I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 13084

Shaking Things Up: On the Stability of Risk and Time Preferences

Michel Beine
Gary Charness
Arnaud Dupuy
Majlinda Joxhe

MARCH 2020

I Z A Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 13084

Shaking Things Up: On the Stability of Risk and Time Preferences

Michel Beine
University of Luxembourg, IRES, IZA and CESifo

Gary Charness
University of California, Santa Barbara, IZA and CESifo

Arnaud Dupuy
University of Luxembourg and IZA

Majlinda Joxhe
University of Luxembourg

MARCH 2020

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Shaking Things Up: On the Stability of Risk and Time Preferences*

We conduct a survey and incentivized lab-in-the-field experimental tasks in Tirana, Albania. While the original purpose of our study was to examine whether and how deep parameters such as time and risk preferences affect the intention to migrate, our study was transformed into a natural experiment owing to two large earthquakes that shook the Tirana area during our data-collection period. These events provide us with a rare opportunity to gather evidence (including a preearthquake control) on the effect of natural disasters on time and risk preferences. We find unambiguous effects towards more risk aversion and impatience for affected individuals. Moreover, as it turns out, the second earthquake amplified the effect of the first one, suggesting that experiences cumulate in their influence on these preferences.

JEL Classification: B49, C90, D91, F22

Keywords: time preferences, risk preferences, natural disaster, Albania, migration

Corresponding author:
Gary Charness
Department of Economics
University of California, Santa Barbara
Santa Barbara, CA 93106
USA
E-mail: gary.charness@ucsb.edu

* This paper has benefitted from comments and suggestions from participants at seminars and conferences at UC Santa Barbara, UWA (Perth) and Maastricht University. We are indebted for useful comments from T. Bharati, Lucas Coffman, Andries De Grip, Uri Gneezy, Leandro Magnusson, Charlie Sprenger, Rod Tyers and Marie Claire Villeval. This project has received financial supported from the Fonds National de la Recherche Luxembourg (Grant CORE C18/SC/12665537 RUMEXP)

1 Introduction

The question of the degree to which time and risk preferences are subject to change is a most important issue in economics (Stigler & Becker, 1977). There is little previous evidence on the malleability of such preferences, since one needs to measure preferences before and after an exogenous shock, such as a natural disaster, whose date is unknown ex ante. In fact, the standard view seems to be that one's preferences are essentially permanent, with only minor possible effects from circumstances and life events. Nevertheless, it is conceptually plausible that people update their time and risk preferences as they gather more experience or information about the world. Our data indicate that risk and time preferences do indeed appear to be considerably malleable.

Deep parameters such as time preferences and risk preferences might well play a role in migration decisions. Ceteris paribus, one would expect more patient people to be less likely to choose to migrate, since they would be more inclined to wait for further developments. By the same token, migration is inherently risky and is expected to be less attractive to people with little tolerance for risk. These theoretical expectations have received empirical support in Jaeger *et al.* (2010) and Dustmann *et al.* (2015) among others, although recent results beg the importance of eliciting these preferences using incentivized games rather than survey questions in the context of developing countries (Goldbach & Schlüter, 2018).

We originally set out to conduct a survey on migration intentions in Tirana, Albania, in the latter part of 2019; this was complemented by incentivized lab-in-the-field experiments to measure deep parameters. There have been few economic studies of the Albanian population, since Albania was highly cloistered for many years under the rule of Enver Hoxha. Albania has lagged economically behind much of Europe: in 2012, the GDP per capita was only 30% of the average for nations in the European Union. While this gap has been slightly shrinking in the past decade due to the high recent growth rate of the Albanian economy, the intended emigration rate is still very high, which made Albania an ideal case study for studying the link between migration intentions and preferences.

Remarkably, however, our study was transformed into a fortuitous natural experiment by two major earthquakes (true exogenous shocks!). As planned, our study wave began on August 31, 2019 and concluded at the end of 2019. Coincidentally, two major earthquakes (5.6 and 6.4 on the Richter scale) hit Tirana while the field experiment was in progress. The first event occurred on September 21, the second on November 26. We therefore have data from before the first quake, from between the quakes, and after the second quake. While Albania is a mountainous country with a history of earthquake activity, there had been no large earthquakes since 1987.

This serendipity gave us the opportunity to test for the effect of successive natural disasters on risk and time preferences. In fact, we find very strong results for both earthquakes, with the second earthquake triggering a change in risk preferences perhaps larger than the first earthquake. To our knowledge, no previous study can make such comparisons before and after natural disasters. One related study is that of Callen *et al.* (2014), who study preferences in war-torn Afghanistan (man-made disasters) and find (p. 144) that "...individuals exposed to violence, when primed to recall fear, exhibit an increased preference for certainty." Gneezy & Fessler (2012) conducted experiments before, during, and after a man-made disaster, the 2006 Israel-Hezbollah war. Their principal finding (p. 219) is that "people are more willing to pay costs to punish non-cooperative group members and reward cooperative group members." However, they did not study risk and time preferences.

In a nutshell, the first earthquake reduces the amount invested in a risky asset (versus a safe asset) by about 25%, while the second one leads to an additional similar effect. To put this into perspective, this is equivalent to four times the effect of gender on risk preferences. Furthermore, it is very interesting that there was such a large effect on these preferences from the second earthquake; if awareness of a local earthquake was in itself sufficient to stimulate changes in time and risk preferences, there should be little or no effect from the second event.

One might feel that people are simply updating their views on the probability of an earthquake occurring. Nevertheless, in principle, this should not affect the choices made in the incentivized experimental tasks, since the probabilities for these choices (50-50) are clearly delineated in the games used. Our view is that the underlying risk and time preferences are indeed affected by a natural disaster, since it is quite unlikely that people fail to understand what is meant by a 50% chance. There is also something of an open question whether such measured preferences are good proxies for choices made in non-experimental settings. Charness *et al.* (2019) find no significant relationship between measured risk preferences and the actual (financial) behavior of Dutch adults in the LISS panel[1] raising the question of whether one's underlying ("true") preferences can be accurately measured in the laboratory. In fact, our results suggest that these lab-in-the-field measures do reflect underlying deep preferences in the field.

Our main results are robust to a large set of complementary investigations concerned with specification issues, econometric modeling of the outcomes, or particular treatments in the time-preference task. Importantly, participation rate in our study was not affected by the earthquakes, providing strong evidence that our results were not driven by selective participation, i.e. unobserved variables that correlate with preferences determine whether one participates in the survey. We also look at whether variation in the intensity of exposition at the time of the earthquakes could generate heterogeneous effects on individual preferences by taking into account the location of the interviews within Tirana. While we find some moderate variation in the effects, the evidence is not fully compelling in favor of an effect of the intensity of exposure, suggesting that the effect on preferences is driven not only by what individuals experience at the time of the disaster but also by its subsequent global consequences. We further investigate whether individual characteristics might influence the response to earthquakes. We find a role for gender, but none for income.

The effect of the earthquakes on the expressed desire to migrate is more complex. While we find no clear relationship between one's intention to migrate and one's elicited risk preference for the whole period, we do find a clear association after the second earthquake.[2] Higher uncertainty due to the repeated shaking increases (respectively decreases) the intention to emigrate for more (respectively less) risk-averse individuals. We also do see a strong relationship between elicited time preferences and the intention to migrate, with more (respectively less) patience meaning less (respec-

[1]Furthermore, while Charness *et al.* (2019) find fairly good correlation among the various risk measures used in the study, a number of other papers do not. Deckers *et al.* (2015) find considerable within-subject variation in behavior among four measures of risk attitude; Filippin & Crosetto (2016) confirm this result. The inconsistency is robust when also considering measures from psychology and cognitive neuroscience, as shown in Pedroni *et al.* (2017) by comparing choices using six difference measures.

[2]About the first relationship, it might be that there is some lag between one's just-changed risk preferences and one's consequent intention to migrate. In addition, it could be that the elicited risk preferences play a role for the actual moves, but not for the intended ones (our follow-up survey will shed some light on this). It might also reflect the fact that, in Albania, the initial intended emigration rate is already very high (70%), making it difficult for it to increase even further.

tively more) intended emigration. This is at least a sign that measured risk preferences are meaningful in terms of behavior in the field. At the very least, these natural disasters led to clear effects on expressed time and risk preferences, indicating that there is a definite relationship between one's experience in the world and how one feels about patience and risk.

In summary, we provide clear evidence that risk and time preferences in a lab-in-the-field experiment are influenced by natural disasters and that in fact these preferences can help to predict behavior. It is extremely rare to have an opportunity to cleanly test for such an effect, so we were quite fortuitous in this respect. While we realize that this is just one study, the results are very clear. Perhaps other researchers will at some point have the chance to gather more data on this important economic issue.

The remainder of this paper is organized as follows. We discuss relevant literature in section 2 and present our study's design in section 3. Section 4 gives the results of our survey and our experimental data. It provides the main result and some robustness tests as well as discussion about important aspects such as selective participation. We conclude in section 5.

2 Selective literature review

This paper contributes to the fast-growing literature investigating the stability of deep economic parameters: time and risk preferences and trust. Since the seminal work of Stigler & Becker (1977), arguing in favor of stable preferences, many empirical studies have tested this hypothesis in various ways. A first branch of the literature provides empirical evidence in support of preferences varying over the life cycle (see Deckers *et al.* (2015) and Dohmen *et al.* (2011) for instance). Yet, these results do not necessarily mean preferences are malleable and hence are potentially sensitive to exogenous life events. Therefore, a second branch of the literature has focused on the question of whether exogenous shocks can actually have significant effects on individuals' preferences and trust.

A first strand of studies in this branch investigates the impact of man-made shocks, be it economic in nature such as income shocks, unemployment shocks (see for instance Guiso & Paiella (2008), Malmendier & Nagel (2011) and Chiappori & Paiella (2011)), or financial crises (see Deckers *et al.* (2015), Dohmen *et al.* (2016) and Jetter M. & S. (2019)) or geopolitical in nature such as violent conflicts (see e.g. Callen *et al.* (2014) and Gneezy & Fessler (2012)).

In contrast, this paper contributes to a second strand of studies investigating the impact of natural disasters such as earthquakes, tsunami, floods etc. on preferences. As is evident from the review of the literature presented in Chuang & Schechter (2015), there seems to be no consensus on the sign and even the significance of these effects. While Becchetti & Castriota (2011) and Bchir & Willinger (2013) conclude that natural disasters have no impact on respectively risk and time preferences, Cameron & Shah (2015), Cassar *et al.* (2017), Chantarat *et al.* (2019) and Van den Berg (2010) show evidence in favor of an increase in risk aversion and Bchir & Willinger (2013), Cassar *et al.* (2017) and Sawada & Kuroish (2015) indicate a similar effect for impatience, whereas Bchir & Willinger (2013), Eckel *et al.* (2009), Hanaoka *et al.* (2018), Ingwersen (2014) and Page *et al.* (2014) document a decrease in risk aversion after a natural shock and Callen (2015) and Chantarat *et al.* (2019) present similar results for impatience.

Natural disasters, and in particular earthquakes, are unexpected and hence unanticipated. This feature of natural disasters provides a source of exogenous variation that can be exploited to test (economic) models. Among the studies in this vein, those of Callen (2015), Cameron & Shah (2015) and Cassar *et al.* (2017) are the most related to our paper. As in our paper, these studies used incentivized tasks to elicit individuals' preferences: Callen (2015) elicits time preferences, Cameron & Shah (2015) elicit risk aversion and Cassar *et al.* (2017) elicit both.

A first concern with the approach in these papers, however, is that since one cannot anticipate these events, one must rely on data collected only after the disaster. Not only must one elicit preferences only after the disaster, but one must also compare groups of individuals (control and treatment) constructed using the intensity of exposure to the disaster. Even if the disaster arguably hits randomly, it is plausible that individuals choose where to live according to their (risk and time) preferences. This procedure gives rise to the so-called "selective exposure": differences in preferences between the control and treatment group may not only reflect differences in exposure to the disaster but also ex-ante differences in preferences across location.

A second issue concerns the delay between the occurrence of the disaster and the data collection. In the three aforementioned studies, data were collected long after the disaster; from 2.5 years in Callen (2015) to 5 years in Cassar *et al.* (2017). While this allows measuring the persistent nature of the potential effect, this also raises questions about the random nature of the control and treatment groups. It is indeed plausible that "selective migration" occurred following the disaster, thereby creating a sample bias.

Compared with this literature, our paper has two main contributions. First, while our data do not allow us to measure changes in preferences at the individual level, as in Hanaoka *et al.* (2018), in contrast to the three studies aforementioned, ours contain a "natural" control group, i.e. a random sample of individuals whose preferences were elicited before the earthquake. Our data collection started on the 31st of August 2019 and the first earthquake took place on the 21st of September. Our control group therefore consists of the individuals interviewed before the 21st of September, whose preferences were elicited before the disaster.

