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Impacts of Anticipatory Cash Transfers in the Context of Weather Disasters

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Impacts of Anticipatory Cash Transfers in the Context of Weather Disasters

Abstract

Anticipatory humanitarian assistance is a novel approach to aid in the context of weather disasters, drawing on meteorological forecasts. Using a randomized study design, we analyze the impact of anticipatory cash transfers distributed to pastoralist households in Mongolia during an extreme winter event. We do not find overall effects on livestock assets, income, investments, or consumption across the study population. No heterogenous effects are found for different levels of disaster intensity. However, there is robust evidence that cash transfers benefited households with lower pre-treatment wealth. The paper concludes by highlighting practical challenges in evaluating (anticipatory) humanitarian interventions.

JEL-Codes: D61, O12, Q54

Keywords: Agriculture; anticipatory humanitarian assistance; extreme weather events; impact evaluation

February 2024

** Lukas Mogge, RWI, RUB and Potsdam Institute for Climate Impact Research (PIK); Julian Roeckert, RWI, RUB and Potsdam Institute for Climate Impact Research (PIK); Kati Kraehnert, RWI, RUB and Potsdam Institute for Climate Impact Research (PIK). – Authors' names have been randomized, using the AEA's Author Randomization Tool (Confirmation Code sl7XizVHtoPq).* *We are grateful to our colleagues at People in Need Mongolia for making this project possible and to the National Statistics Office of Mongolia (NSO) for carrying out household interviews despite extreme winter conditions and a global pandemic. We thank Toman Barsbai, Michael Berlemann, Svenja Fluhrer, Katrin Frühinsfeld, Konstantin Klammert, Adam Lederer, Giulia Malevolti, and Banzragch Nandintsetseg for their helpful comments. The paper also benefitted from comments received at the 2022 Annual Conference of the European Association of Environmental and Resource Economists, the 2022 Asian Economic Development Conference, the 2022 Nordic Conference in Development Economics, the 2022 Annual Seminar of the European Group of Risk and Insurance Economists, the 2022 Annual German Development Economics Conference, the 2022 Tropentag, the 2022 Leibniz Environment and Development Symposium, and the 2023 Summer Conference of the Association of Environmental and Resource Economists. The research was generously funded by the German Federal Foreign Office (grant S08-60 321.50 ALL 04/21), the German Federal Ministry of Education and Research (grant 01LA1804A), the German Federal Environmental Foundation, and Cusanuswerk. The data collection was approved by the Board of the NSO Chairman on May 5, 2020 (wave 4), and April 7, 2021 (wave 5). The ethical review for the distribution of cash transfers was undertaken by People in Need's Relief and Development Department (project ID "CashEval'20"). The Potsdam Institute for Climate Impact Research confirms compliance with EU data protection regulations. The randomized trial is registered in the AEA RCT Registry (RCT ID AEARCTTR-0012880).* *– All correspondence to: Kati Kraehnert, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: kati.kraehnert@rwi-essen.de*

1. Introduction

One novel instrument in humanitarian disaster assistance that stakeholders currently discuss with high expectations is anticipatory humanitarian action (AHA)[1] (Coughlan de Perez 2018; Coughlan de Perez et al. 2015; German Red Cross 2017). Developed since 2015 under the leadership of the World Food Programme (WFP) and the International Federation of Red Cross and Red Crescent Societies (IFRC), AHA builds on meteorological forecasts that predict the risk of weather disasters, such as tropical storms, droughts, and cold spells. As soon as a pre-determined risk level is reached, humanitarian funds are automatically released to set in motion a series of pre-defined measures targeting households at risk. The early distribution is intended to make humanitarian assistance more effective and cost-efficient than conventional humanitarian disaster relief. Recipient households may use the provided resources to initiate adaptive action before a disaster occurs or reaches its peak. It is hoped that such anticipatory action prevents or mitigates humanitarian needs before they fully unfold, thus reducing the socio-economic costs of disasters. In 2022, 70 AHA programs operated in 35 countries, covering more than 7.6 million people and comprising a pre-agreed financing volume of 138 million USD (Anticipation Hub 2022). Yet, despite the enthusiasm among humanitarian stakeholders, there is little evidence on whether AHA programs yield the expected benefits for recipient households (Weingärtner & Wilkinson 2019).

In this paper, we address this knowledge gap and present findings of a randomized impact evaluation of AHA that we implemented in collaboration with practice partners in Mongolia. The country is increasingly afflicted by winter disasters that cause very high livestock mortality and threaten the livelihood of pastoralist households. Mongolia is among the global pioneers introducing AHA schemes and one of the first countries in which, during the 2017/18 extreme winter, risk projections triggered anticipatory humanitarian assistance (IFRC 2020e). Our analysis tests whether unconditional anticipatory cash transfers helped pastoralist households prevent socio-economic damage during the 2020/21 extreme winter. Specifically, we investigate whether the receipt of one-off cash transfers affected recipient households' livestock assets, income, herd-related investments, home consumption of livestock, and consumption expenditures. We conducted a randomized field experiment among sample households of a

[1] This instrument is also referred to as anticipatory action, forecast-based financing, forecast-based action, early action, and early warning early action by different organisations (Tozier de la Poterie et al. 2023). REAP (2022) provides a descriptive glossary of the different terms used in reference to AHA. The G7 defines AHA as "as acting ahead of predicted hazards to prevent or reduce acute humanitarian impacts before they fully unfold" (German Federal Foreign Office 2022).

long-running household panel survey representative of western Mongolia's population. From households participating in the panel survey, we randomly selected pastoralist households at risk of facing extreme winter conditions. Those households then received unconditional cash transfers worth about 236 USD from the NGO People in Need (PIN) in March 2021.[2] For both recipient and control households, four waves of household panel survey data are available from before the intervention, while the fifth panel wave was collected after the 2020/21 winter event.

Results suggest that there is no consistent evidence for a significant impact of the AHA intervention on households' welfare outcomes measured on average seven months after the event when estimating the intention-to-treat effects across the full sample of pastoralists. No heterogenous effects are found for different levels of disaster intensity. When investigating heterogeneous treatment effects along the pre-shock wealth distribution, we consistently find that, for recipients with smaller herds before the disaster, the AHA intervention increases their post-disaster herd size, increases herd-related investments, and increases home consumption of livestock. These effects are large in magnitude and consistent across a range of robustness tests.

The availability of a rich household panel survey serving as baseline and endline data, along with a randomized study design, allows us to expand the state of knowledge in two ways. First, the few existing impact evaluations of AHA were almost entirely conducted by the implementing organizations (e.g., FAO 2018; Gros et al. 2019; Gros et al. 2022; Jjemba et al. 2018; Start Network 2020; Tanner et al. 2019), which raises concerns about desirability bias in the underlying survey data. Moreover, most of those existing impact evaluations lack a study design that would allow causal inference. To the best of our knowledge, only three studies, by Gros et al. (2019) and Pople et al. (2021) on Bangladesh and by Gros et al. (2022) on Mongolia, use quasi-experimental methods to investigate the effectiveness of AHA interventions. The studies by Gros et al. find that unconditional cash transfers increased food intake, reduced psychological stress, and lowered debt accrual among recipients in Bangladesh (Gros et al. 2019), while an AHA intervention in Mongolia increased offspring survival rates of sheep and goats and lowered mortality rates of horses among recipients (Gros et al. 2022). In these studies of Bangladesh and Mongolia, control and treatment groups exhibit significant differences in various pre-treatment covariates, leading to concerns that different vulnerability profiles of

[2] Exchange rates from MTN to USD were stable between May 2020 and May 2022, averaging at 2,866 MTN per USD. All MNT values in this study are converted to USD using this average exchange rate.

households in the two groups could bias the results.[3] Pople et al. (2021) investigate the effect of AHA cash transfers during the 2020 flooding events in Bangladesh, exploiting variation in the program's roll-out. The verification of recipients from a list of pre-identified vulnerable households had to take place within a few days and transfers could only be distributed by a single mobile banking operator, leaving out vulnerable households who were customers of alternative operators. Pople et al. document that recipients of the AHA intervention experienced fewer asset losses during the flood and had higher levels of food consumption and life satisfaction than control households.

In contrast, to the best of our knowledge, our study is the first randomized controlled trial of an anticipatory humanitarian intervention. Differences in post-treatment outcomes between recipients and control households can be attributed to the AHA intervention with a high degree of certainty. In addition, our study builds on a household panel survey that the authors jointly implemented with the National Statistical Office of Mongolia (NSO), which has been ongoing since 2012. Survey interviews with sample households were conducted independently of the disbursal of the assistance, which reduces the risk of desirability bias compared to surveys carried out by the implementing organization and conducted for the sole purpose of evaluating an intervention. Thus, our study provides an example of how building on existing panel data allows for conducting a randomized impact evaluation of anticipatory humanitarian assistance, a field where robust evidence is scarce due to practical and ethical challenges (Puri et al. 2017).

Second, we contribute more broadly to the literature on the effectiveness of cash transfers as an instrument of social protection. Although cash transfer programs are widespread (World Bank 2017) and their effects on recipients' welfare are extensively studied (Baird et al. 2011; Banerjee et al. 2017; Bastagli et al. 2018; Evans & Popova 2017; Haushofer & Shapiro 2016; Temidayo & Awojobi 2020), there is less evidence regarding the social protection effects of on-and-off cash transfers handed out in response to crises. Cash transfers have the potential to reduce households' vulnerability to exogenous shocks in multiple ways. They may help households maintain their consumption levels during a covariate shock, invest in measures of

[3] In both interventions studied by Gros et al., the distribution of AHA was tied to household-level eligibility criteria. In the Bangladesh study (Gros et al. 2019), the AHA intervention targeted the most vulnerable households as measured by a vulnerability score comprising six criteria in four flood-prone communities with the highest concentration of vulnerable households in one district. Control households, sampled from four neighboring communities in the same district, had lower vulnerability scores than recipient households on average. In the Mongolia study (Gros et al. 2022), the AHA intervention targeted the most vulnerable pastoralist households in 40 districts exhibiting the highest projected risk. Control households were sampled from the same districts as recipient households but exhibited a lower vulnerability profile.

preparedness and adaptation, and safeguard access to regular food intake, education, and healthcare (Temidayo & Awojobi 2020). Research on the effects of cash transfers during the Covid-19 pandemic documents that recipients in Brazil worked fewer hours (de Leon et al. 2023) and that transfers led to modest improvements in financial and mental well-being in Colombia (Londoño-Vélez & Querubín 2022). Research on the effects of cash transfers as an instrument of humanitarian assistance is rare, with notable exceptions being studies focused on refugee populations (Altındağ & O'Connell 2023; Gupta et al. 2024; Moussa et al. 2022). Our study provides a new angle to the literature by investigating the effectiveness of cash transfers against the background of anticipatory humanitarian assistance given out during a weather disaster.

The paper is organized as follows. Section 2 provides contextual information on extreme weather events and humanitarian disaster response in Mongolia. Section 3 outlines the study design and Section 4 the empirical strategy. Section 5 presents the results, which are discussed in Section 6. Section 7 concludes.

2. Winter disasters and anticipatory humanitarian action in Mongolia

Pastoralism is the main economic activity in rural Mongolia. Livestock is grazed year-round on open rangelands in extensive pasture management, making the livelihood of pastoralists directly dependent on weather conditions. Pastoralist households tend to keep large parts of their wealth in their herds, which typically consist of a mixture of five species, namely sheep, goats, cattle, camels, and horses. Livestock sustains the livelihood of pastoralist households in multiple ways. Animals provide milk and meat for the immediate consumption needs of the family, while cash income can be generated from the sale of animals and their byproducts, most importantly cashmere wool. Moreover, livestock also serves as collateral for loans (Hahn 2017). Pastoralist households possessing a herd with up to 300 livestock measured in sheep forage units (SFU),[4] the conversion rate commonly used in Mongolia, are considered subsistence producers, while those with a herd size of more than 300 SFU are classified as more commercially-oriented producers (Goodland et al. 2009, p. 13). Subsistence-oriented pastoralists focus more on the production of milk, while commercially-oriented pastoralists tend to generate more income from the sale of meat and cashmere wool (Goodland et al. 2009).

