messages. On the other hand, in line with previous evidence, we find that providing an evacuation plan is crucial for effective nudges to prompt evacuation.

A key difference with the natural disaster literature consists in the greater importance of cultural or identity components, such as religion or language spoken at home in the Ukrainian context (similarly to ethnicity or race in other conflicts). This seems natural from the point of

view that natural disasters do not distinguish possible victims along cultural or ethnic lines, while it might be very important for the parties involved in a war. These arguments seem to provide a promising line of future research.

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