Second, we can address the question of the cumulative effect of disasters that is, to the best of our knowledge, new in this literature. We can do so since data collection ended on the 30th of December, more than a month after the second earthquake took place (26th of November). This feature allows us to construct two treatment groups, a first treatment group consisting of individuals interviewed, and hence whose preferences were elicited, after the first but before the second earthquake, and a second treatment group consisting of individuals interviewed, and whose preferences were elicited, after the second earthquake. As a result, comparing the first treatment group to the control group identifies the effect of the first earthquake on preferences while comparing the second treatment group to the control group identifies the cumulative effect of the two earthquakes.

3 Context and Experimental Design

3.1 Sample and descriptive statistics of the field study

The field study was designed to collect information about the migration intentions of the Albanian population. Albania provided an ideal case for this study as it is still considered a low middle-income country with a GDP per capita around $4,078 per year (World Bank, 2017). It has a history of out-migration starting in 1990 soon after the fall of communism. Albania has had a net emigration rate averaging 3% since 2004, very high by international standards.[3] It is also the highest rate among European countries even though Albania is subject to mobility restrictions imposed by most European countries for it is neither part of the Schengen agreement nor of the European Union. In this study, we focus, in particular, on the population of the capital city, Tirana, as it comprises about 1/3 of the entire population of the country and international migration occurs mainly from big urban areas in developing countries.

Nine trained enumerators conducted the data collection. The enumerators, wearing badges with the logo of the University of Luxembourg and carrying a tablet, randomly intercepted potential subjects (aged 16 and over) and invited them to participate in our survey. As taught during their training, the enumerators approached subjects by stating: "We would like to invite you to participate in a research study about migration paths and migration decisions conducted by the University of Luxembourg." The enumerators then explained to the potential subjects that the interview would last approximately 15 to 20 minutes and to thank them for their time, they will be rewarded with a voucher for a top-up on their mobile phone. The starting amount would be 1000Lek but they could earn more or less depending on some choices they will have to make in tasks proposed at the end of the survey. Finally, the enumerators indicated to potential subjects that, in case they had questions about their rights as participants or wanted to obtain more information about our study, they could contact the researchers directly; the email and telephone number of our Albanian co-author were provided upon request.

The enumerators conducted the interviews in the Albanian language (translated form English in Albanian and then re-translated by a third official translator) with the support of a tablet. This tablet was equipped with a specific IT application, created for the purpose of the study, to collect, instantaneously and in a digital way, all the information about the participants, including the exact geo-localization of the interview. The fieldwork started on August 31, 2019 (following a one-month pilot phase)

[3]See www.indexmundi.com. Data from Gallup World Poll surveys reveal that over the 2015-2017 period, Albania was ranked fourth in the World in terms of intended emigration rate with a value reaching 60%. It is reported that this rate still increased during the last 3 years.

and ended on December 30, 2019.

Our sampling strategy is stratified at the level of a district, i.e. the city of Tirana is composed of 11 districts called "mini-bashki." Each enumerator had to cover all the districts during the survey. In practice, each enumerator was asked to perform at most three interviews per day. Each batch of three interviews could be done in only one of the 11 districts of the city, either in a morning session or in an afternoon session and using either of two types of questionnaires. To make sure that each enumerator's interviews were uniformly distributed across districts, sessions and types of questionnaires, each enumerator was randomly assigned on each day to a district, a session, and a type of questionnaire. In total, 2,374 individuals were randomly intercepted, 1,504 agreed to participate and 1,502 completed the survey.[4] Figure (1) provides the exact locations of all the completed interviews.

An interview took on average about 20 minutes. Each interview involved three different sections. The first section included the baseline characteristics of the subjects: socio-demographic information, such as age, gender, income, education, and family situation. The second part involved an experimental section with choices regarding migration intentions. The third and last part included laboratory incentivized games to elicit individual preferences about risk and time. Participants were informed about the details of the financial incentives of the games only at the start of this last section.[5] They were rewarded with a voucher consisting of a top-up of their mobile phones. The amount of the voucher was based on the outcomes of one of the two games played in the third part of the survey; the application randomly selected which of the games to use for financial reward. The average amount earned is around 1300 Lek (10 Euros) and the maximum potential reward is 3000 Lek (25 Euros). These amounts are quite large; the average earnings per month in Albania is about 30,000 Lek (250 euros, see Table (1)).

Table (1) provides descriptive statistics of the baseline sample regarding the main socio-demographic characteristics of the subjects participating in the survey. The second column gives the average value in the sample while the third column provides an

[4]For 3 subjects, the number of years of education is missing.

[5]More precisely, individuals were informed upon interception that they could earn some money. Nevertheless, the details about the possible amounts, the nature of the games, and the way they would be paid were given at the start of the third module, i.e. after subjects had already agreed to participate.

Table 1: Baseline descriptive statistics of key variables of the field experiment

	Mean	Census Data	Min	Median	Max	Obs.
Male	0.500	0.51	0.00	0.00	1.00	1502
	(0.50)					
Age	32.91	34.50	17.00	28.00	78.00	1502
	(13.09)					
Number Children	0.79	0.80	0.00	0.00	7.00	1502
	(1.16)					
Household members	3.80	3.00	0.00	4.00	12.00	1502
	(1.39)					
Years of schooling	14.10	15.20	0.00	15.00	25.00	1499
	(2.66)					
Employment status	0.81	0.88	0.00	1.00	1.00	1502
	(0.39)					
House ownership	0.64	0.74	0.00	1.00	1.00	1502
	(0.48)					
Individual income*	28.38	29.85	0.00	28.00	1800.00	1502
	(27.82)					
Friends or relatives ever migrated	0.98 (0.15)	n.a	0.00	1.00	1.00	1502

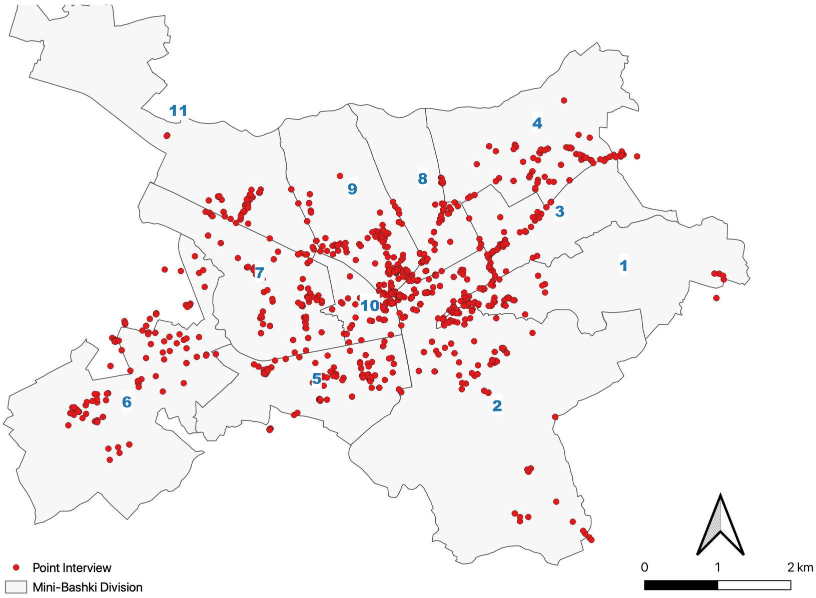
Notes: All data are from the 2019 Baseline survey.
*Individual income is in thousands of Leks. Adjusting for the employment rate in our sample, comparable average income for those employed is 35,039 in our sample.

equivalent measure for the population, using official statistics.[6] Since we stratified the sample by gender, location and time of day, we have a balanced sample in terms of gender. Content in the third column suggests that our sample is quite representative from the population of Tirana in terms of the main characteristics such as age, number of children, education year.[7]

[6]Figures reported in the third column are from various sources: row 2 is from www.instat.gov.al, row 3 is from https://www.statista.com/statistics/443999/fertility-rate-in-albania, rows 1 and 4 are from https://invest-in-albania.org/this-is-the-average-household-size-in-tirana, row 5 from http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/ALB.pdf, row 6 from www.instat.gov.al/media/5577/labour-market-2018-press-release.pdf, but note that, in Albania, the informal employment is estimated to be between 30- 60%, see http://www.ilo.org/wcmsp5/groups/public/@europe/@ro-geneva/@sro-budapest/documents/publication/wcms_167170.pdf. If we account for informal employment, the employment level should be 88%. Row 7 is from http://www.instat.gov.al/al/temat/censet/censusi-i-popullsis%C3%AB-dhe-banesave and row 8 from http://www.instat.gov.al/en/themes/labour-market-and-education/wages/.

[7]The official average monthly income in Albania is higher but include those employed. The average monthly income in Albania is 51,870, which is equal to 415 euros per month.

Figure 1: Distribution of the interviews across the city of Tirana



3.2 Elicited preferences

At the start of the last module, the subjects were asked to participate in two tasks and to make decisions that involved real money. Individuals were endowed with an initial amount of 1,000 Lek (approximately eight Euros) and were told that, depending on their choices during the games, more money could be earned.[8] The IT application helped to explain the game. The initial endowment was divided into 100 coins (tokens), each with a value of 10 Lek.

3.2.1 Elicitation of risk preference

We adopted the elicitation method from Gneezy & Potters (1997), providing a measure of risk preference in the context of financial decision-making with real monetary payoffs.[9] The enumerators asked the subjects to look at the tablet where 100 tokens appeared along with a bag representing the risky asset. The game was explained as follows:

"We will give you a reward for participating to our survey, which will be calculated from the way you make some decisions. You have an initial budget of 1000 Lek. Suppose that, out

[8] The maximum payoff of the first game is 3000 Lek (25 Euros).

[9] The simplicity of this method and the fact that it provides a good metric for capturing differences in attitude towards risk across individuals (see Charness *et al.* (2013)) make it attractive to use in field surveys.

of these 1000 Lek, you put some of them into the bag. The bag will return the amount of coins you decide to invest and multiply it 3 times with a chance of 50% or will return nothing with a chance of 50%. How many coins are you willing to put into the bag and how much are you going to keep for yourself?"

The game was explained twice (or more if needed) in order to make it clear for the subjects. The choice of the number of tokens is the only decision made in the experiment (Charness *et al.* (2013)). We record the amount of tokens invested in the risky asset and then use that amount as a measure of risk preference; the higher the number of tokens invested, the less risk averse the subject is.

The average number of tokens invested in the risky asset before the first earthquake is about 42 of 100, which is slightly lower although very much in line with the existing literature for this test.[10][11] Consistent with other studies, we find that women invest on average four tokens less than men, i.e. are more risk averse. 144 subjects decided to invest zero tokens in the risky asset, whereas 102 invested their entire endowment in the risky asset. Figure (2) provides the distribution of the amount of tokens put in the risky asset in our sample.

3.2.2 Elicitation of time preference

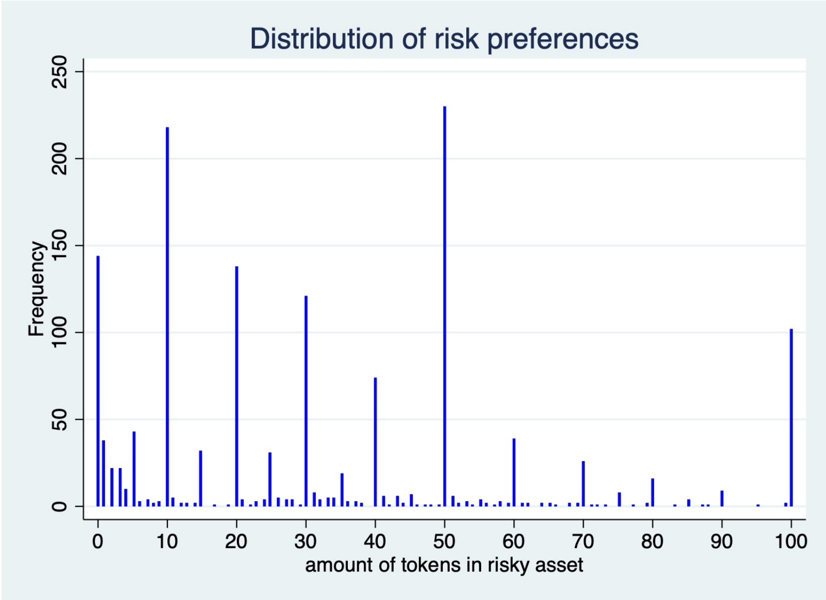
The second game aimed at eliciting the time preference of the subjects in the sample. For that purpose, we adopted the experimental setup proposed in Andersen *et al.* (2008), adapted for the relevant time frame (decision between now and in a month) and interest rate. The intuition of the game can be explained as follows. Consider the discount rate r.[12] This rate, by definition, determines the monetary payment "today", say M_t, equal to the present value of a monetary payment, say $M_t + \tau$, made τ periods

[10] While we are not aware of a prior baseline for Albania, the rate observed before the first earthquake is in line with some measures obtained in other studies (Charness *et al.* (2013)). Dasgupta *et al.* (2019) using the same test, find a proportion of about 48%. In the lab, Charness & Viceisza (2016) find that students invested 44.6% of the endowment in the risky asset. More recently, Holden & M. (2020), using the GP game in Ethiopia find an average proportion of 53.5 %. The slightly lower pre-earthquake rate might be explained by the fact that part of the population experienced a very long and harsh dictatorship lasting during forty-six years. On top of that, in the 1990s Albania experienced a very unstable financial environment that was triggered by major Ponzi schemes.