4 Sheep forage units standardize different species to the feeding requirement of one sheep for one year (365 kg/year of forage). One sheep equals 1 SFU, one goat equals 0.9 SFU, one cow equals 6 SFU, one horse equals 7 SFU, and one camel equals 5 SFU.

In the current millennium, an increasing number of winter disasters, referred to as *dzud* in Mongolia, have put this traditional livestock production system under pressure. Winter disasters are climatic events caused by one or, more often, a combination of several mutually reinforcing adverse weather conditions, among them drought in the previous summer, abnormally low temperature during winter, abnormally low snow during winter, excessive snow during winter, fluctuations in winter temperature above and below the freezing point that cause the snow to melt and then ice over, and winter storms (Murphy 2011). As a result, animals die of starvation or freeze to death within short periods, resulting in high livestock mortality rates. In years with extreme winter conditions, livestock losses peak in late winter and early spring when animals are already weakened and more susceptible to extreme conditions (OCHA 2023). During the 2009/10 winter, the most severe winter disaster in 50 years, more than 10 million animals perished, and 40% of pastoralist households lost more than half of their herd (UNDP & NEMA 2010). Further winter disasters, some of which are geographically confined to specific regions of Mongolia, occurred in the winters of 1999/00, 2000/01, 2001/02, 2015/16, 2017/18, 2019/20, 2020/21, and 2021/22. The socio-economic consequences of such events are disastrous. Extreme winter events are found to negatively affect the health of children (Groppo & Kraehnert 2016), the acquisition of education (Groppo & Kraehnert 2017), and individuals' life satisfaction (Fluhrer & Kraehnert 2022). They are also associated with the abandonment of pastoralism and distress out-migration from affected areas (Roeckert & Kraehnert 2022).

After the 2009/10 disaster, steps have been taken to make disaster responses more systematic and enable anticipatory humanitarian action in the context of extreme winters in Mongolia.[5] An essential component was the introduction of an early warning system for extreme winter conditions. Since 2015, Mongolia's Information and Research Institute of Meteorology, Hydrology, and Environment (IRIMHE), in collaboration with Nagoya University, has generated *dzud* risk maps (Nandintsetseg et al. 2018). At the beginning of each winter, IRIMHE projects the risk of extreme winter conditions based on 14 indicators measuring weather conditions and pasture quality (FAO 2021; PIN Mongolia 2018).[6] The projections are

5 Besides humanitarian responses, the Mongolian government and the World Bank introduced an index-based livestock insurance program in 2006, which allows pastoralists to privately insure against weather risks. Households can purchase insurance coverage from insurance companies or commercial banks during the sales period lasting from January to June in a given year. The insurance covers extreme weather risks between December and June of the following year. The index is the realized livestock mortality rate at the district level during this period, calculated from the annual Mongolian Livestock Census. If the district-level livestock mortality rate exceeds the pre-defined threshold of 5% or 6%, insurance holders receive indemnity payments in August.

6 Those indicators are summer condition, summer days, precipitation anomaly, forecasted precipitation, drought index, pasture carrying capacity, pasture biomass, livestock density, livestock body conditions, temperature anomaly, forecasted temperature, snow depth, snow density, and days with snow cover (FAO 2021).

condensed into five risk categories (very low risk, low, medium, high, and very high risk). This geographically fine-grained forecast of extreme winter risk is then published in the form of a map by the government agency overseeing emergency services, the National Emergency Management Agency. The risk maps are released each year in November or December, with updates published in January and February. They are distributed among organizations coordinating relief efforts and used by the Mongolian government to voice humanitarian appeals to the international donor community.

The risk maps have been employed in various AHA programs in Mongolia. The IFRC introduced anticipatory action programming in 2017 and has since institutionalized its AHA mechanism in the country. Following a pre-defined protocol that contains a definition of household eligibility criteria,[7] IFRC assistance is automatically triggered if the risk map projects the risk level in three or more provinces of Mongolia to be very high in more than 20% of the territory in a given province (IFRC 2020d). The IFRC's AHA mechanism was activated in the winter of 2017/18, 2019/20, and 2020/21 (IFRC 2018, 2020a, 2021). During the 2020/21 disaster, the event studied here, IFRC provided AHA to 2,000 households, who received unconditional cash transfers worth 90 USD and an animal care kit between late January and early February 2021 (IFRC 2021). Similar AHA programs have been implemented in Mongolia by FAO during the winter disasters of 2017/18, 2019/20, and 2020/21 (FAO 2018, 2020). During the 2020/21 winter disaster, FAO distributed 405 tons of fodder and 50 tons of vitamin supplements to 1,000 households with 300 or fewer livestock in six provinces (IFRC 2021). Further AHA programs, also building on the risk maps, have been implemented in Mongolia by Save the Children and World Vision in cooperation with the Start Network.

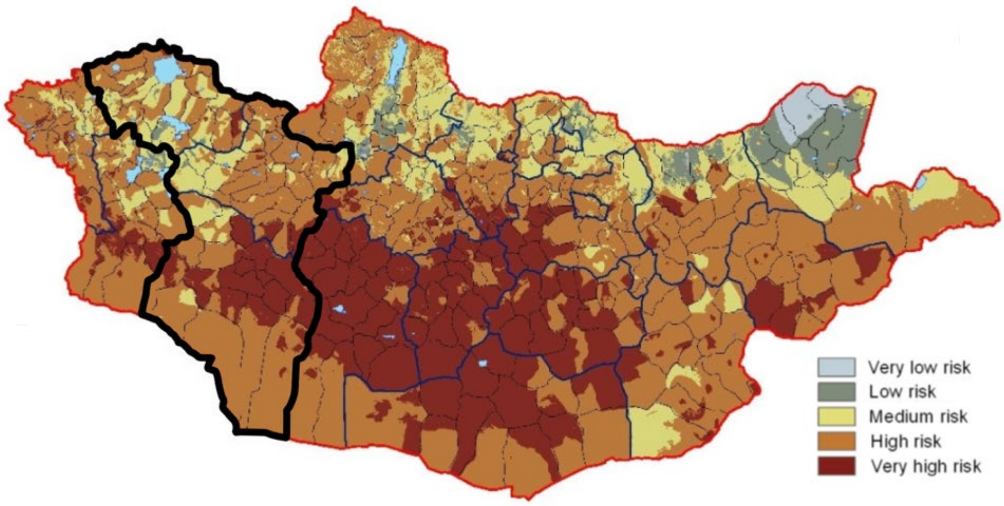
In scenario planning activities conducted by implementing organizations based in Mongolia, cash, food items, and animal nutrition supplies were identified as the most immediate needs of pastoralist households exposed to extreme weather risk (IFRC 2020c). In particular, pastoralist households were found to face binding cash constraints during winter. Cashmere wool and live animals, the most important sources of livestock income, are commonly sold in bulk in one single transaction in late spring and autumn, respectively. During the winter months, even households with large herds are short on cash. This presents an obstacle to pastoralists seeking to purchase hay and other fodder supplements when animals weaken during extreme winter

[7] The IFRC eligibility criteria comprise two elements. First, a household must possess between 50-400 livestock in SFU and, second, the household must meet one of the following characteristics: i) single-headed household, ii) senior herder (+60 years of age) with no guardian, iii) household with a disabled member, or iv) household with five or more children under age 16 (IFRC 2020b).

conditions or to purchase fuel and/or rent a truck to carry animals to areas with better pastures. Cash transfers were identified as more cost-efficient than transporting hay and fodder to rural areas (IFRC 2020c). Moreover, implementing organizations put forward that cash transfers allow households to utilize aid for their specific needs, be it measures to prevent livestock losses or damages to human well-being (MRCS 2020; OCHA 2023).

For the 2020/21 winter, the early warning system predicted the risk of extreme winter conditions to be very high in several regions of the country. The risk map published on November 20, 2020, classified 85% of Mongolia as facing a very high, high, or medium risk of experiencing extreme winter conditions, with the central and western regions projected to face the highest risks (IRIMHE 2021). The projected risk level rose further in the updated risk map published on January 10, 2021 (Fig. 1). In response, four organizations – the Mongolian Red Cross Society (MRCS) (with support from IFRC), FAO, PIN, and World Vision – carried out AHA programs in Mongolia during the 2020/21 winter.

Fig. 1: Risk map for the 2020/21 winter, published January 10, 2021



Notes: The survey area of the *Coping with Shocks in Mongolia Household Panel Survey* is outlined in black. Source: IRIMHE (2021).

3. Study design

We carried out a randomized field experiment consisting of the distribution of unconditional AHA cash transfers to pastoralists during the 2020/21 winter disaster in Mongolia. The intervention is part of an evaluation project funded by the German Federal Foreign Office, in which the authors designed and carried out the randomized impact evaluation and designed the household survey, PIN implemented the AHA intervention according to the randomized design, and the NSO conducted the household survey.

A particular feature of this evaluation of a humanitarian aid project is that it builds on existing survey data, the *Coping with Shocks in Mongolia Household Panel Survey*. The survey has been implemented by the NSO in collaboration with the authors since 2012 (Kraehnert et al. 2022). It comprises five panel waves collected in the three neighboring provinces of Govi-Altai, Zavkhan, and Uvs in western Mongolia. Data from wave 4, collected between June 2020 and May 2021, serves as baseline in this study. The survey is implemented continuously, with one-twelfth of the sample households interviewed every month, thus providing coverage across seasons. In each panel wave, each household is interviewed in the same month. A stratified three-stage design was applied to draw the sample, with the population and housing census of 2010 serving as the sampling frame (Otter & German Institute for Economic Research 2012).[8] Sample households are located in 49 out of the 61 districts in the survey provinces. The sample is representative of the urban and rural populations in each of the three survey provinces as of 2010.

The relevant population for our study is households that fulfilled three eligibility criteria: First, households must participate in the *Coping with Shocks Survey*. Second, households must live in an area projected to be at very high, high, or medium risk of experiencing extreme winter conditions, according to the risk map published on January 10, 2021. This was the case for all sample households of the *Coping with Shocks Survey* (Fig. A.1 in the Appendix). Third, households must own livestock, as winter disasters in Mongolia primarily affect pastoralists. About half of all *Coping with Shocks Survey* sample households are pastoralists.

Based on *Coping with Shocks Survey* data from wave 4 that was available by February 2021, 925 households met those three eligibility criteria (Table 1). Of those 925 households, we

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[8] In the first sampling step, each of the three survey provinces was subdivided into province centers, district centers, and rural areas, resulting in a total of nine mutually exclusive strata. In the second step, primary sampling units (PSU) were randomly selected from each stratum, resulting in a total of 221 PSU. In the third step, eight households were randomly selected from each PSU.

randomly assigned 421 households to the treatment group and 504 households to the control group, with the treatment group earmarked to receive an average of 236 USD. Due to budget constraints, the number of households selected for treatment is slightly lower than the number of households assigned to the control group. The amount of cash assistance was informed by existing AHA programs of humanitarian organizations active in Mongolia. The cash assistance was worth approximately 1.7 months of working for the national minimum wage or the market price of four sheep at the time of the intervention. Compared to baseline data, the cash assistance corresponds to 2% of the median herd value, 6% of the median annual household income, or 54% of median annual herd-related investments.

We randomized at the sub-district level to avoid spillover effects and reduce the potential for conflict between households in the recipient and control groups. In other words, either all or none of the livestock-owning sample households in a given sub-district received the AHA transfers. When randomization was carried out in February 2021, wave 4 data was not yet available for 507 households. For those households, we drew on wave 3 data to check if households met the eligibility criteria. Once the collection of wave 4 data was complete, it turned out that 95 households were wrongly classified as eligible households as they either no longer owned livestock, had moved outside of the survey area, or had attrited from the survey after wave 3.[9] We exclude those households from the main analysis.

In February 2021, the NSO collected pre-intervention data through in-person visits to households selected for treatment, most of whom follow a nomadic or semi-nomadic lifestyle. The NSO enumerators were able to locate and survey 381 of the 421 households selected for treatment. All of those 381 households gave their consent to participate in the study. Households were then informed that they were randomly chosen to receive an AHA transfer from PIN within the next weeks. The pre-intervention survey recorded whether households currently own livestock (which all households did), whether households have a bank account (which all households had),[10] the bank account details of one person in the household, the

[9] Of those 95 households, 43 households (45.3%) were initially assigned to the treatment group and 52 households (54.7%) to the control group. This share of households in the treatment and control group is similar to the one among the 830 households that were confirmed to meet the eligibility criteria after the collection of wave 4 was complete (45.5% and 54.5% of households in the treatment and control group, respectively). This makes us confident that treatment assignment based on wave 3 data is not systematically correlated with the eligibility criteria.