[11] "Located along the Adriatic and Ionian Seas, Albania is earthquake-prone and registers seismic activity every few days." `https://abcnews.go.com/Technology/wireStory/albania-inspects-quake-damages-sees-100-aftershocks-65777824`.

[12] The interest rate by which we based the calculation was 10%, which is higher than the market interest rate. The value of the interest rate was not shown to the subjects.

Figure 2: Frequency distribution of investment in the risky asset



in the future using the formula[13]

$$M_t = \frac{1}{(1+r)^{\tau}} M_{t+\tau}. \tag{3.1}$$

We elicit an individual's discount rate r by confronting him/her with choices between two payoffs that are set one period (in our case one month) apart, i.e. t is measured in months and $\tau = 1$. Participants made up to 10 choices between the two dated payoffs, both labeled in Lek. The game was explained as follows:

"You must make a second choice with your initial budget of 1000Lek. You can decide to take the whole amount of money today or you can wait one month and the amount of money will be higher based on some options that the computer will give."

The enumerator asked the participant to make the choices between option A and option B with several potential iterations. For each iteration, if the subject opts for option A, then the enumerator continued to ask the same question based on the figures of the next line in Table (2), where the amount for the payment today (in option A) is set to 1000 Lek whereas the amount for the payment in a month (option B) is computed as:

[13]Note that we herewith only consider the discount rate determined from the trade-off between monetary amounts today and amounts in one month. One could also consider other trade-offs between two future payments; for instance, choosing between a payment after one month and a payment after six months.

$$M_{t+1}^k = 1000(1+i)^k \quad (3.2)$$

where k indicates the iteration and i the interest rate.

The choice task continues until the subject switches for option B; multiple switches were not permitted. If the subject never switched to option B, the switching point is recorded as 11. The higher the value of the switching point, the more present-oriented (impatient) the subject. The recorded outcome of interest is the switching point (column (1) of Table (2)). It is important to note that payments to the subjects were made according to their choices: for those who never switched, payment vouchers were made within a few days after the interview.[14] Subjects were told that they would receive the payments on their phone in a couple of days. If they opted for a future reward, payments were made a month later.

Table 2: Task to elicit time preferences

Switch Point	Option A	Option B	Monthly Int. Rate
1	1000 LEK	1100 LEK	0.10
2	1000 LEK	1210 LEK	0.21
3	1000 LEK	1330 LEK	0.33
4	1000 LEK	1463 LEK	0.46
5	1000 LEK	1609 LEK	0.61
6	1000 LEK	1770 LEK	0.77
7	1000 LEK	1947 LEK	0.94
8	1000 LEK	2141 LEK	1.14
9	1000 LEK	2355 LEK	1.35
10	1000 LEK	2590 LEK	1.59

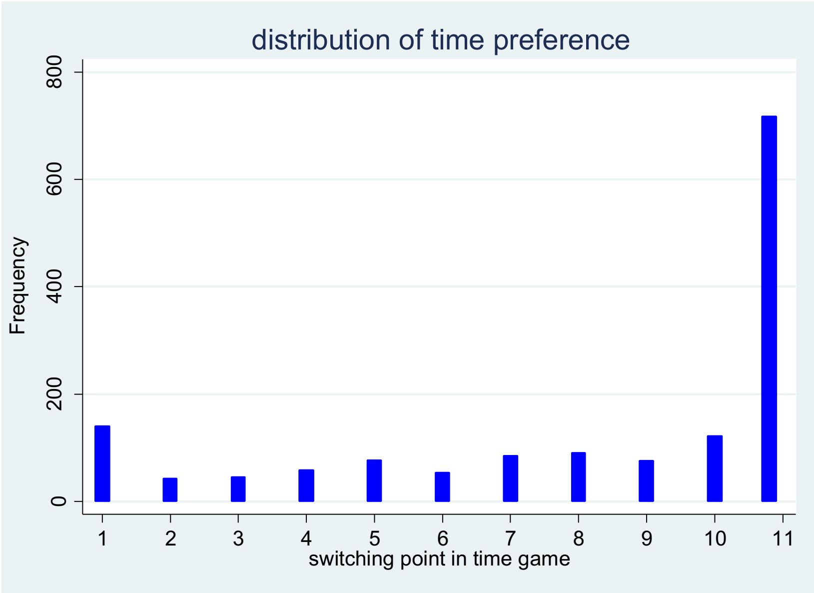
Figure (3) provides the distribution of the switching points. The distribution provides clear evidence in favor of a high preference for the present as 717 subjects never switched to option B and 121 waited to switch for option B at the very last step.[15]

Note that we can use the switching point to compute the associated discount rate for each individual. To do so, we proceed as follows. First, for each row $k < 11$, the associated discount factor r_k is obtained using formula (3.1) where M_t is the amount in option A and M_{t+1} is the amount in option B. Second, for subjects switching at row

[14]To increase trust about the payment, subjects were given a phone number to be called in case they did not receive the payments. In addition, they were invited to share an email address for future exchanges about issues related to the payments. This could be used in case the phone number they shared had an issue.

[15]The high number of non-switchers might reflect that in spite of the measures taken to increase trust between the subjects and the enumerators, some subjects might still have doubts about the actual payment of the reward. In order to account for that, we also conduct some analyses relying only on the variation within non-switchers. See Section (4.4.4).

Figure 3: Frequency distribution of switching points



$1 < k \leq 10$, we assign the discount factor $r^* = \frac{r_{k-1}+r_k}{2}$; for those who never switched, we assign the lower bound $r^* = r_{10}$ and for switchers at iteration 1, we assign the upper bound $r^* = r_1$. The annualized rate of patience is then simply obtained as $F = (\frac{1}{1+r^*})^{12}$. In our data, the rate of patience is on average 0.037.[16]

3.2.3 Intended migration

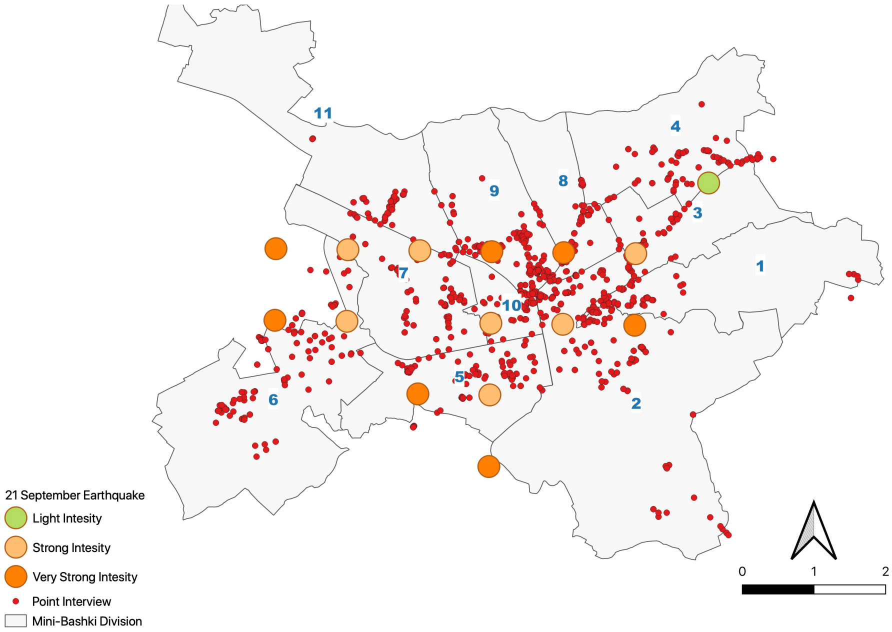
The initial main objective of our study was to address the question of the extent to which migration intentions and desired destination countries are conditioned by risk and time preferences.[17] Albania has one of the highest desired emigration rates in the world and our data confirm this macro-evidence.[18] We asked subjects if they were planning to migrate in the future. Without any further information about some key variables (such as relative wages between Albania and potential destinations), 71.6% of the sample replied that they wished to emigrate. Additional questions concern the

[16]Since there is a one-to-one relation between switching point and rate of patience, the plot of the distribution is essentially reproducing the same information as that for the switching point. Note that the standard deviation in the rate of patience is 0.095, the lowest value (least patient individuals, i.e. non-switchers) is 0.000011 and highest value (most patient subjects, switching at point $n = 1$) is 0.318.

[17]In that respect, one of the main purposes was to revisit the association between mobility and deep parameters based on the existing literature (Jaeger *et al.* (2010); Dustmann *et al.* (2015); Paz & Ubelmesser (2018)).

[18]Over the 2015-2017 period, the Gallup World Poll survey gives an estimated desired emigration rate of 60% for Albania. Over that period of time, Albania was ranked 4th in the World in terms of desired emigration rate, behind Sierra Leone, Liberia and Haiti.

Figure 4: Shake-map stations with the intensity of the 21 of September earthquake in Tirana



choice of destinations conditional on being able to leave. Table (B1) in Appendix B provides the list of preferred destinations for the subjects.

3.2.4 Earthquakes

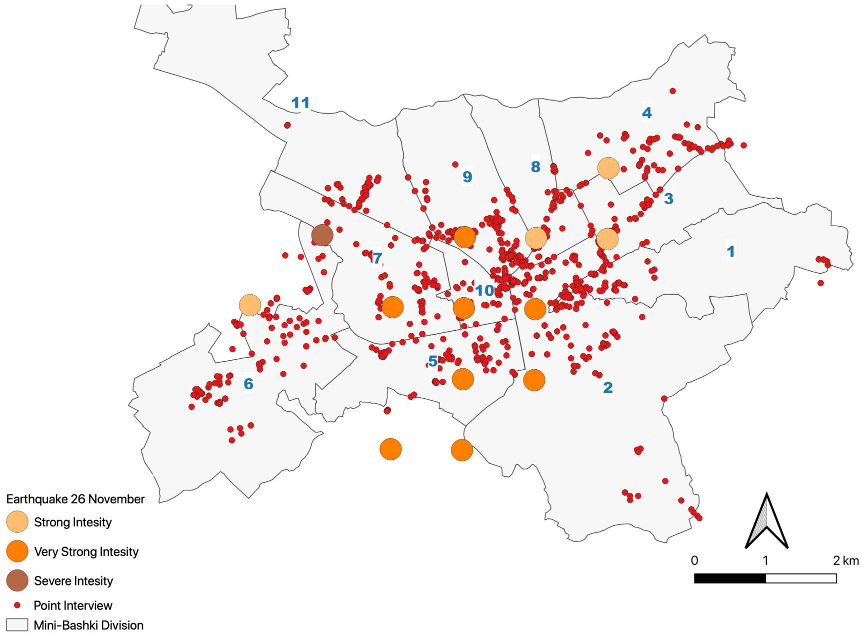
While our field experiment was in progress, two major earthquakes stroked Tirana. On September 21, a first earthquake hit Durrës, 30 kilometers west of Tirana. The intensity at the epicenter was considered severe (VIII) and reached 5.6 on Richter scale.[19] While no one was killed, 108 people were injured and many buildings were destroyed and damaged. Even though Albania is known to be a seismic area, it was the most violent event of that kind in the last 40 years. Tirana was affected, with intensities varying from light (V), to strong (VI) and very strong (VII) depending on the exact location in the city as shown in Figure (4).

On November 26, a second earthquake occurred in Albania, hitting the area of Mamurras, 30km North to Tirana. This earthquake was more violent, reaching 6.4 on the Richter scale at the epicenter.[20] This second quake was deadly, killing 52 people in different areas, including Tirana and more than 3000 people were reported to be injured.

[19] https://earthquake.usgs.gov/earthquakes/eventpage/us60005lrf/map

[20] https://earthquake.usgs.gov/earthquakes/eventpage/us70006d0m/map?shakemap-code=us70006d0m&shakemap-source=us&shakemap-intensity=true&shakemap-mmi-contours=false&shakemap-stations=true.

Figure 5: Shake-map stations with the intensity of the 26 of November earthquake in Tirana



It was the strongest earthquake to hit Albania in more than 40 years, its deadliest earthquake in 99 years and the world's deadliest earthquake in 2019. Tirana was also affected, with reported intensities by the USGS going from strong (VI) to very strong (VII) and violent (VIII), as shown in Figure (5). Aftershocks were also felt in Tirana, with less intensity. The second earthquake amplified the feeling of panic and danger. One reason is that most people had not experienced such an event in their entire life.[21] Albania received international aid from many European countries and the European Union to overcome the chaotic situation and mitigate the short-run consequences of the earthquakes.