[10] For households not in possession of a bank account, PIN planned to hand out checks in person as part of the AHA intervention, yet all surveyed households indicated they own a bank account. The government of Mongolia has been transferring social welfare via bank transfer since 2012 (UNICEF 2019), hence the ownership of bank accounts is almost universal.

relationship of the bank account owner to the head of household, and the head's mobile phone number. It also recorded whether the household could easily access a local bank branch to withdraw the transferred money (to which all households answered yes), potential obstacles to reaching the bank branch, and whether the household needed support to reach the bank branch (which none of the households did). This way, it was ensured that the potential needs of vulnerable people – particularly households lacking adequate transport – were identified and could be addressed.

In the second week of March 2021, PIN distributed money via bank transfer to 381 households participating in the pre-intervention survey. Full documentation is available, showing that all transactions were implemented successfully. Immediately after the bank transactions were completed, PIN informed recipient households either via phone call or text message that they received the transfers.

Beginning in mid-April 2021, PIN started implementing a short post-intervention phone survey among recipient households to verify that all treated households had indeed received the bank transfer and inquire about the usage of cash assistance.[11] Descriptive statistics, displayed in Table A.1 in the Appendix, show that all respondents had withdrawn the cash assistance from their bank account by the time of the post-intervention phone survey. When asked about what mode of emergency assistance is best suited to their needs, the majority (77%) indicated cash assistance, followed by 20% preferring livestock fodder or hay. According to respondents, the optimal amount of cash transfers is 442 USD. With respect to the timing of AHA assistance, about one-third (35%) of respondents indicated March to be the most suitable month, representing the modal response. This figure compares with 8% of the respondents indicating a preference for December, 23% for January, and 23% for February. When asked how the cash assistance was used (allowing for multiple answer options), the most commonly mentioned categories were the purchase of livestock fodder or hay (92%), food items for the household (49%), and gasoline for transportation (24%). These descriptive statistics should be interpreted with care, as desirability bias – respondents overreporting desirable outcomes in order to fulfill the perceived expectations of PIN, who both delivered the humanitarian aid and implemented the phone survey – is likely.

[11] From May 2021 onwards, pastoralist households start moving their herds to spring and summer pastures. Some recipient households could not be reached via mobile phone and the completion of the post-intervention phone survey took longer than expected. By the end of June 2021, 92% of recipient households were interviewed and by the end of September 2021, all but 8 recipient households were interviewed.

Between June 2021 and May 2022, the NSO implemented wave 5 of the *Coping with Shocks Panel Survey*. Of the population meeting the eligibility criteria of the AHA intervention, wave 5 data was successfully collected for 815 households, while 15 households attrited from the survey between wave 4 and wave 5. Among the eligible households for whom complete wave 5 is available, 39 gave up herding and are excluded from the analysis.

Recall that each wave of the *Coping with Shock Survey* is implemented over a 12-month period. Wave 4 was implemented between June 2020 and May 2021, while the AHA intervention was delivered to households in March 2021. We restrict the final sample to 647 households for whom wave 4 interviews were implemented before the disbursal of anticipatory cash transfers. The final sample used in the analyses below comprises 299 treated households (living in 45 sub-districts) and 348 control households (living in 53 sub-districts).

In order to avoid double targeting of households, all humanitarian organizations active in Mongolia coordinated their activities during the 2020/21 winter disaster and exchanged distribution plans listing targeted districts during regular meetings of the Humanitarian Country Team. MRCS and FAO, the two organizations delivering the most significant amount of aid, focused their AHA activities on Mongolia's central region, where the highest risk of disaster was forecasted (whereas the intervention studied here was implemented in the western region). Moreover, the limited number of households targeted by both MRCS and FAO reduces the risk of our sample households receiving an AHA intervention from another humanitarian organization. In their 2021 AHA program, FAO targeted 160 households (about 1.4% of the pastoralist population) in Govi-Altai province, one of the three survey provinces of the *Coping with Shocks Survey*. MRCS implemented AHA in 18 provinces, targeting 2,020 households in total (about 1% of the pastoralist population in those 18 provinces). Among the sample considered in this evaluation study, only 5 households indicated in the *Coping with Shocks Survey* (wave 5) that they received humanitarian cash assistance from humanitarian actors other than PIN.

Table 1: Sample

	Treatment	Control	Total
Number of households meeting the eligibility criteria, based on data available in February 2021	421	504	925
Number of households meeting the eligibility criteria, based on complete wave 4 data	378	452	830
Number of households receiving AHA cash transfers	381	-	381
Number of eligible households for whom wave 5 data were successfully collected	373	442	815
Number of eligible households that still owned livestock by the time of wave 5	359	417	776
Number of eligible households that still owned livestock by the time of wave 5 and for whom wave 4 data were collected before the disbursal of AHA cash transfers (sample used in analysis)	299	348	647
Number of sub-districts in which eligible households reside (sample used in analysis)	45	53	98

Source: Coping with Shocks in Mongolia Household Panel Survey (waves 3-5).

4. Empirical strategy

To test whether receiving unconditional anticipatory humanitarian assistance helped pastoralist households prevent socioeconomic damage during the weather disaster, we estimate the following model:[12]

$$y_{isd} = \alpha + \beta_1 \, transfer_{isd} + \beta_2 \, realized\, risk_d + \phi \, X_{isd} + \tau_m + \varphi_p + \varepsilon_{isd} \quad (1)$$

where y_{isd} stands for a variety of socio-economic outcomes measured for household i living in sub-district s and district d. $Transfer_{isd}$ is an indicator for treatment that equals one if a household was selected to receive an AHA cash transfer worth 236 USD, on average. $Realized\ risk_d$ is a district-level measure for the realized intensity of the winter disaster. X_{isd} is a vector representing household-level and district-level controls measured at baseline. Standard errors are clustered at the sub-district level, the level of randomization. We also control for interview month fixed effects (τ_m) and province fixed effects (φ_p) to account for the survey design. Summary statistics for all variables of interest are displayed in Table A.2 in the Appendix.

Our choice of outcomes is informed by the aim of the AHA intervention: Preventing disaster-related damage in pastoralist households' assets, income, investments, and consumption. The

[12] Funding for the impact evaluation project was not authorized until few days before the distribution of the cash transfers in March 2021. Moreover, the collection of the household panel survey was ongoing during the intervention (see Section 3 for details). For these reasons, a pre-analysis plan was not created.

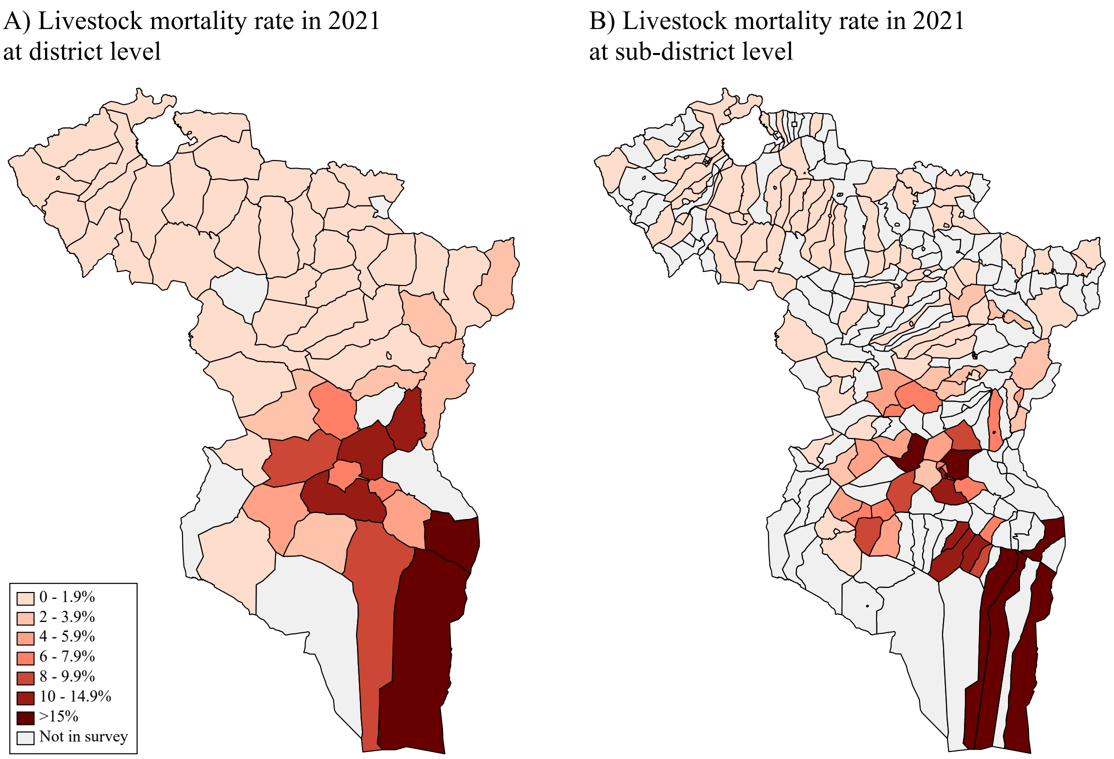
first outcome is post-treatment herd size.[13] Given that livestock serves as a source of income, a means of storing wealth, and an important source of food, the number of livestock owned by pastoralists is a good proxy for their overall wealth. Herd size is measured in SFU at the time of the wave 5 interview. The second outcome is total annual household income in the 12 months preceding the wave 5 interview. The third outcome is herd-related investments in the 12 months preceding the wave 5 interview. It captures the sum of household expenditures on 12 different herd-related categories, including expenditures for extra fodder and hay, transporting animals to pastures with better grazing conditions, material for animal shelters, drugs and veterinarians, and hiring laborers. These herd-related expenditures are among the few strategies available to pastoralists to keep their animals alive during extremely harsh winter conditions and strengthen their productivity. As a fourth outcome, we employ the number of livestock, measured in SFU, slaughtered for own consumption during the 12 months preceding the wave 5 interview. This measure allows us to detect whether households sacrificed their own consumption in order to protect their asset base. Relatedly, the fifth outcome is expenditures on non-food consumption during the 12 months preceding the wave 5 survey interview. This measure includes expenditures for clothing, communication (mobile phone credit, internet use), and transportation (public transport, fuel). We include the one-year lag of each post-treatment outcome to reduce undesired noise and increase the precision of the estimates. As expected, all outcomes are strongly and significantly correlated with their lags (Table A.3 in the Appendix).

The 2020/21 winter disaster struck with considerable geographic variation in its intensity. In Mongolia, livestock mortality, calculated from the annual Livestock Census (Mongolian Statistical Information Service 2023), is commonly used as an indicator for the intensity of winter disasters. Collected each year in December, the Livestock Census records from every pastoralist household the current number of animals and the number of animals lost in the previous 12 months, both disaggregated by species. Figure 2 displays the livestock mortality rate in 2021, measured in SFU, for the districts and sub-districts covered by the *Coping with Shocks Survey*. Panel B shows that the livestock mortality rate varied between 0.1% in the least affected sub-district and 19% in the most severely affected sub-district. Most livestock losses occurred in the southern part of the survey area, while in the northern part, livestock mortality was close to the long-term average. Among the sample considered in this evaluation study, 23% of households live in districts in which livestock mortality exceeded 6%, a value often

[13] Our preferred measure would have been household-level livestock mortality rates, which, unfortunately, the *Coping with Shocks Survey* recorded too imprecisely to be used in the analysis.

considered to indicate extreme winter conditions in Mongolia.[14] To account for the effect of realized risk, we include district-level livestock mortality as independent variable in the regression model.

Fig. 2: Realized risk in the survey area



Notes: Both panels display the three survey provinces covered by the *Coping with Shocks Survey*, with district boundaries shown in Panel A and sub-district boundaries shown in Panel B. Livestock mortality is measured in SFU. Source: Mongolia Livestock Census.