4 Empirical results

4.1 Balance tests

We first provide balance tests (parametric and nonparametric) of the null hypothesis that means of our measures of risk and time preferences are equal for individuals interviewed before the first earthquake (denoted by C), after the first (denoted by T1) and after the second one (denoted by T2). Table (3) provides the results for parametric

[21]Connecting this to our data, this means that 74.90% of the people in our experiment were not born when the last major earthquake occurred, and 10.05% more were less than 10 years old at that time.

t-tests. The left panel reports the means and standard deviations, while the right panel provides the p-values of the associated tests (allowing for different dispersion). For the measure of time preference, we provide results for the whole sample but also results excluding non-switchers since their switching point is arbitrarily set to the value 11 and their rate of patience set to the lower bound 0.000011. The results clearly indicate a significant increase in risk aversion, both after the first earthquake and after the second one. Results also indicate the second earthquake has amplified the effect of the first one, as its impact is on average higher than that of the first quake. Both earthquakes seem to have also led to a significant increase in impatience, as indicated by the decrease in the rate of patience and the increase of the switching point. The results also tend to suggest that the impact of the second quake on the time preference is primarily perceived at the intensive margin: while the overall average switching point is statistically the same before and after the second quake; among those who switched, the average switching point has increased after the second quake indicating a change towards higher impatience.

Table 3: Parametric balance test across three groups

	Before 1st Earth. (C) (1)	After 1st Earth. (T1) (2)	After 2nd Earth. (T2) (3)	Diff (C vs. T1) (4)	Diff (C vs. T2) (5)	Diff (T1 vs. T2) (6)
Risk	41.70	33.60	23.37	0.001	0.000	0.000
	(31.66)	(28.38)	(21.63)			
Patience	0.077	0.035	0.021	0.000	0.000	0.007
	(0.131)	(0.091)	(0.070)			
Patience*	0.148	0.068	0.038	0.000	0.000	0.001
	(0.015)	(0.005)	(0.007)			
Switch. points	7.374	8.317	8.548	0.003	0.001	0.263
	(0.301)	(0.109)	(0.175)			
Switch. points*	4.096	5.745	6.625	0.000	0.000	0.001
	(0.332)	(0.137)	(0.218)			
Nber Observ.	198	999	305	-	-	-

Notes: p-values are from two-tailed tests of equal means across two groups, allowing for different standard deviations. In cols (1)−(3), mean reported, standard deviation in parentheses. In cols (4)−(6), p-values reported.

* indicates people who never switched were excluded.

We conduct also a non-parametric balance test in order to provide evidence that does not rely on any distributional assumption. Table (4) provides the results of the

Mann-Whitney Rank test of equal distributions for the same outcome variables.[22]

Table 4: Mann-Whitney rank test across groups

	Diff (C vs. T1)	Diff (C vs. T2)	Diff (T1 vs. T2)
	(1)	(2)	(3)
Risk	0.001	0.000	0.000
Patience	0.000	0.075	0.919
Patience*	0.000	0.000	0.001

Notes: p-values for tests of equal distributions across two categories. * indicates that never switchers are excluded.

4.2 Impact on distributions

While the balance tests suggest that earthquakes led to a shift in the mean and median values of the preference parameters, it does not provide any information on how these events affected the whole distribution. Figure (6) and Figure (7) give the kernel estimates of the densities across the three groups for risk and time preferences. Figure (6) shows the impact of earthquakes is not purely a story of displacement of means. While the distribution of risk preference appear to exhibit three modes before the earthquakes, each quake led to a lower mode at the extreme right of the support, progressively transforming the distribution to a bi-modal one. The panels also clearly illustrate the fact that the earthquakes led to a dramatic decrease of risk-seeking behavior.

Figure (7) provides similar information for the time preference as measured by the switching point. While the distribution before the earthquakes is clearly bimodal, i.e. a mode at the two extreme of the support, the successive quakes have contributed to an erosion of the mode at the extreme left of the support. The impact of earthquakes goes through a significant decrease in the proportion of patient individuals (early switchers) and an increase of the mass probability in the right part of the support, indicating an increase in impatience.

Figures (8) and (9) present the cumulative probability distributions for risk and time preferences respectively. Unlike the kernel density plots, these plots do not rely on any distributional assumptions and bandwidth selection. They provide a raw picture of the impact of earthquakes at all possible levels of the preferences. Overall,

[22] Note that since there is a one-to-one match in terms of rank between the rate of patience and the switching point, the test gives exactly the same result with the switching point measure.

Figure 6: Kernel density estimates for risk preferences by the three groups

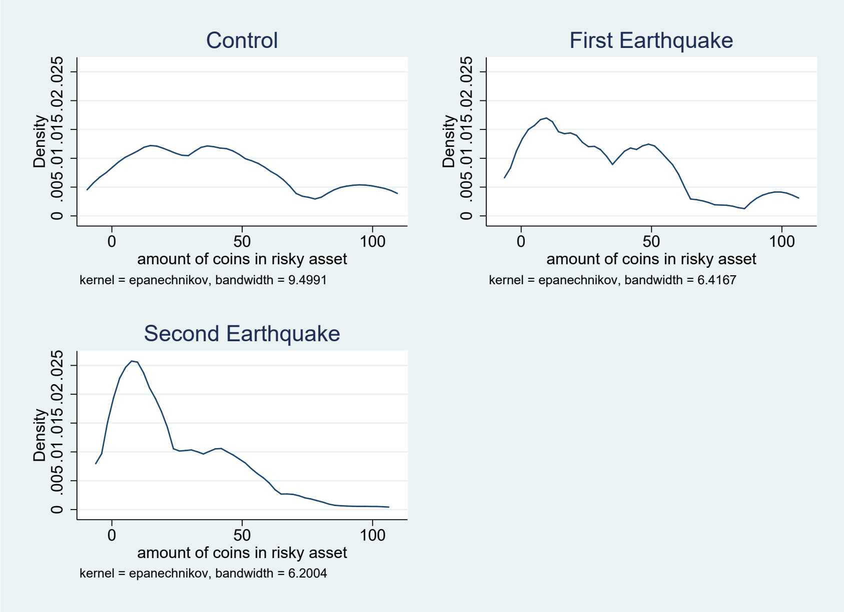
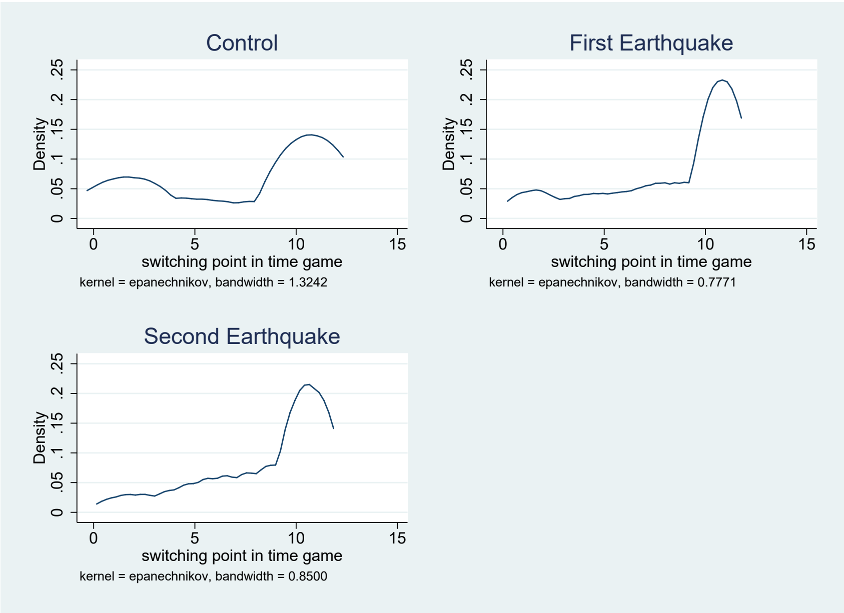


Figure 7: Kernel density estimates for patience in the three groups



Figures (8) and (9) confirm the global impact of both earthquakes towards increased risk aversion and impatience. Figure (8) clearly exhibits a displacement of the CDFs towards the left of the support after each quake. In fact, the distribution of risk preferences before each quake statistically dominates at the first order the distribution before that quake. Regarding time preferences, Figure (9) clearly indicate a counter-clock wise rotation of the CDFs after each quake around the value of the switching point 9. Stated otherwise, after each quake, the mass of people switching before (resp. after)

Figure 8: Cumulative probability distribution for risk preferences

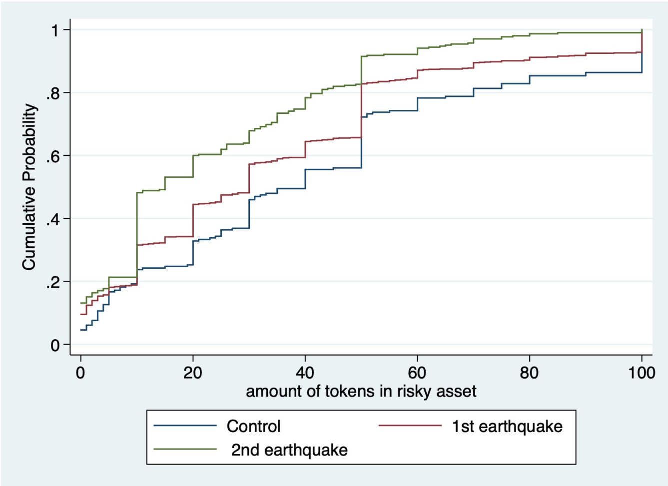
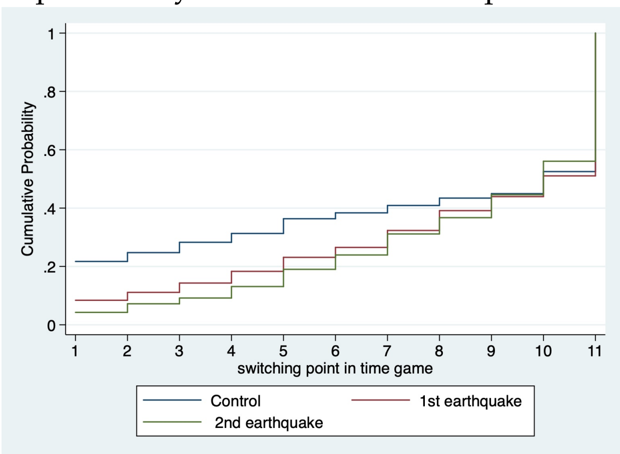


Figure 9: Cumulative probability distribution for risk preferences (switching point)



point 9 decreases (resp. increases), pointing towards a global increase in impatience.

4.3 Benchmark regression results

In a perfectly randomized context, the balance tests and figures of distributions would provide enough information to grasp the causal impact of earthquakes on risk and time preferences. Our field experiment involves randomization of a couple of variables such as the location of the interviews, the schedule of the interviews and the interviewer. Nevertheless, important potential determinants of deep parameters such as education, income or age are not randomized and subject to sample variation. It is therefore important to check how their distribution varies across the three groups. Table (5) provides parametric balance tests for a set of individual characteristics across the three groups.

Table 5: Parametric balance tests for covariates across three groups

	Before 1st Earth. (C) (1)	After 1st Earth. (T1) (2)	After 2nd Earth. (T2) (3)	Diff (C vs. T1) (4)	Diff (C vs. T2) (5)	Diff (T1 vs. T2) (6)
Age	32.94	32.25	31.79	0.756	0.317	0.088
	(12.42)	(13.24)	(12.93)			
Male	0.505	0.507	0.468	0.950	0.429	0.238
	(0.501)	(0.500)	(0.500)			
Marital status	3.369	3.298	3.177	0.640	0.283	0.349
	(1.933)	(1.947)	(1.987)			
Years of Schooling	14.636	14.041	13.944	0.006	0.005	0.571
	(2.779)	(2.640)	(2.606)			
Income	31721	28061	27266	0.167	0.118	0.622
	(35147)	(27291)	(23799)			
Nber Children	0.677	0.823	0.764	0.071	0.365	0.421
	(1.011)	(1.198)	(1.116)			

Notes: p-values are from two-tailed tests of equal means across two groups, allowing for different standard deviations. Cols (1)−(3): mean, standard deviation in parentheses. Cols (4)−(6): p-values.

Overall, the three groups appear balanced in terms of the covariates. However, the table shows a weak imbalance in terms of age between the first and the second treatment groups as well as in terms of number of children between the control and the first treatment group. More importantly, the table shows a more pronounced imbalance in terms of reported years of schooling between the group of individuals interviewed before the first earthquake and those interviewed after both earthquakes, although the first and the second treatment groups appear balanced in terms of education.