The choice of additional controls is informed by a balance test (Table 2). A comparison of means indicates that the treatment and control groups are well-balanced across a wide range of household characteristics. The means comparison reveals only two statistically significant differences, namely (i) the sex of the household head, with households in the treatment group being 4 percentage points more likely to have a female head, and (ii) household size, with households in the treatment group having on average 0.33 fewer household members than households in the control group. When considering the normalized difference in means across treatment and control groups (Imbens & Rubin 2015), household location in the provincial

[14] All of these households live in districts with high or very high projected risk according to the risk map published on January 10, 2021. Of the 194 households living in districts with a very high projected risk of extreme winter conditions, 123 experienced district-level livestock mortality rates over 6%. Of the 473 households living in districts with a high projected risk, 57 experienced district-level livestock mortality of over 6%. The projected risk score is a significant predictor of realized livestock mortality (Table A.4 in the Appendix).

center and the forecasted risk of extreme weather are identified as unbalanced, with the absolute normalized difference exceeding 0.2. Households in the treatment group have a 9 percentage point lower probability of living in a provincial center and a 10 percentage point higher probability of living in a district with only medium risk, according to the risk projection published January 10, 2021. Consequently, we include measures for female headship, household size, location in the provincial center, and forecasted risk as controls.

Table 2: Balance test from baseline survey

	Mean values, treatment group (N=299)	Mean values, control group (N=348)	T-test p-value	Normalized difference
	(1)	(2)	(3)	(4)
Household characteristics (pre-treatment)				
Female head of household (0-1)	0.15	0.11	0.06*	-0.13
Age of head of household	48.11	49.37	0.26	0.11
Education of head of household: none (0-1)	0.16	0.12	0.35	-0.10
Education of head of household: primary (0-1)	0.25	0.22	0.70	-0.08
Education of head of household: above primary (0-1)	0.59	0.66	0.36	0.14
Household size	4.25	3.92	0.02**	-0.19
Herd size in SFU (ln)	5.83	5.90	0.36	0.07
Number of goats (ln)	4.52	4.58	0.42	0.04
Number of sheep (ln)	4.22	4.35	0.31	0.08
Number of large animals (cattle, horses, and camels) (ln)	2.93	2.97	0.74	0.03
Total income in USD (ln)	8.15	8.22	0.44	0.08
Income from livestock byproducts in USD (ln)	6.50	6.52	0.67	0.01
Income from sold animals in USD (ln)	4.24	4.21	0.80	-0.01
Total expenditures on herding in USD (ln)	5.52	5.73	0.48	0.11
Fodder expenditures in USD (ln)	4.67	4.88	0.73	0.10
Fuel expenditures in USD (ln)	4.94	4.98	0.93	0.02
Number of livestock consumed (ln)	3.19	3.18	0.84	-0.03
Expenditures on non-food consumption in USD (ln)	7.15	7.12	0.57	-0.04
Household lives in province center (0-1)	0.11	0.20	0.21	0.25
Winter intensity				
Livestock mortality rate in district 2021 (%)	3.31	3.02	0.60	-0.07
Forecasted risk of extreme weather event in district: very high (0-1)	0.18	0.24	0.21	0.14
Forecasted risk of extreme weather event in district: high (0-1)	0.58	0.62	0.77	0.08
Forecasted risk of extreme weather event in district: medium (0-1)	0.24	0.14	0.10	-0.25
F-test of joint significance (F-stat)			1.79***	
F-test, number of observations			629	

Notes: Col. 3 displays the p-value from OLS regressions of each variable on the indicator for treatment, controlling for interview-month and province fixed effects and clustering standard errors at the sub-district level. Col. 4 reports the normalized difference between the treatment and control group means. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 3-4), Mongolia Livestock Census, and IRIMHE (2021).

Heterogeneity analysis

As an extension, we explore the heterogeneity of effects of the AHA intervention with respect to disaster intensity and pre-shock wealth, two important dimensions of humanitarian need.

The AHA intervention is targeted at households whose livelihood is *projected* to be at risk by extreme weather conditions. Anticipatory cash transfers are expected to enable those households to avoid disaster-induced decreases in their assets, income, and consumption, as well as enable investments in adaptative strategies. Assessing whether AHA cash transfers are more effective among households living in areas with higher *realized* risk should provide insights into the primary objective of AHA, which is to prevent the emergence of humanitarian need in the first place. To this aim, equation 2 extends the baseline model by an interaction term between cash transfers and realized disaster intensity. The latter is proxied by livestock mortality, measured in SFU, in 2021 at the district level, calculated from Livestock Census data.

$$y_{isd} = \alpha + \beta_1\, transfer_{isd} + \beta_2\, realized\, risk_d + \beta_3\, transfer_{isd} * realized\, risk_d + \phi\, X_{isd} + \tau_m + \varphi_p + \varepsilon_{isd} \quad (2)$$

Existing AHA programs often consider household vulnerability as an additional criterion in deciding whom to target in AHA interventions. In Mongolia, wealthy pastoralists with large herds tend to have better access to high-quality pastures, which determines their ability to prepare hay and fodder reserves for the winter as well as resources needed to move their animals across long distances during winter disasters (Goodland et al. 2009). In contrast, subsistence-oriented households with smaller herds are often in a weaker position to access good pastureland and are, therefore, less well positioned to protect their livestock against extreme weather. We hypothesize that their livelihood may be more directly affected by disaster-induced livestock mortality compared to market-oriented pastoralists and, consequently, that the AHA intervention has larger beneficial effects among those households. To explore potential heterogeneities along the distribution of livestock assets, equation 3 includes an additional interaction term between AHA cash transfer and pre-treatment herd size (while controlling for pre-treatment herd size).

$$y_{isd} = \alpha + \beta_1\, transfer_{isd} + \beta_2\, realized\, risk_d + \beta_3\, herd\, size_{isdt-1} + \beta_4\, transfer_{isd} * herd\, size_{isdt-1} + \phi\, X_{isd} + \tau_m + \varphi_p + \varepsilon_{isd} \quad (3)$$

5. Results

Treatment effects of cash transfers across the full sample

Table 3 reports intent-to-treat effects of the anticipatory cash transfers, obtained with OLS, for five distinct outcomes. Results for the determinants of post-treatment herd size are displayed in columns 1 (without the extended set of pre-treatment controls) and 2 (with the extended set of pre-treatment controls). AHA cash transfers do not have detectable effects on the post-treatment herd size of recipient households. In column 1, the point estimate of receiving AHA cash transfers is 0.01 and not significant at conventional levels. The 90% confidence interval (CI) ranges from -0.05 to 0.06. To understand which effect size we could have detected, given the realized data at hand, we calculate the *ex-post* Minimal Detectable Effect (MDE) at 80% power and 10% significance level by multiplying the standard error with 2.49 (Bloom 1995). The *ex-post* MDE of the AHA cash transfers on herd size is 0.08. In other words, if the AHA cash transfers had increased post-treatment herd size by 8%, we would have picked up a significant effect at the 10% significance level with an 80% probability. The proxy for realized disaster intensity – livestock mortality rate in 2021, measured at the district level – is significantly and negatively correlated with households' post-treatment herd size. A 1 percentage point higher district-level mortality rate is associated with a 1% decrease in households' post-treatment herd size. Adding the extended set of controls (col. 2) yields very similar results, with a point estimate of receiving AHA cash transfers of 0.00, the 90% confidence interval ranging from -0.06 to 0.06, and an ex-post MDE of 0.9.

Next, we explore the effects of AHA cash transfers on total annual household income (col. 3-4). The direction of effects is *a priori* unclear: On the one hand, the additional cash resources may have reduced the need to generate income by selling livestock and byproducts on the market, thereby lowering total income. On the other hand, cash transfers may have freed up productive capacities or increased mobility, leading to a situation where households could generate additional income. Results indicate that the receipt of cash transfers does not have statistically significant effects on total income, neither in the model without the extended set of controls (90% CI: [-0.11;0.05], MDE: 0.11) nor with the extended set of controls (90% CI: [-0.11;0.05], MDE: 0.12).

In columns 5 and 6, we test if the receipt of AHA cash transfers increased herd-related investments, i.e., households' spending related to strengthening livestock health and productive capacities. Point estimates indicate a 5% increase in herd-related expenditures in the specification without the extended set of pre-treatment controls (col. 5) and a 12% increase in the specification with the extended set of controls (col. 6). Yet, these effects are again not statistically significant at conventional levels, with 90% confidence intervals between -0.24 and 0.34 (MDE: 0.44) and between -0.17 and 0.42 (MDE: 0.44) in the models without and with controls, respectively.

We then explore whether the receipt of AHA cash transfers affected the home consumption of livestock (col. 7-8). The point estimates indicate a 6% increase in livestock consumption in the model without the extended set of pre-treatment controls (90% CI: [-0.03;0.15], MDE: 0.14) and a 4% increase in the model with the extended set of controls (90% CI: [-0.05;0.14], MDE: 0.14). Effects are not significant at conventional levels.

Lastly, in columns 9 and 10, we investigate the effects of receiving AHA cash transfers on households' expenditures on non-food consumption goods. Again, the consumption expenditures of treatment households are, on average, not affected by the AHA cash transfers, with an estimated effect size of 1% in the specification without the extended pre-treatment controls (90% CI: [-0.07;0.09], MDE: 0.11) and in the specification with extended controls (90% CI: [-0.07;0.09], MDE: 0.12).

In sum, the intent-to-treat effects of receiving anticipatory AHA cash transfers on post-treatment herd size, household income, investments in adaptive strategies, and consumption are indistinguishable from zero when considering the average effects across the full sample of pastoralists.

Table 3: Intent-to-treat effects of AHA cash transfers

Dependent variable:	Herd size (ln)		Income (ln)		Herding expenditures (ln)		Consumed livestock (ln)		Consumption expenditures (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Selected for treatment	0.01 (0.03)	-0.00 (0.03)	-0.03 (0.05)	-0.03 (0.05)	0.05 (0.18)	0.12 (0.18)	0.06 (0.06)	0.04 (0.06)	0.01 (0.05)	0.01 (0.05)
Livestock mortality in district	-0.01** (0.01)	-0.01** (0.01)	-0.01* (0.01)	-0.01* (0.01)	0.06* (0.03)	0.05 (0.04)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)
Pre-treat. herd size (ln)	0.95*** (0.02)	0.92*** (0.02)								
Pre-treat. income (ln)			0.52*** (0.03)	0.49*** (0.03)						
Pre-treat. herding expenditures (ln)					0.31*** (0.05)	0.28*** (0.05)				
Pre-treat. consumed livestock (ln)							0.37*** (0.06)	0.31*** (0.06)		
Pre-treat. consumption expenditures (ln)									0.73*** (0.04)	0.50*** (0.04)
Female head of household		-0.17** (0.07)		-0.20*** (0.06)		-0.38* (0.20)		-0.04 (0.06)		-0.30*** (0.08)
Number of household members		0.02 (0.01)		0.05*** (0.01)		0.05 (0.03)		0.07*** (0.01)		0.12*** (0.02)
Located in province center		-0.14*** (0.04)		-0.01 (0.07)		-0.24 (0.20)		-0.12 (0.08)		-0.03 (0.06)
High predicted risk in district		0.01 (0.04)		0.04 (0.07)		0.18 (0.23)		0.03 (0.08)		0.06 (0.08)
Very high predicted risk in district		0.00 (0.06)		-0.01 (0.10)		0.94** (0.39)		0.05 (0.11)		0.07 (0.11)
Constant	0.14 (0.15)	0.30** (0.15)	4.38*** (0.27)	4.33*** (0.31)	3.57*** (0.73)	3.15*** (0.73)	1.93*** (0.21)	1.81*** (0.21)	2.11*** (0.29)	3.09*** (0.30)
R-squared	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	647	647	629	629	629	629	629	629	629	629

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. All specifications include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

Heterogeneous effects by disaster intensity

The aim of the anticipatory cash transfer intervention is to assist households predicted to be at risk of facing extreme winter conditions. Hence, it is our particular interest to explore the effectiveness of the intervention among households with different levels of actual exposure to the disaster. Table 4 displays the results of the extended model (eq. 2) that includes an interaction term between being selected to receive AHA cash transfers and livestock mortality at the district level, our measure for realized winter intensity.