In this context, the value added of regression results is to account for the possible impact of these imbalances on the estimated effect of earthquakes;[23] these also show a more straightforward effect of the disasters. In the interest of time and space, we report in the core of the paper the tables associated with the most simple regression results and then expose the various robustness checks and extensions we have carried out to show that these simple regression results are very robust to an important set of statistical concerns. The tables reporting these additional results are gathered in Appendix A.

Table(6) reports the regression results for risk and time preferences. We capture the occurrence of the two earthquakes by dummy variables (denoted respectively First quake and Second quake), taking 1 after the date of the earthquake, 0 before. This means that in a regression framework, the second dummy should capture the cumulative effect on risk aversion of exposure to the first and second earthquake. For pa-

[23]We control for age, gender, marital status, education and income.

tience, we use the rate implied by the switching point obtained in the time game. We use OLS and control for gender, marital status, education and income (entered separately since they are highly correlated). Regression results confirm the main results reported in Tables (3) and (4). We find a strong effect of the first earthquake in terms of increased risk aversion and impatience. The second earthquake amplifies these effects, particularly in terms of risk aversion.[24]

Table 6: Linear regressions for risk and time preferences

	Tokens invested		Patience	
	(1)	(2)	(3)	(4)
First Quake	-7.692	-8.063	-0.043	-0.043
	(2.439)***	(2.388)***	(0.010)***	(0.010)***
Second Quake	-17.719	-18.079	-0.055	-0.055
	(2.598)***	(2.544)***	(0.010)***	(0.010)***
Age	0.032	-0.047	0.001	0.001
	(0.071)	(0.069)	(0.000)**	(0.000)**
Male	4.306	3.396	0.008	0.007
	(1.449)***	(1.423)**	(0.005)	(0.005)
Marital status	0.454	0.661	0.001	0.001
	(0.496)	(0.494)	(0.002)	(0.002)
Years of School.	0.548	-	-0.000	-
	(0.286)*		(0.001)	
Income†	-	0.950	-	0.002
		(0.182)***		(0.001)***
Constant	28.909	31.718	0.055	0.039
	(6.455)***	(4.311)***	(0.023)**	(0.016)**
R^2	0.05	0.06	0.04	0.04
N Obs.	1499	1502	1499	1502

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

† Specification for income is $ln(income + 1)$.

The effects found in the benchmark regression are important in terms of magnitude. To put this in perspective, the first quake exerted an impact on risk twice as large as the gender effect, and the second one more or less doubled this first impact. In terms of time preference, the first disaster generated an impact on impatience four

[24] A formal test of the null hypothesis that the effect of the first quake is equal to the cumulated effect of the two quakes is rejected with a t-stat equal to 4.65 in absolute terms. The significant effect of the second quake is confirmed in the robustness checks when we get rid of the pre-earthquakes period and use the individuals subject to the first quake only as the control group. See Table (A7).

times the impact of gender, and the second event led overall to an impact five times the gender gap in terms of time preference.

4.4 Robustness checks and extended regression results

The results from Table (6) are based on simple OLS regressions. It is therefore desirable to assess to what extent these are robust to a set of various concerns. In the interest of space, we only describe the various robustness checks and extensions we have carried out to show that these simple regression results are quite robust to an important set of statistical concerns and leave the tables reporting these additional results for Appendix A.

4.4.1 Age brackets, interaction of risk and time preferences, and interviewer fixed effects

We first extend the investigation by allowing for a more flexible structure in terms of the effect of age. A linear specification such as the one used for generating the results in columns (1) and (2) might be unable to capture correctly the impact of age on preferences. To that aim, we introduce age brackets of 10 years. The literature on risk and time preferences has shown that both preferences are actually intertwined (Andreoni & Sprenger, 2012). A second robustness check is therefore to account in each specification for the level of the other preference, i.e. to account for the level of risk aversion (respectively patience) in the impact of quakes on patience (respectively risk aversion). Third, we account for enumerator fixed-effects to capture potential systematic influence of the enumerators on the results of the games.[25]

Moreover, even though we have a relatively well-balanced dataset in terms of enumerators, there are moderate imbalances within each period of time.[26] Tables (A1) and (A2) in Appendix A present the results of these three robustness checks. Columns (1) and (2) present results when including age-brackets. Column (3) reports results obtained with the additional inclusion of the other preference. Column (4) and (5) report results obtained with the addition of enumerator fixed-effects. All results are

[25]We also include district fixed effects to control for slight deviations in the randomization of locations per enumerator. The results are virtually unchanged compared to the benchmark results.

[26]Four enumerators conducted 200 interviews, four conducted 150 interviews, and one conducted 100 interviews.

very similar to those provided in Table (6), for both preferences.

4.4.2 Count data regressions

Since our measures of preferences are essentially discrete, i.e. we use the number of tokens invested for risk aversion and the switching point for the time preference, one can question the validity of a linear model. Another robustness check therefore involves the choice between a non-linear and a linear regression model to capture the impact of earthquakes. To that aim, we estimate two exponential models. The first one assumes a Poisson distribution for the measures of risk and time preferences. This specification assumes a mean parameter equal to the variance, an assumption often violated in the presence of over-dispersion and, in our context, dispersion is higher than the mean for switching points in the time game. We therefore apply a second specification, namely the negative binomial distribution for the measures of preferences (see Cameron & Trivedi (2013)). The results of these two models, reported in Table (A3), are very similar to those obtained in the baseline regression, both in statistical terms and in terms of magnitude.[27]

4.4.3 SURE regressions

Another way of accounting for the interdependence between risk and time preferences is to allow for some correlation in the unobserved components of both outcomes. We do so by estimating both equations using the SURE regression method. In that respect, this complements results of Tables (A1) and (A2) in which the other measure of preference was included as a covariate. The results reported in Table (A4) turn out to be fully in line with those obtained based on the estimations of each equation separately.

[27]Note that since these models are non-linear in parameters, one needs to compute marginal effects to make them comparable to those obtained with a linear model. Computing the marginal effects for each individual and averaging across them using parameters reported in Table (A3), we obtain a predicted effect for the first earthquake of -7.10 and for the second earthquake of -17.69. The average marginal effects are respectively -7.04 and -17.49 for the negative binomial model. For the rate of patience, the average marginal effects are respectively -0.031 and -0.082 for both the Poisson and the negative binomial models.

4.4.4 Accounting for non-switchers

We also look at the influence of our treatment of non-switchers in the time-preference elicitation game. In the game, subjects who do not switch are assigned a value of 11 for the switching point. Accordingly, the rate of patience (respectively discount rate) assigned to these individuals is an upper (respectively lower) bound. Since we do not observe their true rate of patience, we face a typical case of censoring: their true switching point and rate of patience are different than the arbitrary value we assigned to them. To account for this censoring, we assess the sensitivity of our results by running two specific regressions regarding the impact of earthquakes on patience.

The first strategy is to run a Tobit regression that accounts for the censoring of our data in the time game.[28] The second check is simply to run the previous OLS regressions on the sample of switchers only. In both regressions, we use either the rate of patience or the switching point as a measure of time preference. This last robustness check allows us to evaluate the sensitivity of our results to the fact that we have a relatively high number of non-switchers that could potentially reflect a lack of trust of the subjects regarding the future payment of the rewards. Results, reproduced in Table (A5), show that the impacts of earthquake are quite robust to the treatment of non-switchers.

4.4.5 Accounting for possible time-varying confounding factors

Since our experiments were conducted in the field, a possible concern is the presence of a confounding factor that could have influenced the evolution of preferences in the absence of the earthquakes. To account for that possibility, we first supplement our regressions by including some time trends in the specifications. Note that we do not detect any significant trend for the pre-earthquake period, either for the risk or for the time preference. We nevertheless include either a time trend specific to the pre-earthquakes period or a general trend for the whole period. Table (A6) reports the results for the risk and time preferences. These estimations show that our results are robust to these inclusions.

A second robustness check involves restricting the period of analysis around the

[28] For the rate of patience, we use a left-censoring approach, while for the switching point we use a right-censoring approach.

two disasters. The idea is to lower the probability of occurrence of a confounding shock by looking at a shorter period of time. To that aim, we look at the impact of the first quake by including only individuals that were interviewed between 22 days before (control) and after (treatment 1) the first quake, i.e. to have the same number of days before and after. We also do the same for the second quake, by including individuals interviewed 35 days before, and hence after the first quake, (treatment 1) and after (treatment 2) the second quake. Findings regarding the impact of the two earthquakes turn out to be similar to those obtained in the benchmark regressions.[29]

4.4.6 Specific impact of second quake

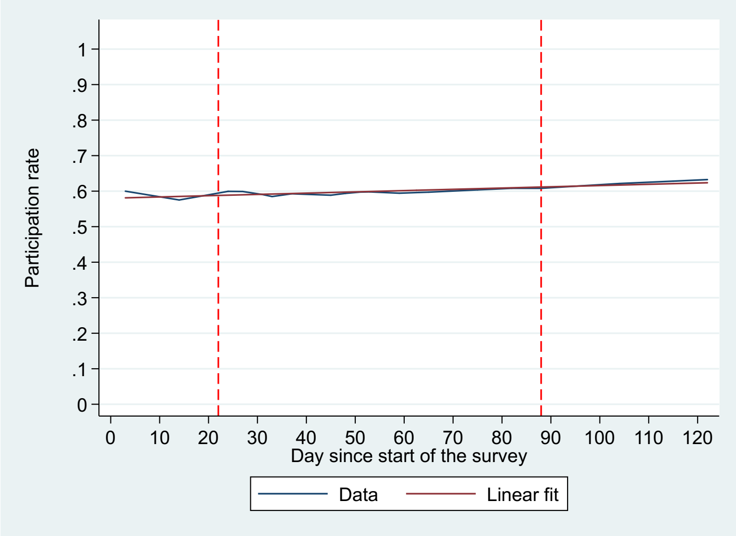
We also look at the specific impact of the second earthquake in terms of amplification of the effect of the first one. To that aim, we estimate the impact of the second earthquake using the individuals interviewed between the two events as a "control" group. Table (A7) reports the results for risk and time preferences. The results confirm the amplification effect related to the second quake already documented in previous regressions.

4.5 Selective participation

The participation rate in our study is remarkably high (63%), reflecting (partly) the careful procedure used to approach the subjects (see Section 3.1) and the sizeable monetary incentives provided to participants, averaging about 4% of the average monthly income in Albania. One may still wonder whether the effects of the earthquakes on preferences presented in the previous subsections are not in fact reflecting "selective" participation. Indeed, it is plausible that, for some reasons, after the earthquakes the subjects accepting to participate in the study are relatively more risk averse and more impatient. Even though subjects interviewed after the earthquakes appear similar in terms of observable attributes such as age, gender, income etc. to those interviewed before (see Table (5)), we cannot completely exclude the possibility that the samples are unbalanced on unobservable variables that correlate with preferences.

[29]The results are not reported here in the interest of space but are available upon request to the authors.

Figure 10: Evolution of the participation rate over the duration of the survey



Fortunately, thanks to the digital application used by the enumerators to administer the survey, we were able to monitor on a regular basis the evolution of our dataset, and in particular the number of participating subjects and the number of refusals. As a result, as can be seen on Figure (10), we can track the evolution of the participation rate over the duration of the survey, from the start of the survey (31/08/2019) until the end (30/12/2019). The two vertical dashed lines in Figure (10) indicate day 22 and day 88, i.e. the first and second earthquakes respectively. The figure clearly shows the participation rate slightly increased over the duration of the survey but in a quasi-linear fashion (the red line indicates the linear fit). Hence, the participation rate does not appear to relate significantly with the timing of the two quakes, as one should observe "breaks" around those dates in that case.[30] This empirical evidence therefore casts serious doubt on the plausibility of selective participation as an explanation for our main results.

[30]We did observe a higher participation rate after December 23, i.e. during the Christmas period. Perhaps people intercepted on the street had more time to participate to the survey due to the Christmas break and the higher participation was driven by the need to fund purchases. To deal with that, we re-estimate the models, dropping observations after December 22. We find similar effects for risk preferences, with a very slight decrease in the cumulative effect of earthquakes and nearly identical results regarding time preferences. Results are available upon request.

4.6 Heterogeneity across individuals

It might be desirable to explore heterogeneous effects of earthquakes across individuals. We consider two main dimensions of heterogeneity: (1) across individual characteristics such as gender and income and (2) across exposure to the natural disasters, as done in many papers of the literature on preferences and natural disasters.

4.6.1 Gender and income effects

The effect of gender on risk preferences is one of the most robust stylized facts in the preferences literature, while our regression results show that income also correlates with risk and time preferences: richer people tend to be less risk averse and more patient. It is thus interesting to investigate whether natural disasters affect the relation between these individual characteristics and preferences. For the sake of simplicity, we consider only two income groups, i.e. "poor" and "rich", where poor individuals are those whose income is below the median income observed in our sample.