We do not find evidence for significant heterogeneous effects across different levels of realized winter intensity on post-treatment herd size. In the models without (col. 1) and with extended pre-treatment controls (col. 2), the point estimates for the interaction effect between receiving

AHA cash transfers and district-level livestock mortality are indistinguishable from zero. Similar results, with no significant differences in the effects of AHA cash transfers across treatment households living in areas with high and low realized winter intensity, are obtained when considering income (col. 3-4), herding expenditures (col. 4-5), and livestock slaughtered for own consumption (col. 7-8). Results for non-food consumption expenditures are mixed: In the model without controls (col. 9), the interaction effect is positive and significant at the 10% level, while the interaction effect is not significant in the model with controls (col. 10).

Table 4: Heterogeneity analysis by disaster intensity

Dependent variable:	Herd size (ln)		Income (ln)		Herding expenditures (ln)		Consumed livestock (ln)		Consumption expenditures (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Selected for treatment	0.01 (0.03)	-0.00 (0.03)	-0.03 (0.05)	-0.03 (0.05)	0.05 (0.18)	0.12 (0.18)	0.06 (0.06)	0.04 (0.06)	0.01 (0.05)	0.01 (0.05)
Livestock mortality in district	-0.01** (0.01)	-0.01* (0.01)	-0.02* (0.01)	-0.01 (0.01)	0.10*** (0.03)	0.07** (0.03)	-0.01 (0.01)	-0.01 (0.01)	-0.02 (0.01)	-0.01 (0.01)
Selected for treatment × livestock mortality in district	0.00 (0.01)	-0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	-0.06 (0.04)	-0.04 (0.04)	0.00 (0.01)	-0.00 (0.01)	0.02* (0.01)	0.01 (0.01)
Constant	0.11 (0.15)	0.27* (0.15)	4.34*** (0.27)	4.29*** (0.31)	3.81*** (0.74)	3.35*** (0.77)	1.90*** (0.20)	1.77*** (0.21)	2.09*** (0.29)	3.07*** (0.30)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.47	0.50	0.25	0.28	0.26	0.30	0.44	0.51
Observations	647	647	629	629	629	629	629	629	629	629

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. Livestock mortality in district is centered around its mean. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

Heterogeneous effects by pre-treatment wealth

Next, we explore whether heterogeneous treatment effects exist along the pre-treatment wealth distribution of pastoralist households, as cash transfers may have varying impacts depending on the availability of alternative resources that can be used for adaptation (Table 5). For herd size (col. 1-2), investments in herding (col. 5-6), as well as the number of consumed livestock (col. 7-8), we indeed find evidence for significant heterogeneities in treatment effects, suggesting that the AHA cash transfers have larger effects for recipients with smaller pre-treatment herd size than for recipients with larger pre-treatment herd size. Specifically, poorer recipients of the AHA cash transfers (i) increase their post-treatment herd size, (ii) invest more in the health and productivity of their livestock, and (iii) increase their meat consumption in comparison to wealthier recipients.

Table 5: Heterogeneity analysis by pre-treatment herd size

Dependent variable:	Herd size (ln)		Income (ln)		Herding expenditures (ln)		Consumed livestock (ln)		Consumption expenditures (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Selected for treatment	0.01	-0.00	-0.01	-0.01	0.08	0.17	0.09*	0.08	0.03	0.03
	(0.03)	(0.03)	(0.04)	(0.05)	(0.18)	(0.17)	(0.05)	(0.06)	(0.05)	(0.05)
Livestock mortality in district	-0.01**	-0.01**	-0.01	-0.00	0.06*	0.05	-0.01	-0.01	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Pre-treat. herd size (ln)	0.99***	0.95***	0.24***	0.23***	0.55***	0.56***	0.34***	0.32***	0.20***	0.18***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.09)	(0.09)	(0.04)	(0.04)	(0.04)	(0.04)
Selected for treatment × pre-treat. herd size (ln)	-0.08**	-0.07*	-0.03	-0.04	-0.30**	-0.35**	-0.12**	-0.12**	-0.08	-0.09
	(0.04)	(0.04)	(0.05)	(0.05)	(0.14)	(0.14)	(0.05)	(0.05)	(0.06)	(0.06)
Constant	5.72***	5.68***	5.06***	4.97***	4.01***	3.67***	2.42***	2.30***	2.70***	3.53***
	(0.08)	(0.10)	(0.27)	(0.31)	(0.68)	(0.68)	(0.16)	(0.18)	(0.29)	(0.29)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.54	0.55	0.29	0.32	0.41	0.43	0.47	0.54
Observations	647	647	629	629	629	629	629	629	629	629

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. Pre-treatment herd size (ln) is centered around its mean. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

To further explore these heterogeneities, we now estimate the model without interactions separately for the subsample of subsistence-oriented pastoralists with a pre-treatment herd size of up to 300 SFU and more commercially-oriented pastoralists with more than 300 SFU before the disaster (Table 6).[15] For the group of pastoralists with a pre-treatment herd size below 300 SFU (Panel A), we find significant and positive effects of the AHA cash transfers on post-disaster herd size (col. 1-2), investments in herding (col. 5-6), and the number of livestock slaughtered for own consumption (col. 7-8). In comparison, for wealthier households (Panel B), receiving AHA cash transfers significantly reduces post-treatment herd size (col. 1-2), while the treatment has no significant effects on the other outcomes considered for this group.

15 The choice of the cut-off at 300 SFU was informed by the literature on the herding sector in Mongolia (Goodland et al. 2009). Results discussed in this paragraph are robust to varying the cut-off between 260-320 SFU.

Table 6: Heterogeneity analysis by pre-treatment herd size, distinguishing between subsistence-oriented and commercially-oriented pastoralists

Dependent variable:	Herd size (ln)		Income (ln)		Herding expenditures (ln)		Consumed livestock (ln)		Consumption expenditures (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Households with pre-treatment herd sizes below 300 SFU										
Selected for treatment	0.14**	0.11*	0.06	0.04	0.45*	0.55**	0.17**	0.14*	0.12	0.11
	(0.06)	(0.06)	(0.08)	(0.08)	(0.25)	(0.24)	(0.08)	(0.08)	(0.09)	(0.10)
Livestock mortality in district	-0.02**	-0.02*	-0.01	-0.01	0.06	0.05	0.00	-0.00	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.26	0.60	4.36***	4.32***	1.05	1.14	1.96***	1.84***	2.23***	3.49***
	(0.46)	(0.44)	(0.33)	(0.38)	(1.18)	(1.26)	(0.34)	(0.34)	(0.38)	(0.46)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.57	0.60	0.47	0.50	0.27	0.29	0.21	0.24	0.44	0.53
Observations	251	251	240	240	240	240	240	240	240	240
Panel B: Households with pre-treatment herd sizes above 300 SFU										
Selected for treatment	-0.06*	-0.06**	-0.07	-0.07	-0.15	-0.10	0.03	0.02	-0.02	-0.03
	(0.03)	(0.03)	(0.05)	(0.05)	(0.19)	(0.19)	(0.06)	(0.07)	(0.06)	(0.07)
Livestock mortality in district	-0.01*	-0.01	-0.01	-0.01	0.05	0.04	-0.02*	-0.02	-0.02*	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.21	0.18	5.10***	4.96***	4.83***	4.47***	2.56***	2.45***	3.16***	3.64***
	(0.22)	(0.23)	(0.38)	(0.45)	(0.67)	(0.76)	(0.16)	(0.22)	(0.44)	(0.49)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.71	0.72	0.38	0.40	0.18	0.20	0.17	0.20	0.33	0.40
Observations	396	396	389	389	389	389	389	389	389	389

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

To further investigate the positive effects of AHA cash transfers for households with smaller pre-treatment herd sizes, we estimate the model with interaction effects for a number of extended outcomes (Table 7).[16] Columns 1 and 2 present results for the post-treatment possessions of goats and sheep, respectively, the two most commonly held species. Column 3 presents results for the number of large animals owned by households after the disaster, i.e., the sum of cattle, horses, and camels. Next, we investigate the differential effects of the cash transfers on herd-related income strategies, namely income generated from the sale of animal byproducts (col. 4) and whether or not households generated income from the sale of livestock (col. 5). In column 6, we employ an indicator variable measuring if a household purchased livestock in the last 12 months, an additional form of investing in the asset base that is not

[16] Note that the sample size differs across those outcomes because of different item non-response rates.

captured by herd expenditures. Column 7 considers as outcome household expenditures for livestock fodder, a sub-category of investments in herding and the single most important means to increase the chance of animal survival during late winter and early spring. Recipients of the cash transfers could have used the assistance to purchase fuel, thus increasing their mobility and the frequency of visiting markets. Hence, in column 8, we employ fuel expenditures as outcome.

Results indicate that the AHA cash transfers helped pastoralists with smaller pre-treatment herd sizes to increase the number of goats and sheep owned after the disaster (col. 1-2), increase the likelihood that households generate income from the sale of animals (col. 5), and to purchase animal fodder (col. 7) compared to recipient households with larger pre-treatment herd size. All interaction effects are statistically significant, at least at the 10% level.[17] Although the heterogeneity analysis is constrained by a limited sample size, the combined evidence indicates that cash transfers have positive and economically large effects for the group of subsistence-oriented households.

Table 7: Heterogeneity analysis by pre-treatment herd size on extended set of outcomes

Dependent variable:	Number of goats (ln)	Number of sheep (ln)	Number of large animals (ln)	Income from livestock byproducts (ln)	Income from livestock sales (0-1)	Purchased livestock (0-1)	Fodder expen-ditures (ln)	Fuel expen-ditures (ln)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selected for treatment	-0.05 (0.05)	0.04 (0.05)	-0.02 (0.04)	-0.12 (0.09)	-0.03 (0.04)	0.05* (0.03)	0.21 (0.20)	0.08 (0.19)
Livestock mortality in district	-0.01 (0.01)	-0.01 (0.01)	-0.03*** (0.01)	-0.05** (0.02)	0.01 (0.01)	0.00 (0.01)	0.04 (0.03)	-0.02 (0.02)
Pre-treat. herd size (ln)	0.04 (0.04)	0.10** (0.05)	0.10* (0.05)	0.48*** (0.12)	0.22*** (0.02)	-0.02 (0.02)	0.66*** (0.12)	0.56*** (0.13)
Selected for treatment × pre-treat. herd size (ln)	-0.08* (0.04)	-0.10** (0.05)	-0.05 (0.05)	-0.14 (0.10)	-0.07** (0.03)	-0.02 (0.04)	-0.36** (0.15)	-0.15 (0.18)
Constant	0.12 (0.18)	0.39 (0.27)	0.27* (0.15)	2.63*** (0.59)	0.43*** (0.10)	0.02 (0.10)	3.46*** (0.74)	2.89*** (0.61)
Extended pre-treat. controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.85	0.84	0.85	0.64	0.34	0.09	0.23	0.50
Observations	647	647	647	629	629	629	629	629

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. Pre-treatment herd size (ln) is centered around its mean. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

[17] When estimating the baseline specification (without interaction effects) for those additional outcomes, the receipt of cash transfers does not have a significant effect in all but one specification (Table A.5, Panel A in the Appendix).

Robustness tests

In the results presented so far, we considered households' treatment status as the main explanatory variable of interest. Table A.6 in the Appendix displays second-stage results from a 2SLS estimation of local average treatment effects, i.e., the average treatment effects for households that actually received the cash transfer, where receiving the treatment is instrumented by the assigned treatment status. The estimated effects for actual recipients are similar in magnitude and statistical significance to the baseline estimates obtained for households selected for treatment.

The intervention was initially set up with two treatment arms that differed in the amount of AHA cash transfers allocated to each household, with one treatment arm containing a lower (177 USD) and the other a higher (295 USD) amount. However, in the analysis presented so far, we abstain from exploiting those different treatments as (i) the treatment arms are of small size, with less than 200 households in each arm, and (ii) the treatment clusters are spatially correlated with realized disaster intensity.[18] Results, now estimated separately for the two treatment arms, are displayed in Table A.7 in the Appendix. When considering the full sample (Panel A), only one significant effect is detected, namely the higher treatment leading to larger herding investments (col. 6). In the heterogeneity analysis by realized disaster intensity (Panel B), we (only) find a significant interaction effect of the lower treatment and livestock mortality in the district on non-food consumption expenditures (col. 9-10). In the heterogeneity analysis by pre-treatment herd size (Panel C), all significant effects point in the same direction as the main results in Table 5. Yet, effects for some outcomes (e.g., post-treatment herd size or expenditures in herding) are not significant across all specifications and both treatment arms. Estimating the combined effects for both treatment arms remains our preferred specification.

Next, we re-estimate all specifications with a more precise measure for realized disaster intensity. Table A.8 in the Appendix displays results obtained when using the livestock mortality rate 2021 at the sub-district level (instead of at district level) to measure winter intensity. As before, the livestock mortality rate is calculated from aggregated Livestock Census data. As of 2021, districts and sub-districts had, on average, a population of 628 and 129 pastoralist households, respectively. Thus, the weight each sample household has in the livestock mortality rate is considerably higher in the sub-district than the district-level measure

[18] The average district-level livestock mortality rate in 2021 was 3.02 for the control group, 2.94 for households in the lower treatment arm, and 3.66 for households in the higher treatment arm.

used in the main specification. The finer measure for disaster intensity confirms all results obtained for the full sample (Panel A), the heterogeneity analysis by winter intensity (Panel B), and the heterogeneity analysis by pre-treatment herd size (Panel C).

Lastly, we explore whether reductions in sample size are systematically linked to the intervention. For 696 of the 830 households defined as eligible based on complete wave 4 data, wave 4 data were collected before the disbursal of the AHA cash transfers. Of those 696 households we excluded 49 households from the analysis, either because they attrited from the *Coping with Shocks Survey* after wave 4 (13 households) or gave up herding by the time of wave 5 (36 households). In a first test, we consider the sample of eligible households based on wave 4 data (N=696) and investigate whether the receipt of AHA cash transfers affected their probability of being part of the sample used in the main analysis (N=647). Results are displayed in columns 1 and 2 of Table A.9 in the Appendix. A second test considers only eligible households for whom wave 5 data is available (N=683) and estimates the determinants of giving up herding between wave 4 and wave 5. Results are shown in columns 3 and 4. In neither test is the receipt of AHA cash transfers significantly related to survey attrition or giving up herding.

6. Discussion

Our analysis yields three main results. First, no significant effects of anticipatory cash transfers on assets, income, adaptive investments, or consumption are detected in the baseline analysis when estimating the intent-to-treat effect across the full sample of pastoralists. Second, there is no evidence that cash transfers are more effective in areas where winter conditions are more extreme. Third, for households with lower pre-treatment wealth, there is robust evidence that AHA cash transfers increase their post-treatment herd size, adaptive investments, and consumption, suggesting that these households can benefit the most from anticipatory humanitarian assistance.

While our results are in support of tying AHA to household-level vulnerability criteria practiced by humanitarian organizations in Mongolia and elsewhere, results are less conclusive about whether AHA provides effective disaster protection. The absence of pronounced and consistent findings in both the baseline specification and the heterogeneity specification assessing differential effects on the realized disaster intensity might stem from various factors, including (i) limitations due to survey design, (ii) features of the AHA intervention, and (iii) uncertainties surrounding the extent to which projected winter risk realized. We discuss those factors in turn.

The survey design might have introduced measurement errors. Households may struggle to accurately recall their income, specific expenditures, or consumption over the past 12 months, potentially introducing noise. Yet, this does not apply to herd size, the most relevant outcome, which is measured at the time of the endline survey interview. Survey respondents were able to report their herd size without difficulty, and we do not have reason to expect respondents facing incentives to either under or over-report their livestock holdings. Additionally, the rolling-basis structure of the panel survey limits the ability to study the immediate post-disaster period in detail. Variables that capture income, expenditures, or consumption encompass the immediate (post-)disaster period but also additional months before and after the treatment. Thus, effects may have averaged out over time. Moreover, since cash transfers were unconditional, the assistance might have been used for welfare-enhancing purposes that are not recorded in the survey, such as purchasing food items in the direct aftermath of the disaster.

A second possibility is that the AHA intervention is indeed of limited effect for all but the poorest households. In particular, the effectiveness of the AHA intervention to assist households exposed to harsh winter conditions may be constrained by its volume, modality, and timing. While it is possible that the amount of assistance was insufficient to promote adaptive action or meaningful investments at the household level, the value of cash transfers in the intervention studied here aligns with previous AHA programs implemented in Mongolia. Allocating a higher amount of assistance per household might not be feasible in practice. Bank transfers may not be the ideal modality of AHA in the context of Mongolia, where households could face challenges accessing banks, reaching distant markets, and possibly encounter limited supplies in local markets. However, recipients reported high satisfaction with the bank transfer, which they withdrew shortly after disbursement. The most difficult time for animal survival is during late winter and early spring. Consequently, the timing of the transfers in the intervention studied here seems appropriate. This notwithstanding, the most effective preparation activities might be implemented in early winter, when risk projections are not yet available, highlighting a key challenge faced by AHA programs in general.

Lastly, the lack of substantial effects might have been due to the fact that realized winter conditions were rather mild in parts of the survey area. While medium, high, and very high risks were projected for the entire survey region, only one-third of the sample districts were ultimately affected. In the sample considered, 139 out of 647 households experienced district-level mortality of over 6%, a threshold commonly used in Mongolia to identify extreme winter conditions. Among the 137 sample households living in districts with the highest projected risk, 61% experienced livestock mortality exceeding this threshold. The imperfect projection of disaster risk is relevant for both cost-benefit considerations of AHA interventions and the evaluation of intervention effectiveness. A substantial portion of the cash transfers was allocated to households that, upon evaluation, were not exposed to the anticipated risk, resulting in no observable reduction in their herd size regardless of the intervention. The uncertainty about the eventual realization of risk highlights an important feature inherent in the design of AHA that complicates the evaluation of its effectiveness.

Based on our findings, we conduct a back-of-the-envelope calculation on the return on investment of the AHA intervention from the perspective of recipient households. Our calculation is based on the sample of households with a pre-treatment herd size of less than 300 SFU, for whom we find robust treatment effects, and who live in an area projected to be at very high, high, or medium risk of experiencing a weather disaster. We only consider as cost of investment the amount of cash transferred to households, but not the cost of identifying households with small herds, collecting bank account information from recipients, or implementing bank transfers. We perceive those costs to be low, as Mongolia's public administration maintains a digital database of households' livestock holdings updated annually with data from the yearly livestock census. Social welfare, which virtually all families in Mongolia receive, is disbursed through bank transfers. Hence, recipients' bank account information is readily available. When multiplying the size of the treatment effect for post-disaster herd size with the average market price of sheep in the survey area in autumn 2021, we find a return to investment of about 3.5 USD.[19] In other words, for every USD invested in AHA cash transfers, less wealthy pastoralist households were able to increase the value of their herd by 3.5 USD. Note that this return to investment even includes cash transferred to households living in areas where disaster risk did not eventually materialize due to imperfect risk projection.

7. Conclusion

Our study provides novel evidence of the effectiveness of anticipatory humanitarian action by evaluating the effects of unconditional cash transfers delivered to randomly selected pastoralist households in Mongolia amid a weather disaster. The robust positive effects of AHA cash

[19] This sub-sample had an average post-treatment herd size of 116 SFU. The average market prices for living sheep, averaged across female and male animals and averaged over the months August to November 2021, was 187,000 Mongolian trugrik (MTN), with little variation across months. Hence, the calculation is 116 SFU * 11% effect size * 187,000 MTN market price per sheep / 2866 MTN/USD exchange rate / 236 USD cash transfer.

transfers for less wealthy households reinforce the rationale of targeting households based on vulnerability.

Evaluating the impact of humanitarian aid is a notoriously difficult task. This complexity is further compounded in anticipatory humanitarian programs, where accounting for predicted risks introduces an additional layer of uncertainty (Puri et al. 2017; Weingärtner & Wilkinson 2019). We applied a new approach, building on a rich and long-standing household panel survey that is implemented independently of the intervention as well as a randomized study design that allows for a causal interpretation of results. Thus, our study provides an example of how existing surveys can be utilized to carry out a rigorous impact evaluation of (anticipatory) humanitarian assistance that is cost-efficient, fast, and reduces desirability bias.

One conclusion from our study is that future impact evaluations of AHA should ideally be based on larger sample sizes that cover large enough areas to facilitate impact evaluation even when the projected risk does not materialize in some areas. In future impact evaluations, sufficient sample sizes that allow for simultaneous testing of wealth and disaster intensity heterogeneities are desirable. Furthermore, exploring variations in aid modality and comparing AHA programs to *ex-post* humanitarian aid approaches present promising directions for larger interventions. These should also allow for studying the effects of AHA programs on mitigating distress migration.

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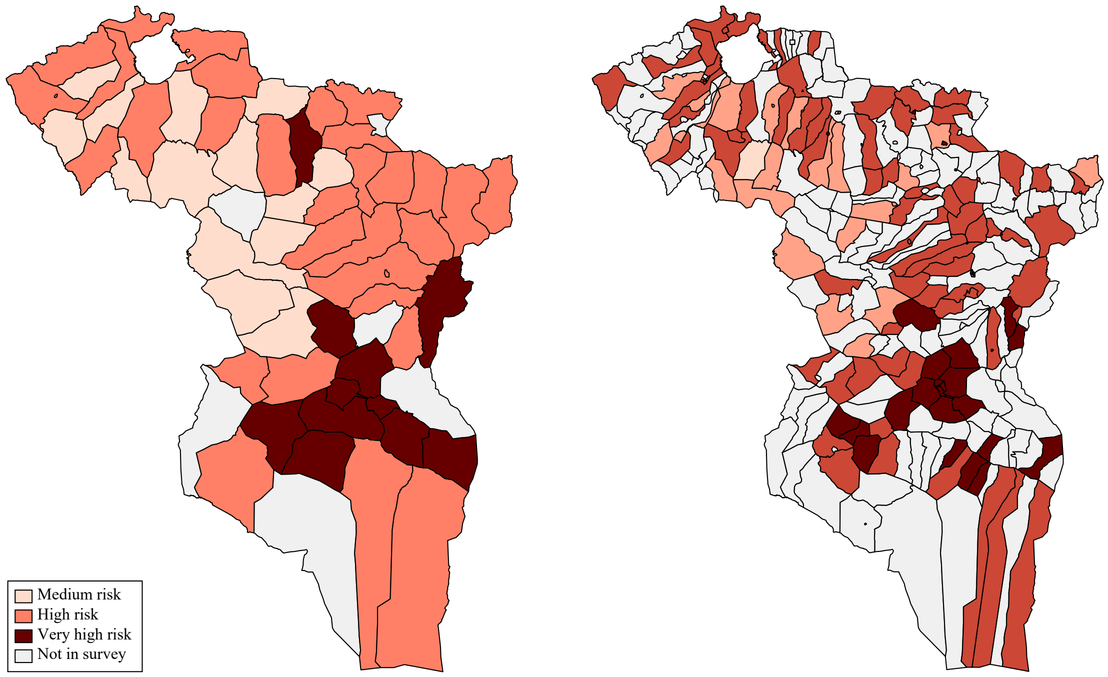
Online Appendix

Fig. A.1: Predicted risk levels for the 2020/21 winter in the survey area as of January 10, 2021

A) District level

B) Sub-district level



Notes: Both panels display the three survey provinces covered by the *Coping with Shocks Survey*, with district boundaries shown in Panel A and sub-district boundaries shown in Panel B. Risk levels are taken from the risk map, published January 10, 2021 (Fig. 1). Source: IRIMHE (2021).