We produce two sets of results. First, we estimate gender (resp. income group)-specific regressions. These separate regressions allow us to estimate group-specific parameters for all variables including the earthquake dummies. Second, using the full sample, i.e. including both groups (either men and women, or rich and poor), we run regressions including interaction terms between each earthquake dummy and either a male dummy or a poor dummy, hereby imposing common coefficients for all the other covariates and the variance of the residuals.[31]

Overall, results suggest that the impact of the earthquakes on risk and time preferences was homogenous across income groups, see Tables (A8) and (A9) respectively. Since the effects of earthquakes on the outcome of the games are similar for rich and poor, it is very unlikely that these reflect how individuals try to cope with damages caused by the earthquake when performing the risk and time preferences tasks. Indeed, one may argue that poor people used the money earned during the games as a mean to cope with material damages due to the earthquakes. In that case, one might indeed expect poor people to (i) put less tokens in the risky asset to guarantee a stream of money and (ii) choose in favor of amounts today. As a result, after the earthquakes,

[31]Chow tests for pooling across groups support gender-specific regressions, with a p-value for the null hypothesis of common specification for risk preferences lower than 0.001. For income, results are more supportive of the common model with a comparable p-value for the Chow test of about 2.4%.

poor people would appear as more risk averse and impatient than poor people before the earthquakes. For rich people however, the amount of money earned during the games would not matter when it comes to paying for damages due to the earthquakes. It follows that, while the scenario outlined above is a plausible one for poor people, it does not square with the homogeneity of the effects across income groups.

The effects of the earthquakes on preferences seem to be slightly different for men and women. Interestingly, when it comes to risk aversion (Table (A8)), women appear to be more sensitive to the first earthquake, whereas men tend to catch up after the second event. Overall, it seems that earthquakes tend to contribute slightly to the gender gap in terms of risk preferences, even though the results are not statistically significant at the usual significance levels.[32] In contrast, as shown in Table (A9), the results for time preferences reveal a gender-specific effect: although each quake makes both groups more impatient, the increase of impatience following each quake tends to be about twice as large for men as for women.

4.6.2 Intensity of exposure to earthquakes

So far, we have captured the effects of earthquakes through period-specific dummies in all regressions. Implicitly, this assumes that within each period, all subjects have been exposed to earthquakes in the same way. It can be desirable to try to capture to what extent differences in exposition to the events can potentially affect the preferences of individuals. In most of the existing literature, in the absence of measures of preferences before the event, the main empirical strategy is to exploit the variability in treatment. In this sense, we replicate this strategy for the treated individuals.

Even though the epicenters of both earthquakes were located outside Tirana, parts of the city were affected differently. Interestingly, the way the earthquakes waves spread from the epicenter and the resulting intensity of the shaking does not directly correlate with the distance from the epicenter. To take advantage of this variation, we compute for each individual a level of intensity in the following manner. We start from the information retrieved from the shaking maps provided for each earthquake by the USGS. The shaking map of the first earthquake on September 21 provides 15

[32]The estimates of the cumulated effect of earthquakes are not different between columns (1) and (2) of Table (A8).

spots within Tirana with the exact geodesic coordinates as can be seen in Figure (4). For each spot, a level of intensity is provided. The levels range from level III (light shaking) to level IV (strong shaking) and to level V (very strong shaking). For the second earthquake on November 26, 14 spots are available, with three levels of intensity (strong, very strong and violent shaking, i.e. level IX) as shown in Figure (5). We combine this information with the precise location of the interviews, assuming this location reflects some vicinity with the location of the individual at the time of the earthquake. For the second treated group, we use the information from the second earthquake only.[33] Then, we compute for each individual the intensity of the closest sport from the location of the interview.[34]

Table (A10) provides the results of this analysis for risk preference. In column (1), we look at the heterogeneity of the response to the first earthquake with respect to its intensity. In column (2), we do the same, but only for the second earthquake. In column (3), we allow for a different response for both events. Overall, the estimates point to some interesting variation in the coefficients. For instance, we find higher increase in risk aversion for higher exposition to the first earthquake. We also find that after the second earthquake, the higher increase in risk aversion is for those exposed to the highest intensity, i.e. violent shaking.

Nevertheless, statistical tests of differences in coefficients do not reject the null hypothesis of equal coefficients at usual significance levels. One potential reason is that the effect on preferences is not driven by the exposure to the earthquake per se but more by the global consequences that individuals see afterwards and the overall coverage of the event. A second reason is that variation in intensity across spots was not large enough to generate heterogeneous effects.

Table (A11) provides the same information as Table (A10), but for time preference. Variation in the estimates is more random than for risk preferences. Nevertheless, we reach the same statistical conclusion of homogeneous coefficients.

One should emphasize nevertheless two limitations of this exercise. First, in absence of the precise location of individuals at the time of the earthquake, we have to

[33] Statistically speaking, we could account for their location at the time of the first earthquake but this would require some additional information for these individuals.

[34] Based on this assignment, for the first earthquake, we have 140 individuals exposed to light shaking, 411 to strong shaking and 448 to very strong shaking. For the second earthquakes, we have 146, 105 and 23 individuals exposed respectively to strong, very strong and violent shaking.

assume that this is best approximated by the location of the interview. Second, the shaking maps provide objective measures of intensity but "felt" intensity also matters. While some information of that kind exists (it is provided by USGS), the information is very incomplete and in any case does not allow us to compute systematic distances from the location of individuals.

We try to address the first aforementioned limitation by slightly modifying the analysis of the intensity of exposure. In order to better capture the location of individuals at the time of the earthquake, we can increase the probability that the location of the interview is a good proxy of the location of their home by getting rid of the interviews that took place during the daytime. This is particularly relevant for the second quake since the event occurred around three in the morning. We therefore conduct the same analysis but with data collected before 10:00 and after 17:00, with the presumption that interviews took place close to participants' homes (rather than their workplace, for instance). We should nevertheless emphasize that this analysis is subject to some caveat since it restricts significantly the number of observations, and hence the number of points used to identify the impact of earthquakes by level of intensity.[35] Table (A12) provides the results of this modified analysis of the impact of earthquakes on risk preferences.[36] With the aforementioned caveats in mind, we can nevertheless emphasize interesting results from Table (A12). In particular, based on estimates in columns (1) and (3), we find a stronger effect on risk aversion for individuals exposed to strong and very strong shaking (as opposed to light shaking). Likewise, based on estimates in columns (2) and (3), we find a stronger effect on risk aversion for individuals exposed to violent shaking (as opposed to strong and very strong shaking).

[35]For instance, the identification of the impact of the first earthquake in a location with light intensity relies on 47 points rather than 140 in the estimation of Tables (A10) and (A11). Likewise, the identification of the impact of the second earthquake in a location with violent intensity relies on 4 points only, as opposed to 23 points in the benchmark estimations.

[36]Results for the time preferences do not differ qualitatively from those of Table (A11) and are therefore not provided here to save space. Once again, they can be obtained upon request.

4.7 Intended migration and earthquakes

International migration is one particular economic decision that has received some attention in relation with individual preferences and in particular with risk aversion.[37] There is less empirical evidence on a possible relationship between time preference and emigration. In terms of theoretical conjectures, one might expect that risk averse agents will be less likely to locate in the more uncertain environment. If an external location is perceived to be associated to more uncertain potential outcomes compared to the current location, then one can expect that risk-averse individuals will be less likely to migrate.[38] Conversely, if uncertainty increases in the home location, this could induce risk-averse individuals to consider more migration. Regarding patience, one could explain that more patient people would be more resilient with respect to bad conditions. If the detrimental shock occurs at home, this would imply a positive relationship between impatience and intended emigration.

We complement our analysis by looking at the impact of earthquakes on intended emigration that go through the shift in preferences. To that purpose, we rely on the simplest measure of intended migration of our field experiment: the mere intention to migrate outside of Albania. For intended emigrants, we disregard the preferences in terms of foreign destination. Since our outcome variable takes the form of a dummy variable (1 for intended emigration, 0 otherwise), we estimate a logit regression model. We control for the main expected factors, such as age, gender, family situation, past migration experience, education and income. The results are reported in Table (A13)

[37]Jaeger *et al.* (2010)) can be seen as the first paper providing compelling evidence on an association between risk aversion and actual international moves. This has given rise to a burgeoning empirical literature that we just cover with a couple of examples. Using stated preferences of risk, they show that the propensity to emigrate internally across German regions is negatively associated to risk aversion. Hao *et al.* (2016) conduct a field experiment in China to understand whether Chinese migrants differ from non-migrants in terms of preferences regarding risk and uncertainty in various contexts. Their results suggest that migration may be driven more by a stronger belief in ones chance of succeeding in an uncertain competitive environment than by differences risk attitudes related to state uncertainty. Goldbach & Schlüter (2018) document the same relationship for international and internal movers from Ghana and Indonesia, with elicited preferences of risk and time. Paz & Ubelmesser (2018) show that internal migration within the US is correlated with risk aversion. They show that risk attitudes are more important for moves over longer distances that involve more uncertainty.

[38]This is the underlying theoretical mechanism explaining the findings of the aforementioned empirical papers. Nevertheless, such an uncertainty refers to state uncertainty as opposed to strategic uncertainty, which refers to the uncertainty induced by the behavior of other players in an interactive decision situation. In that respect, using evidence from internal migration in China, Hao *et al.* (2016) do not find any association between migration and risk preferences under state uncertainty and document rather a positive association with the willingness to compete in strategic interactions.

in Appendix A. Column (1) includes the benchmark estimation for the whole period. Columns (2) to (4) provide the results for each period delimited by the two earthquakes separately. Column (5) and (6) pool the three groups, but allow for different coefficients of risk preference (column 5) and time preference (column 6). Column (7) reports the same results, but for heterogeneous coefficients for both risk aversion and time preference. The results point to an interesting variation in the role of preferences across the three period. For risk aversion, the impact of risk preference on intended emigration appears only after the second earthquake. The change in the coefficient of risk is very strong, both in terms of magnitude and in terms of statistical significance. We find mainly a composition effect, with more risk averse people more willing to leave after the second earthquake. Overall, the role of time preference in the choice to emigrate is more visible throughout the whole period, with more impatient individuals being more interested in leaving. Nevertheless, the results are driven by the two periods after the earthquakes. Furthermore, the impact of time preference is definitely higher after the second quake compared to before.

Our results therefore show that earthquakes mainly affected also the relationship between the desires to emigrate and these preferences. In that sense, these earthquakes do not have a direct effect on intended emigration, which is understandable given the initial level of intended emigration. Earthquakes exert rather an indirect effect on emigration through their effect on preferences, generating a composition effect. We consider this result as a sign that measured risk and time preferences are meaningful in terms of behavior in the field.

5 Discussion and Conclusion

We present evidence from a natural experiment in Albania, showing conclusively that earthquakes have the potential to trigger changes in choices reflecting both risk and time preferences. Our fortuitous lab-in-the-field experiments provide us with a large sample of the general populace residing in Tirana, and the degree of control in these experiments is rather close to the complete degree of control available in the laboratory. Arguably nothing else besides the two earthquakes really changed in the environment over the three-month period of our data collection, so that the earthquakes could reasonably be considered to be causal for the observed differences. The differences are indeed sizeable, particularly for the change in risk preferences. Furthermore, these risk and time preferences have predictive value for the intention to migrate in the sense they induce composition effects, with more risk averse and less patient people willing to leave Tirana. This suggests that laboratory or lab-in-the-field measurements may in fact reflect preferences that manifest in economic choices in the field.

The documented effect of these disasters on preferences has an important magnitude. To put these effects in perspective, the first quake had an effect of magnitude equivalent to twice the gender gap, while the second more or less doubled this impact. Regarding time preferences, the impact of the first event is equivalent to four times the gender gap while the second is equivalent to the gender gap. So, it would certainly appear that risk and time preferences are indeed malleable and subject to experience. We feel that our study is an exceptionally clean demonstration of this. But let us consider what factors there might be that would limit or alter this conclusion. First, we cannot be certain whether we capture a true shift in preferences or merely a change in the way the environment is perceived (riskier and a with a higher sense of urgency). However, the chance of success is clearly known to the individual and if there is one interior probability that people understand, it is a 50% chance. It is therefore a bit difficult to believe that having experienced an earthquake or two would lead people to think that the clear 50% chance is really a 25% chance, for example. However, as Andreoni and Sprenger (2012) succinctly put it: "Time preferences are not risk preferences" and indeed matters might well be different in relation to time preferences. Here there is a degree of uncertainty about actual payment due to both the usual suspicion about actually receiving a delayed payment which may already be high in Albania and the experience of seeing things shaken up so dramatically. We suspect that both factors are present here, so that the change we observe may be an upper limit.

Our results also survive a number of robustness tests, such as alternative regression formats and the inclusion of age brackets, the interaction of risk and time preferences, and interviewer fixed effects. One concern might still be that there could be selective participation that skews the results. However, thanks to the digital application we used to administer the survey, we have been able to track the refusal rates over time. While the participation rate was found to be quite high, it was strikingly stable over time and unrelated to the timing of the earthquakes, providing evidence against selective participation based on unobservable determinants of preferences. Finally, selective participation due to the presence of financial incentives is by design unlikely to play an important role since the details of the financial reward were mentioned only at the start of the last module, long after the decision to participate had been made. Moreover, there were no statistical differences in reported income across the control and treatment groups and the effects of the earthquakes were homogenous across income groups.

A final issue of major importance is whether these changes are evanescent or enduring. To answer this question, it would be desirable to conduct a follow-up study, but for now we can only speculate. Our guess is that there is a steady decline in the first months after the earthquakes, but that it then tapers off at a level that it significantly different than the initial one. We do think that there are permanent effects on risk and time preferences from physical disasters, but this remains an issue to be tested. More generally, we welcome further research into this topic whenever it is feasible. At the least, measurements could be made while in the midst of natural disasters and then updated after a period of time. It would also be worthwhile to have a periodically-updated baseline for these preferences in a variety of locations, in order to take advantage of natural disasters. We hope to see further work in this critical area.

References

Andersen, Steffen, Harrison, Glenn, Lau, Morten, & Rutstrom, Elisabet. 2008. Eliciting Risk and Time Preferences. *Econometrica*, **76**(3), 583–618.

Andreoni, James, & Sprenger, Charles. 2012. Risk Preferences Are Not Time Preferences. *American Economic Review*, **102**(7), 3357–76.

Bchir, Mohamed Ali, & Willinger, Marc. 2013. *Does the exposure to natural hazards affect risk and time preferences? Some insights from a field experiment in Per*. Working Papers. LAMETA, Universtiy of Montpellier.

Becchetti, Leonardo, & Castriota, Stefano. 2011. Does Microfinance Work as a Recovery Tool After Disasters? Evidence from the 2004 Tsunami. *World Development*, **39**(6), 898–912.

Callen, Michael. 2015. Catastrophes and time preference: Evidence from the Indian Ocean Earthquake. *Journal of Economic Behavior and Organization*, **118**(C), 199–214.

Callen, Michael, Isaqzadeh, Mohammad, Long, James D., & Sprenger, Charles. 2014. Violence and Risk Preference: Experimental Evidence from Afghanistan. *American Economic Review*, **104**(1), 123–148.

Cameron, A. Colin, & Trivedi, Pravin K. 2013. *Regression Analysis of Count Data*. Econometric Society Monograph, No 53, Cambridge University Press.

Cameron, Lisa, & Shah, Manisha. 2015. Risk-Taking Behavior in the Wake of Natural Disasters. *Journal of Human Resources*, **50**(2), 484–515.

Cassar, Alessandra, Healy, Andrew, & von Kessler, Carl. 2017. Trust, Risk, and Time Preferences After a Natural Disaster: Experimental Evidence from Thailand. *World Development*, **94**(C), 90–105.

Chantarat, Sommarat, Oum, Sothea, Samphantharak, Krislert, & Sann, Vathana. 2019. Natural Disasters, Preferences, and Behaviors: Evidence from the 2011 Mega Flood in Cambodia. *Journal of Asian Economics*, **63**(C), 44–74.

Charness, Gary, & Viceisza, Angelino. 2016. Three Risk-elicitation Methods in the Field: Evidence from Rural Senegal. *Review of Behavioral Economics*, **3**(2), 145–171.

Charness, Gary, Gneezy, Uri, & Imas, Alex. 2013. Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior and Organization*, **87**(C), 43–51.

Charness, Gary, Garcia, Thomas, Offerman, Theo, & Villeval, Marie Claire. 2019 (June). *Do Measures of Risk Attitude in the Laboratory Predict Behavior under Risk in and outside of the Laboratory?* IZA Discussion Papers 12395. Institute of Labor Economics (IZA).

Chiappori, Pierre, & Paiella, Monica. 2011. Relative Risk Aversion is constant: Evidence from Panel Data. *Journal of the European Economic Association*, **9**(6), 1021–1052.

Chuang, Yating, & Schechter, Laura. 2015. Stability of experimental and survey measures of risk, time, and social preferences: A review and some new results. *Journal of Development Economics*, **117**(C), 151–170.

Dasgupta, Utteeyo, Mani, Subha, Sharma, Smriti, & Singhal, Saurabh. 2019. Internal and external validity: Comparing two simple risk elicitation tasks. *Journal of Behavioral and Experimental Economics*, **81**, 39 – 46.

Deckers, Thomas, Falk, Armin, Kosse, Fabian, & Schildberg-Hrisch, Hannah. 2015. *How Does Socio-Economic Status Shape a Child's Personality?* IZA Discussion Papers 8977. Institute of Labor Economics (IZA).

Dohmen, Thomas, Falk, Armin, Huffman, David, Sunde, Uwe, Schupp, Jrgen, & Wagner, Gert G. 2011. Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences. *Journal of the European Economic Association*, **9**(3), 522–550.

Dohmen, Thomas, Lehmann, Hartmut, & Pignatti, Norberto. 2016. Time-varying individual risk attitudes over the Great Recession: A comparison of Germany and Ukraine. *Journal of Comparative Economics*, **44**(1), 182–200.

Dustmann, Christian, Fasani, Francesco, Meng, Xin, & Minale, Luigi. 2015 (Oct.). *Risk Attitudes and Household Migration Decisions*. CReAM Discussion Paper Series 1514. Centre for Research and Analysis of Migration (CReAM), Department of Economics, University College London.

Eckel, Catherine C., El-Gamal, Mahmoud A., & Wilson, Rick K. 2009. Risk loving after the storm: A Bayesian-Network study of Hurricane Katrina evacuees. *Journal of Economic Behavior and Organization*, **69**(2), 110–124.

Filippin, Antonio, & Crosetto, Paolo. 2016. A Reconsideration of Gender Differences in Risk Attitudes. *Management Science*, **62**(11), 3138–3160.

Gneezy, Ayelet, & Fessler, Daniel M. T. 2012. Conflict, sticks and carrots: war increases prosocial punishments and rewards. *Proceedings of the Royal Society B: Biological Sciences*, **279**(1727), 219–223.

Gneezy, Uri, & Potters, Jan. 1997. An Experiment on Risk Taking and Evaluation Periods. *The Quarterly Journal of Economics*, **112**(2), 631–645.

Goldbach, Carina, & Schlüter, Achim. 2018. Risk aversion, time preferences, and outmigration. Experimental evidence from Ghana and Indonesia. *Journal of Economic Behavior and Organization*, **150**(C), 132–148.

Guiso, Luigi, & Paiella, Monica. 2008. Risk Aversion, Wealth and Background Risk. *Journal of the European Economic Association*, **6**(6), 1109–1150.

Hanaoka, Chie, Shigeoka, Hitoshi, & Watanabe, Yasutora. 2018. Do Risk Preferences Change? Evidence from the Great East Japan Earthquake. *American Economic Journal: Applied Economics*, **10**(2), 298–330.

Hao, Li, Houser, Daniel, Mao, Lei, & Villeval, Marie Claire. 2016. Migrations, risks, and uncertainty: A field experiment in China. *Journal of Economic Behavior and Organization*, **131**(PA), 126–140.

Holden, S., & M., Tilahun. 2020. *Endowment Effects and Loss Aversion in the Risky Investment Game*. Tech. rept.

Ingwersen, N. 2014. *Impact of a natural disaster on observed risk aversion*. Tech. rept. Unpublished Manuscript.

Jaeger, David, Dohmen, Thomas, Falk, Armin, Huffman, David, Sunde, Uwe, & Bonin, Holger. 2010. Direct Evidence on Risk Attitudes and Migration. *The Review of Economics and Statistics*, **92**(3), 684–689.

Jetter M., Magnusson L. M., & S., Roth. 2019. Becoming Sensitive: Males Risk and Time Preferences After the 2008 Financial Crisis. *Unpublished Manuscript, University of Western Australia*, August.

Malmendier, Ulrike, & Nagel, Stefan. 2011. Depression Babies: Do Macroeconomic Experiences affect risk taking? *The Quarterly Journal of Economics*, **126**(1), 373–416.

Page, Lionel, Savage, David, & Torgler, Benno. 2014. Variation in risk seeking behaviour following large losses: A natural experiment. *European Economic Review*, **71**(C), 121–131.

Paz, R., & Ubelmesser, S. 2018. *Risk Attitudes and Migration Decisions*. Tech. rept.

Pedroni, Andreas, Frey, Renato, Bruhin, Adrian, Dutilh, Gilles, Hertwig, Ralph, & Rieskamp, Jörg. 2017. The risk elicitation puzzle. *Nature Human Behaviour*, **1**(11), 803–809.

Sawada, Y., & Kuroish, Y. 2015. *How to Strengthen Social Capital in Disaster Affected Communities? The Case of the Great East Japan Earthquake*. Tech. rept. 2.

Stigler, George, & Becker, Gary. 1977. De Gustibus Non Est Disputandum. *American Economic Review*, **67**(2), 76–90.

Van den Berg, Marrit. 2010. Household income strategies and natural disasters: Dynamic livelihoods in rural Nicaragua. *Ecological Economics*, **69**(3), 592–602.

World Bank. 2017. *Europe and Central Asia Economic Update, October 2017 : Migration and Mobility*. Working Papers. World Bank Group.

A Additional statistical tables

Table A1: Additional regressions for risk seeking

	(1)	(2)	(3)	(4)	(5)	(6)
	Tokens invested					
First Quake	-7.512	-7.952	-7.131	-8.446	-9.047	-9.012
	(2.434)***	(2.386)***	(2.428)***	(2.312)***	(2.293)***	(2.320)***
Second Quake	-17.423	-17.915	-16.862	-14.280	-15.026	-14.998
	(2.593)***	(2.549)***	(2.606)***	(2.408)***	(2.391)***	(2.428)***
Age1525	4.062	8.253	9.117	14.389	13.959	12.493
	(3.809)	(3.818)**	(3.917)**	(3.600)***	(3.616)***	(3.644)***
Age2535	4.306	6.311	7.302	13.486	13.024	11.681
	(3.613)	(3.482)*	(3.612)**	(3.317)***	(3.320)***	(3.418)***
Age3545	8.198	9.288	10.143	13.001	12.643	11.970
	(3.771)**	(3.721)**	(3.824)***	(3.514)***	(3.528)***	(3.539)***
Age4555	4.386	5.388	6.061	6.116	5.800	5.575
	(3.633)	(3.608)	(3.717)	(3.370)*	(3.391)*	(3.392)
Age5565	6.924	8.214	8.842	8.584	8.289	8.228
	(4.025)*	(3.999)**	(4.102)**	(3.717)**	(3.735)**	(3.726)**
Male	4.372	3.484	3.353	4.077	4.205	4.590
	(1.462)***	(1.428)**	(1.426)**	(1.273)***	(1.274)***	(1.281)***
Marital Status	0.610	0.762	0.750	0.602	0.610	0.604
	(0.506)	(0.504)	(0.503)	(0.456)	(0.456)	(0.455)
Years of School.	0.527	-	-	-	-	-
	(0.301)*					
Income†	-	0.985	0.948	0.522	0.524	0.469
		(0.191)***	(0.192)***	(0.192)***	(0.193)***	(0.194)**
Patience	-	-	18.692	14.180	-	-
			(8.005)**	(8.156)*		
Constant	24.699	22.213	20.305	30.220	31.593	33.445
	(5.604)***	(4.234)***	(4.374)***	(4.518)***	(4.469)***	(4.843)***
Interv. FE	No	No	No	Yes	Yes	Yes
Edu Brackets	No	No	No	No	No	Yes
R^2	0.05	0.06	0.07	0.28	0.28	0.28
N Obs	1499	1502	1502	1502	1502	1502

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

† Specification for income is $ln(income + 1)$.

Table A2: Additional regressions for time preference

	(1)	(2)	(3)	(4)	(5)	(6)
	Rate of Patience					
First Quake	-0.044 (0.010)***	-0.044 (0.010)***	-0.042 (0.010)***	-0.041 (0.010)***	-0.042 (0.010)***	-0.042 (0.010)***
Second Quake	-0.056 (0.010)***	-0.056 (0.010)***	-0.052 (0.010)***	-0.050 (0.010)***	-0.053 (0.010)***	-0.053 (0.010)***
Age1525	-0.053 (0.025)**	-0.046 (0.024)*	-0.048 (0.025)*	-0.033 (0.023)	-0.030 (0.023)	-0.028 (0.023)
Age2535	-0.054 (0.024)**	-0.053 (0.024)**	-0.054 (0.024)**	-0.035 (0.022)	-0.033 (0.022)	-0.031 (0.023)
Age3545	-0.046 (0.025)*	-0.046 (0.024)*	-0.048 (0.024)*	-0.028 (0.023)	-0.025 (0.023)	-0.024 (0.023)
Age4555	-0.037 (0.025)	-0.036 (0.025)	-0.037 (0.025)	-0.023 (0.023)	-0.022 (0.023)	-0.022 (0.023)
Age5565	-0.036 (0.026)	-0.034 (0.025)	-0.035 (0.026)	-0.022 (0.024)	-0.021 (0.024)	-0.021 (0.024)
Male	0.008 (0.005)	0.007 (0.005)	0.006 (0.005)	0.008 (0.005)*	0.009 (0.005)*	0.009 (0.005)*
Marital Status	0.000 (0.002)	0.001 (0.002)	0.001 (0.002)	0.000 (0.002)	0.001 (0.002)	0.001 (0.002)
Years of School.	0.000 (0.001)	-	-	-	-	-
Income	-	0.002 (0.001)***	0.002 (0.001)***	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Risk	-	-	0.000 (0.000)**	0.000 (0.000)*	-	-
Constant	0.121 (0.028)***	0.102 (0.026)***	0.097 (0.026)***	0.091 (0.026)***	0.097 (0.026)***	0.094 (0.027)***
Interv. FE	No	No	No	Yes	Yes	Yes
Edu Brackets	No	No	No	No	No	Yes
R^2	0.04	0.05	0.05	0.12	0.11	0.11
N Obs	1499	1502	1502	1502	1502	1502

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

† Specification for income is $ln(income + 1)$.