Table A.1: Summary statistics from post-intervention phone survey

	Mean	Std. Dev.	Min	Max	N
Household withdrew cash transfer from bank account (0-1)	1	0	1	1	373
Preferred kind of emergency assistance: Cash (0-1)	0.77	0.42	0	1	373
Preferred kind of emergency assistance: Fodder and hay (0-1)	0.20	0.40	0	1	373
Preferred kind of emergency assistance: Other (0-1)	0.03	0.17	0	1	373
Optimal amount of cash assistance (USD)	441.71	361.43	0	2,772	373
Preferred month for emergency assistance: September (0-1)	0.03	0.18	0	1	373
Preferred month for emergency assistance: October (0-1)	0.02	0.15	0	1	373
Preferred month for emergency assistance: November (0-1)	0.03	0.18	0	1	373
Preferred month for emergency assistance: December (0-1)	0.08	0.28	0	1	373
Preferred month for emergency assistance: January (0-1)	0.23	0.42	0	1	373
Preferred month for emergency assistance: February (0-1)	0.23	0.42	0	1	373
Preferred month for emergency assistance: March (0-1)	0.35	0.48	0	1	373
Preferred month for emergency assistance: April (0-1)	0.02	0.14	0	1	373
Household spent cash transfer on hay and fodder (0-1)	0.92	0.26	0	1	373
Household spent cash transfer on purchasing livestock (0-1)	0.03	0.16	0	1	373
Household spent cash transfer on other livestock-related investments (0-1)	0.13	0.33	0	1	373
Household spent cash transfer on food items (0-1)	0.49	0.50	0	1	373
Household spent cash transfer on non-food items (0-1)	0.08	0.28	0	1	373
Household spent cash transfer on health care (0-1)	0.09	0.28	0	1	373
Household spent cash transfer on education (0-1)	0.03	0.18	0	1	373
Household spent cash transfer on gasoline (0-1)	0.24	0.43	0	1	373
Household used cash transfer as saving (0-1)	0.01	0.09	0	1	373
Household used cash transfer to pay back loan (0-1)	0.05	0.23	0	1	373
Household shared cash transfer with relatives or friends (0-1)	0.01	0.07	0	1	373
Household spent cash transfer on other items or activities (0-1)	0.02	0.15	0	1	373
Household has not used the cash transfer yet (0-1)	0	0	0	0	373
Satisfaction with timing of cash transfer (1=not satisfied at all, 5=extremely satisfied)	4.78	0.48	3	5	373
Satisfaction with amount of cash transfer (1=not satisfied at all, 5=extremely satisfied)	4.71	0.57	2	5	373
Satisfied with receiving assistance in the form of bank transfer (0-1)	1	0	1	1	373

Note: The phone survey was conducted by PIN among recipient households only. Data collection was carried out between mid-April and September 2021. Eight recipient households could not be reached. Source: Post-intervention phone survey.

Table A.2: Summary statistics from baseline and endline surveys

	Mean	Std. Dev.	Min	Max	N
Dependent variables (measured in endline survey)					
Herd size, SFU	526.34	451.69	6	2,430	647
Number of goats	169.82	168.18	0	1,500	647
Number of sheep	154.43	175.81	0	1,074	647
Number of large animals (cattle, horses, and camels)	34.20	37.89	0	240	647
Total annual household income in previous 12 months, USD	6,506.54	4,722.17	491	36,902	647
Income from livestock byproducts in previous 12 months, USD	2,335.66	2,454.13	0	15,385	647
Income from sold animals in previous 12 months, USD	1,616.60	2,843.54	0	22,524	647
Total expenditures on herding in previous 12 months, USD	901.65	926.18	0	8,836	647
Fodder expenditures in previous 12 months, USD	497.96	491.39	0	3,465	647
Fuel expenditures in previous 12 months, USD	535.03	578.47	0	4,158	647
Number of livestock consumed in previous 12 months, SFU	29.65	15.57	0	111	647
Expenditures on non-food consumption in previous 12 months, USD	1,776.33	1,178.88	17	7,765	647
Household characteristics (measured in baseline survey)					
Female head of household (0-1)	0.13	0.34	0	1	647
Age of head of household (years)	48.79	11.35	21	89	647
Education of head of household: none (0-1)	0.14	0.35	0	1	647
Education of head of household: primary (0-1)	0.24	0.43	0	1	647
Education of head of household: above primary (0-1)	0.62	0.48	0	1	647
Household size (number of persons)	4.07	1.73	1	10	647
Herd size, SFU	511.91	418.16	18	2,550	647
Number of goats	168.58	174.00	0	2,200	647
Number of sheep	148.99	168.43	0	1,130	647
Number of large animals (cattle, horses, and camels)	32.93	34.38	0	262	647
Total annual household income in previous 12 months, USD	5,001.30	4,500.01	35	44,058	629
Income from livestock byproducts in previous 12 months, USD	1,486.85	1,783.98	0	14,006	629
Income from sold animals in previous 12 months, USD	1,532.57	2,933.73	0	24,255	629
Total expenditures on herding in previous 12 months, USD	676.92	741.52	0	4,245	629
Fodder expenditures in previous 12 months, USD	342.40	403.71	0	2,772	629
Fuel expenditures in previous 12 months, USD	356.63	344.75	0	2,685	629
Number of livestock consumed in previous 12 months, SFU	28.56	18.36	0	149	629
Expenditures on non-food consumption in previous 12 months, USD	1,536.04	954.94	121	7,938	629
Household lives in province center (0-1)	0.16	0.36	0	1	647
Household lives in Zavkhan province (0-1)	0.36	0.48	0	1	647
Household lives in Govi-Altai province (0-1)	0.32	0.47	0	1	647
Household lives in Uvs province (0-1)	0.32	0.47	0	1	647
Disaster intensity					
District-level livestock mortality in 2021, SFU (%)	3.15	4.49	0	19.22	647
Forecasted risk of extreme weather event: very high (0-1)	0.21	0.41	0	1	647
Forecasted risk of extreme weather event: high (0-1)	0.60	0.49	0	1	647
Forecasted risk of extreme weather event: medium (0-1)	0.19	0.39	0	1	647

Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolian Livestock Census, and IRIMHE (2021).

Table A.3: Autocorrelation in outcome variables over time

	Correlation between wave 4 (baseline) and wave 5 (endline) data
Herd size (ln)	0.91***
Income (ln)	0.64***
Herding expenditures (ln)	0.38***
Consumed livestock (ln)	0.47***
Consumption expenditures (ln)	0.65***

Notes: Pearson's correlation coefficient; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources Coping with Shocks in Mongolia Household Panel Survey (waves 4-5).

Table A.4: Correlation between projected and realized risk

Dependent variable:	Livestock mortality rate in 2021 at district level		Livestock mortality rate in 2021 at sub-district level	
	(1)	(2)	(3)	(4)
Mean risk score (1-5) in district	5.47*** (0.94)			
Median risk score in district: High risk		1.65 (1.22)		
Median risk score in district: Very high risk		7.09*** (1.57)		
Mean risk score (1-5) in sub-district			4.30*** (0.59)	
Median risk score in sub-district: High risk				1.67* (0.92)
Median risk score in sub-district: Very high risk				6.51*** (1.09)
Constant	-18.93*** (3.74)	0.49 (1.02)	-14.47*** (2.39)	0.52 (0.81)
R-squared	0.39	0.30	0.28	0.23
Number of observations	55	55	142	142

Notes: Estimates from OLS estimations with standard errors in parentheses. The sample includes districts (col. 1-2) and sub-districts (col. 3-4) where the sample households considered in the evaluation study resided in March 2021. The actual risk score in the survey districts ranges from 3 (“medium risk”) to 5 (“very high risk”), according to the risk map of January 10, 2021. Livestock mortality is measured in SFU. Sources: Mongolia Livestock Census and IRIMHE (2021).

Table A.5: Intent-to-treat effects of AHA cash transfers and heterogeneity by disaster intensity on extended set of outcomes

Dependent variable:	Number of goats (ln)	Number of sheep (ln)	Number of large animals (ln)	Income from livestock byproducts (ln)	Income from livestock sales (0-1)	Purchased livestock (0-1)	Fodder expen-ditures (ln)	Fuel expen-ditures (ln)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Effects for full study population								
Selected for treatment	-0.05	0.04	-0.03	-0.15	-0.06	0.05*	0.14	0.01
	(0.05)	(0.05)	(0.04)	(0.09)	(0.04)	(0.03)	(0.21)	(0.19)
Livestock mortality in district	-0.01	-0.01	-0.03***	-0.06***	0.00	0.00	0.04	-0.03
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)	(0.02)
Constant	0.12	0.27	0.12	1.76***	0.31***	0.03	3.05***	2.43***
	(0.15)	(0.22)	(0.11)	(0.54)	(0.11)	(0.10)	(0.80)	(0.68)
Extended pre-treat. controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.85	0.83	0.85	0.61	0.25	0.08	0.17	0.46
Observations	647	647	647	629	629	629	629	629
Panel B: Heterogeneity by disaster exposure								
Selected for treatment	-0.05	0.04	-0.03	-0.15	-0.06	0.05*	0.13	0.01
	(0.05)	(0.05)	(0.04)	(0.09)	(0.04)	(0.03)	(0.21)	(0.19)
Livestock mortality in district	-0.01	-0.01	-0.03***	-0.05***	0.01	0.01*	0.06*	-0.03
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)	(0.04)
Selected for treatment × livestock mortality in district	-0.01	-0.01	-0.00	-0.02	-0.01	-0.01*	-0.03	-0.00
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.04)	(0.04)
Constant	0.09	0.24	0.04	1.57***	0.34***	0.06	3.21***	2.34***
	(0.16)	(0.23)	(0.11)	(0.56)	(0.12)	(0.10)	(0.83)	(0.70)
Extended pre-treat. controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.85	0.83	0.85	0.62	0.26	0.09	0.17	0.46
Observations	647	647	647	629	629	629	629	629

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. In Panel B, livestock mortality in district is centered around its mean. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

Table A.6: The effects of cash transfers: Local average treatment effects

Dependent variable:	Herd size (ln)		Income (ln)		Herding expenditures (ln)		Consumed livestock (ln)		Consumption expenditures (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Effects for full study population										
Recipient of cash transfer	0.01	-0.00	-0.03	-0.03	0.05	0.12	0.06	0.05	0.01	0.01
	(0.03)	(0.03)	(0.05)	(0.05)	(0.18)	(0.18)	(0.05)	(0.06)	(0.05)	(0.05)
Livestock mortality in district	-0.01**	-0.01**	-0.01*	-0.01*	0.06*	0.05	-0.01	-0.01	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.14	0.30**	4.38***	4.33***	3.57***	3.16***	1.94***	1.81***	2.11***	3.09***
	(0.15)	(0.15)	(0.27)	(0.31)	(0.72)	(0.71)	(0.20)	(0.21)	(0.29)	(0.30)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.46	0.50	0.24	0.27	0.26	0.30	0.44	0.51
Observations	647	647	629	629	629	629	629	629	629	629
Panel B: Heterogeneity by disaster exposure										
Recipient of cash transfer	0.01	-0.00	-0.03	-0.03	0.05	0.12	0.06	0.05	0.01	0.01
	(0.03)	(0.03)	(0.05)	(0.05)	(0.18)	(0.18)	(0.05)	(0.06)	(0.05)	(0.05)
Livestock mortality in district	-0.01**	-0.01*	-0.02*	-0.01	0.10***	0.07**	-0.01	-0.01	-0.02	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Recipient of cash transfer × livestock mortality in district	0.00	-0.00	0.01	0.00	-0.06	-0.04	-0.00	-0.00	0.02*	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.11	0.27*	4.34***	4.29***	3.82***	3.36***	1.90***	1.78***	2.09***	3.06***
	(0.15)	(0.15)	(0.27)	(0.31)	(0.72)	(0.75)	(0.20)	(0.21)	(0.29)	(0.30)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.47	0.50	0.25	0.28	0.26	0.30	0.44	0.51
Observations	647	647	629	629	629	629	629	629	629	629
Panel C: Heterogeneity by pre-treatment herd size										
Recipient of cash transfer	0.01	-0.00	-0.01	-0.01	0.09	0.18	0.09*	0.08	0.03	0.04
	(0.03)	(0.03)	(0.04)	(0.05)	(0.18)	(0.17)	(0.05)	(0.05)	(0.05)	(0.05)
Livestock mortality in district	-0.01**	-0.01**	-0.01	-0.00	0.06**	0.05	-0.01	-0.01	-0.00	-0.00
	(0.00)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Pre-treat. herd size (ln)	0.99***	0.95***	0.24***	0.23***	0.55***	0.56***	0.34***	0.32***	0.20***	0.18***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.09)	(0.09)	(0.04)	(0.04)	(0.04)	(0.04)
Recipient of cash transfer × pre-treat. herd size (ln)	-0.08**	-0.07**	-0.03	-0.04	-0.31**	-0.36***	-0.12**	-0.13**	-0.08	-0.09
	(0.04)	(0.04)	(0.05)	(0.05)	(0.14)	(0.14)	(0.05)	(0.05)	(0.06)	(0.06)
Constant	5.73***	5.68***	5.06***	4.97***	4.04***	3.70***	2.43***	2.31***	2.71***	3.53***
	(0.07)	(0.09)	(0.27)	(0.30)	(0.66)	(0.65)	(0.16)	(0.17)	(0.28)	(0.29)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.54	0.55	0.29	0.32	0.42	0.43	0.47	0.54
Observations	647	647	629	629	629	629	629	629	629	629

Notes: Estimates from two-stage least squares (2SLS) estimations with standard errors clustered at the sub-district level in parentheses. All specifications instrument the recipient status with treatment status assignment. In Panel B, all specifications instrument the interaction of recipient status and livestock mortality in district with the interaction of treatment status assignment and livestock mortality in district. In Panel C, all specifications instrument the interaction of recipient status and pre-treatment herd size (ln) with the interaction of treatment status assignment and pre-treatment herd size (ln). In Panel B, livestock mortality in district is centered around its mean. In Panel C, pre-treatment herd size (ln) is centered around its mean. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE

Table A.7: Intent-to-treat effects of AHA cash transfers: Value of transfer

Dependent variable:	Herd size (ln)		Income (ln)		Herding expenditures (ln)		Consumed livestock (ln)		Consumption expenditures (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Effects for full study population										
Selected for treatment, 177 USD	0.04	0.05	-0.02	-0.01	-0.16	-0.13	0.09	0.09	-0.04	-0.03
	(0.04)	(0.04)	(0.06)	(0.06)	(0.28)	(0.27)	(0.06)	(0.06)	(0.06)	(0.06)
Selected for treatment, 295 USD	-0.02	-0.05	-0.04	-0.05	0.23	0.37^{**}	0.03	-0.00	0.05	0.06
	(0.04)	(0.04)	(0.06)	(0.06)	(0.16)	(0.18)	(0.07)	(0.08)	(0.05)	(0.06)
Livestock mortality in district	-0.01^{**}	-0.01^{**}	-0.01^{*}	-0.01^{*}	0.06^{*}	0.05	-0.01	-0.01	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.11	0.28^{*}	4.38^{***}	4.33^{***}	3.64^{***}	3.18^{***}	1.91^{***}	1.80^{***}	2.13^{***}	3.10^{***}
	(0.15)	(0.15)	(0.27)	(0.31)	(0.72)	(0.69)	(0.21)	(0.22)	(0.29)	(0.30)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.46	0.50	0.25	0.28	0.26	0.30	0.44	0.52
Panel B: Heterogeneity by disaster exposure										
Selected for treatment, 179 USD	0.04	0.05	-0.02	-0.02	-0.16	-0.12	0.09	0.09	-0.04	-0.03
	(0.04)	(0.04)	(0.06)	(0.06)	(0.29)	(0.27)	(0.06)	(0.06)	(0.06)	(0.06)
Selected for treatment, 298 USD	-0.02	-0.05	-0.04	-0.05	0.22	0.36^{*}	0.03	-0.00	0.06	0.06
	(0.04)	(0.04)	(0.06)	(0.06)	(0.16)	(0.19)	(0.07)	(0.08)	(0.05)	(0.05)
Livestock mortality in district	-0.01^{**}	-0.01	-0.02^{**}	-0.02	0.09^{***}	0.06	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
177 USD × livestock mortality in district	-0.01	-0.01	-0.01	-0.01	-0.11	-0.10	-0.00	-0.00	0.03^{*}	0.02^{*}
	(0.01)	(0.01)	(0.01)	(0.02)	(0.10)	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)
295 USD × livestock mortality in district	0.00	-0.00	0.02^{*}	0.01	-0.04	-0.00	0.00	-0.00	0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.07	0.23	4.30^{***}	4.25^{***}	3.75^{***}	3.20^{***}	1.88^{***}	1.77^{***}	2.13^{***}	3.12^{***}
	(0.16)	(0.16)	(0.27)	(0.31)	(0.73)	(0.75)	(0.21)	(0.22)	(0.30)	(0.30)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.47	0.50	0.26	0.29	0.26	0.31	0.44	0.52
Panel C: Heterogeneity by pre-treatment herd size										
Selected for treatment, 177 USD	0.04	0.04	0.03	0.03	-0.05	-0.04	0.15^{***}	0.14^{**}	0.01	0.01
	(0.04)	(0.04)	(0.06)	(0.06)	(0.28)	(0.26)	(0.06)	(0.06)	(0.07)	(0.07)
Selected for treatment, 295 USD	-0.02	-0.04	-0.06	-0.05	0.20	0.39^{**}	0.04	0.01	0.06	0.07
	(0.04)	(0.04)	(0.05)	(0.06)	(0.15)	(0.18)	(0.07)	(0.07)	(0.05)	(0.05)
Livestock mortality in district	-0.01^{**}	-0.01^{**}	-0.01	-0.00	0.06^{*}	0.05	-0.01	-0.01	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Pre-treat. herd size (ln)	0.99^{***}	0.95^{***}	0.24^{***}	0.23^{***}	0.54^{***}	0.55^{***}	0.34^{***}	0.32^{***}	0.20^{***}	0.18^{***}
	(0.03)	(0.03)	(0.03)	(0.04)	(0.09)	(0.09)	(0.04)	(0.04)	(0.04)	(0.04)
177 USD × pre-treat. herd size (ln)	-0.07	-0.07	-0.04	-0.05	-0.31	-0.36^{*}	-0.09^{*}	-0.09^{*}	-0.04	-0.06
	(0.04)	(0.04)	(0.06)	(0.06)	(0.20)	(0.19)	(0.05)	(0.05)	(0.10)	(0.09)
295 USD × pre-treat. herd size (ln)	-0.08^{*}	-0.07	-0.02	-0.03	-0.30^{*}	-0.38^{**}	-0.14^{**}	-0.14^{*}	-0.12^{*}	-0.12^{**}
	(0.05)	(0.05)	(0.06)	(0.06)	(0.16)	(0.18)	(0.07)	(0.07)	(0.06)	(0.06)
Constant	5.71^{***}	5.67^{***}	5.04^{***}	4.97^{***}	4.04^{***}	3.66^{***}	2.39^{***}	2.28^{***}	2.69^{***}	3.51^{***}
	(0.08)	(0.10)	(0.27)	(0.31)	(0.68)	(0.64)	(0.17)	(0.18)	(0.29)	(0.29)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.54	0.55	0.30	0.33	0.42	0.43	0.47	0.54
Observations	647	647	629	629	629	629	629	629	629	629

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. In Panel B, livestock mortality in district is centered around its mean. In Panel C, pre-treatment herd size (ln) is centered around its mean. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * p < 0.10, ** p < 0.05, *** p < 0.01. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

Table A.8: Intent-to-treat effects of AHA cash transfers: Realized disaster proxied with livestock mortality rate at sub-district level

Dependent variable:	Herd size (ln)		Income (ln)		Herding expenditures (ln)		Consumed livestock (ln)		Consumption expenditures (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Effects for full study population										
Selected for treatment	0.00	-0.01	-0.04	-0.04	0.08	0.15	0.06	0.04	0.01	0.01
	(0.03)	(0.03)	(0.04)	(0.05)	(0.18)	(0.18)	(0.06)	(0.06)	(0.04)	(0.05)
Livestock mortality in sub-district	-0.01***	-0.01***	-0.02***	-0.01***	0.06**	0.05*	-0.01	-0.01*	-0.01**	-0.01**
	(0.00)	(0.00)	(0.01)	(0.00)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.00)
Constant	0.15	0.32**	4.38***	4.33***	3.56***	3.14***	1.94***	1.82***	2.13***	3.09***
	(0.15)	(0.15)	(0.27)	(0.31)	(0.72)	(0.73)	(0.21)	(0.21)	(0.29)	(0.31)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.47	0.50	0.25	0.28	0.26	0.30	0.44	0.52
Observations	647	647	629	629	629	629	629	629	629	629
Panel B: Heterogeneity by disaster exposure										
Selected for treatment	0.00	-0.01	-0.04	-0.04	0.08	0.15	0.06	0.04	0.01	0.01
	(0.03)	(0.03)	(0.04)	(0.05)	(0.18)	(0.18)	(0.06)	(0.06)	(0.04)	(0.05)
Livestock mortality in sub-district	-0.01***	-0.01***	-0.02***	-0.01*	0.07***	0.06**	-0.01	-0.01	-0.02***	-0.02***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Selected for treatment × livestock mortality in sub-district	-0.00	-0.00	0.00	-0.00	-0.02	-0.01	-0.00	-0.00	0.02**	0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.11	0.28*	4.34***	4.28***	3.77***	3.32***	1.91***	1.79***	2.10***	3.05***
	(0.15)	(0.15)	(0.26)	(0.30)	(0.73)	(0.75)	(0.20)	(0.21)	(0.29)	(0.30)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.47	0.50	0.25	0.28	0.26	0.30	0.44	0.52
Observations	647	647	629	629	629	629	629	629	629	629
Panel C: Heterogeneity by pre-treatment herd size										
Selected for treatment	0.00	-0.01	-0.02	-0.01	0.11	0.20	0.09*	0.07	0.03	0.03
	(0.03)	(0.03)	(0.04)	(0.05)	(0.17)	(0.17)	(0.05)	(0.06)	(0.05)	(0.05)
Livestock mortality in sub-district	-0.01***	-0.01***	-0.01**	-0.01*	0.07***	0.06**	-0.01	-0.01	-0.01**	-0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.03)	(0.01)	(0.01)	(0.00)	(0.00)
Pre-treat. herd size (ln)	0.98***	0.95***	0.24***	0.22***	0.57***	0.58***	0.34***	0.32***	0.20***	0.18***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.09)	(0.09)	(0.04)	(0.04)	(0.04)	(0.04)
Selected for treatment × pre-treat. herd size (ln)	-0.08**	-0.07*	-0.03	-0.04	-0.31**	-0.36***	-0.12**	-0.12**	-0.08	-0.09
	(0.04)	(0.04)	(0.05)	(0.05)	(0.13)	(0.13)	(0.05)	(0.05)	(0.06)	(0.06)
Constant	5.72***	5.68***	5.05***	4.95***	4.02***	3.68***	2.42***	2.31***	2.70***	3.51***
	(0.08)	(0.10)	(0.27)	(0.31)	(0.66)	(0.67)	(0.16)	(0.18)	(0.29)	(0.30)
Extended pre-treat. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.84	0.85	0.54	0.55	0.30	0.33	0.41	0.43	0.47	0.54
Observations	647	647	629	629	629	629	629	629	629	629

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. In Panel B, livestock mortality in sub-district is centered around its mean. In Panel C, pre-treatment herd size (ln) is centered around its mean. All specifications control for the lagged dependent variable and include interview month fixed effects and province fixed effects; * p < 0.10, ** p < 0.05, *** p < 0.01. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).

Table A.9: The effects of cash transfers on sample attrition

Dependent variable:	Household is not part of sample used in main analysis (0-1)		Household no longer owned livestock in wave 5 (0-1)	
	(1)	(2)	(3)	(4)
Selected for treatment	-0.03 (0.02)	-0.02 (0.02)	-0.03 (0.02)	-0.02 (0.02)
District mortality	-0.01*** (0.00)	-0.01** (0.00)	-0.01** (0.00)	-0.01** (0.00)
Pre-treat. herd size (ln)	-0.06*** (0.01)	-0.05*** (0.01)	-0.07*** (0.01)	-0.06*** (0.01)
Female head of household		0.04 (0.04)		0.03 (0.03)
Number of household members		-0.01** (0.01)		-0.01*** (0.00)
Located in province center		0.06 (0.04)		0.03 (0.03)
High predicted risk in district		0.02 (0.03)		0.02 (0.03)
Very high predicted risk in district		0.00 (0.05)		0.01 (0.04)
Constant	0.35*** (0.08)	0.26*** (0.09)	0.40*** (0.08)	0.34*** (0.08)
R-squared	0.14	0.16	0.17	0.18
Observations	696	696	683	683

Notes: Estimates from OLS estimations with standard errors clustered at the sub-district level in parentheses. All specifications include interview month fixed effects and province fixed effects; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sources: Coping with Shocks in Mongolia Household Panel Survey (waves 4-5), Mongolia Livestock Census, and IRIMHE (2021).