Table A3: Count data regressions for risk and time preferences

	(1)	(2)	(3)	(4)
	Tokens Invested		Switch. Points	
First Quake	-0.247	-0.354	0.125	0.117
	(0.012)***	(0.075)***	(0.029)***	(0.033)***
Second Quake	-0.478	-0.624	0.144	0.138
	(0.017)***	(0.088)***	(0.034)***	(0.038)***
Age1525	0.428	0.407	-0.032	-0.021
	(0.037)***	(0.184)**	(0.072)	(0.081)
Age2535	0.397	0.403	-0.015	-0.006
	(0.036)***	(0.176)**	(0.069)	(0.078)
Age3545	0.391	0.349	-0.029	-0.020
	(0.036)***	(0.179)*	(0.070)	(0.079)
Age4555	0.183	0.140	-0.032	-0.025
	(0.037)***	(0.181)	(0.071)	(0.081)
Age5565	0.273	0.219	-0.010	-0.002
	(0.038)***	(0.188)	(0.073)	(0.083)
Male	0.132	0.183	-0.007	-0.008
	(0.009)***	(0.050)***	(0.018)	(0.021)
Marital Status	0.021	0.025	-0.007	-0.008
	(0.003)***	(0.018)	(0.007)	(0.008)
Income†	0.016	0.020	-0.003	-0.003
	(0.001)***	(0.007)***	(0.003)	(0.003)
Constant	3.360	3.404	2.025	2.025
	(0.040)***	(0.207)***	(0.080)***	(0.091)***
$ln(\alpha)$	-	-0.154	-	-3.244
		(0.040)***		(0.199)***
Interv. FE	Yes	Yes	Yes	Yes
N	1502	1502	1502	1502

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

* Dependent variables are number of tokens in risky asset and switching point in time task.

* Cols (1) and (3): Poisson regressions. Cols (2)-(4): Negative binomial regressions.

$ln(\alpha)$ is the overdispersion parameter in the negative binomial case.

† Specification for income is $ln(income + 1)$.

Table A4: SURE Regressions of risk and time preferences

	(1) Tokens Invested	(2) Patience	(3) Tokens Invested	(4) Patience
First Quake	-8.633	-0.043	-9.045	-0.042
	(1.888)***	(0.007)***	(1.882)***	(0.007)***
Second Quake	-14.580	-0.053	-15.023	-0.052
	(2.252)***	(0.008)***	(2.243)***	(0.008)***
Age1525	12.087	-	14.182	-
	(4.621)***		(4.612)***	
Age2535	11.904	-	13.311	-
	(4.499)***		(4.426)***	
Age3545	12.093	-	12.870	-
	(4.512)***		(4.486)***	
Age4555	5.553	-	6.032	-
	(4.558)		(4.548)	
Age5565	7.854	-	8.542	-
	(4.709)*		(4.703)*	
Male	4.938	0.009	4.210	0.009
	(1.264)***	(0.005)*	(1.254)***	(0.005)**
Marital Status	0.495	0.000	0.607	0.000
	(0.455)	(0.002)	(0.456)	(0.002)
Years of School.	0.522	-0.001	-	-
	(0.256)**	(0.001)		
Age	-	0.000	-	0.000
		(0.000)		(0.000)
Income†	-	-	0.522	-0.000
			(0.191)***	(0.001)
Constant	30.080	0.073	31.372	0.059
	(5.768)***	(0.022)***	(5.185)***	(0.016)***
Interv. FE	Yes	Yes	Yes	Yes
N Obs.	1502	1502	1502	1502

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

† Specification for income is $ln(income + 1)$.

Table A5: Accounting for non-switchers in time preference elicitation game

	(1) Patience	(2) Switch. P	(3) Patience	(4) Switch. P
	Tobit		OLS (switchers only)	
First Quake	-0.068	1.750	-0.079	1.558
	(0.012)***	(0.439)***	(0.016)***	(0.378)***
Second Quake	-0.073	1.661	-0.105	2.332
	(0.014)***	(0.527)***	(0.016)***	(0.406)***
Age1525	-0.032	-0.347	-0.056	-0.064
	(0.028)	(1.049)	(0.030)*	(0.658)
Age2535	-0.035	-0.171	-0.063	0.302
	(0.027)	(1.003)	(0.029)**	(0.625)
Age3545	-0.027	-0.285	-0.045	-0.113
	(0.027)	(1.017)	(0.030)	(0.647)
Age4555	-0.020	-0.448	-0.049	0.151
	(0.027)	(1.029)	(0.030)	(0.637)
Age5565	-0.024	-0.054	-0.045	0.190
	(0.029)	(1.070)	(0.032)	(0.699)
Male	0.008	0.031	0.018	-0.335
	(0.008)	(0.299)	(0.008)**	(0.209)
Marital Status	0.002	-0.083	-0.001	0.070
	(0.003)	(0.109)	(0.003)	(0.075)
Income†	0.002	-0.082	-0.001	0.031
	(0.001)	(0.045)*	(0.001)	(0.031)
Constant	0.135	5.078	0.194	4.045
	(0.004)***	(0.142)***	(0.036)***	(0.822)***
Interv. FE	Yes	Yes	Yes	Yes
N obs	1502	1502	785	785
R^2	-	-	0.15	0.22

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

† Specification for income is $ln(income + 1)$.

Table A6: Accounting for time trends in estimations

	(1)	(2)	(3)	(4)
	Tokens invested		Patience	
First Quake	-9.058	-13.440	-0.042	-0.053
	(2.294)***	(4.734)***	(0.010)***	(0.018)***
Second Quake	-15.067	-19.417	-0.053	-0.064
	(2.394)***	(4.756)***	(0.010)***	(0.018)***
Age1525	13.974	13.601	-0.030	-0.031
	(3.618)***	(3.627)***	(0.023)	(0.023)
Age2535	13.020	12.762	-0.033	-0.033
	(3.322)***	(3.327)***	(0.022)	(0.022)
Age3545	12.639	12.463	-0.025	-0.026
	(3.530)***	(3.529)***	(0.023)	(0.023)
Age4555	5.796	5.741	-0.022	-0.022
	(3.392)*	(3.406)*	(0.023)	(0.023)
Age5565	8.290	8.003	-0.021	-0.022
	(3.736)**	(3.750)**	(0.024)	(0.024)
Male	4.214	4.173	0.009	0.009
	(1.275)***	(1.273)***	(0.005)*	(0.005)*
Marital Status	0.611	0.625	0.001	0.001
	(0.456)	(0.456)	(0.002)	(0.002)
Income†	0.526	0.498	0.000	0.000
	(0.193)***	(0.194)**	(0.001)	(0.001)
Trend	0.340	-366.398	0.001	-0.916
	(0.168)**	(294.799)	(0.000)*	(1.211)
Constant	31.561	36.529	0.097	0.109
	(4.473)***	(6.363)***	(0.026)***	(0.030)***
Interv. FE	Yes	Yes	Yes	Yes
R^2	0.28	0.28	0.11	0.11
N Obs	1502	1502	1502	1502

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

† Specification for income is $ln(income + 1)$.

In columns (1) and (3), time trend for the whole period.

In columns (2) and (4), time trend specific to pre-earthquake period.

Table A7: Effect of the second earthquake

	(1)	(2)	(3)	(4)
	Tokens Invested		Patience	
Second Quake	-5.936	-5.951	-0.012	-0.012
	(1.309)***	(1.298)***	(0.004)***	(0.004)***
Age1525	13.810	15.722	-0.045	-0.046
	(3.893)***	(3.891)***	(0.023)*	(0.023)**
Age2535	13.167	14.901	-0.045	-0.046
	(3.687)***	(3.578)***	(0.023)**	(0.023)**
Age3545	12.608	13.591	-0.033	-0.033
	(3.823)***	(3.826)***	(0.023)	(0.023)
Age4555	5.070	5.515	-0.036	-0.036
	(3.646)	(3.643)	(0.024)	(0.024)
Age5565	4.258	4.960	-0.041	-0.041
	(3.914)	(3.915)	(0.024)*	(0.024)*
Male	6.092	5.364	0.004	0.004
	(1.301)***	(1.301)***	(0.005)	(0.005)
Marital Status	0.187	0.252	0.001	0.001
	(0.475)	(0.473)	(0.002)	(0.002)
Years of School.	0.610	-	-0.000	-
	(0.287)**		(0.001)	
Income†		0.347		-0.000
		(0.203)*		(0.001)
Constant	19.916	23.722	0.072	0.071
	(5.102)***	(4.439)***	(0.026)***	(0.025)***
Interv. FE	Yes	Yes	Yes	Yes
R^2	0.30	0.30	0.14	0.14
N Obs	1301	1304	1301	1304

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

† Specification for income is $ln(income + 1)$.

Table A8: Individual heterogeneity: risk preferences

	(1) Males	(2) Females	(3) All	(4) Poor	(5) Rich	(6) All
First Quake	-4.594	-14.106	-13.432	-8.106	-9.108	-8.803
	(3.241)	(3.293)***	(3.226)***	(3.009)***	(3.461)***	(2.652)***
Second Quake	-13.370	-16.461	-17.139	-13.683	-17.350	-15.946
	(3.432)***	(3.366)***	(3.327)***	(3.070)***	(3.647)***	(2.853)***
First Q.$\times$Male	-	-	8.682	-	-	-
			(4.515)*			
Second Q.$\times$Male	-	-	4.006	-	-	-
			(4.645)			
First Q.$\times$Poor	-	-	-	-	-	-0.476
						(2.109)
Second Q.$\times$Poor	-	-	-	-	-	1.875
						(2.346)
Male	-	-	-2.400	5.267	2.633	4.251
			(4.260)	(1.667)***	(2.014)	(1.277)***
Marital Status	0.453	0.871	0.628	-0.159	1.062	0.621
	(0.781)	(0.541)	(0.456)	(0.653)	(0.628)*	(0.456)
Income†	0.580	0.496	0.524	0.301	7.143	0.527
	(0.312)*	(0.236)**	(0.193)***	(0.242)	(3.236)**	(0.221)**
Constant	35.201	29.019	35.076	29.280	-33.119	31.553
	(6.114)***	(6.562)***	(4.892)***	(5.252)***	(35.687)	(4.643)***
Interv. FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Brackets	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.25	0.35	0.28	0.32	0.25	0.28
N obs	750	752	1502	753	749	1502

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Dependent variable: Number of tokens in risky asset.

† Specification for income is $ln(income + 1)$.

Table A9: Individual heterogeneity: time preferences

	(1) Males	(2) Females	(3) All	(4) Poor	(5) Rich	(6) All
First Quake	-0.061	-0.024	-0.024	-0.055	-0.031	-0.046
	(0.015)***	(0.013)*	(0.013)*	(0.015)***	(0.013)**	(0.011)***
Second Quake	-0.070	-0.035	-0.035	-0.060	-0.045	-0.061
	(0.015)***	(0.013)***	(0.013)***	(0.016)***	(0.013)***	(0.011)***
First Q.×Male	-	-	-0.036	-	-	-
			(0.020)*			
Second Q.×Male	-	-	-0.034	-	-	-
			(0.020)*			
First Q.×Poor	-	-	-	-	-	0.008
						(0.009)
Second Q.×Poor	-	-	-	-	-	0.017
						(0.010)
Marital Status	-0.002	0.003	0.001	0.001	0.000	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Income†	-0.001	0.001	0.000	0.001	-0.003	0.001
	(0.001)	(0.001)*	(0.001)	(0.001)	(0.012)	(0.001)
Male	-	-	0.040	0.008	0.011	0.010
			(0.019)**	(0.007)	(0.007)	(0.005)**
Constant	0.155	0.032	0.080	0.120	0.065	0.088
	(0.037)***	(0.032)	(0.027)***	(0.032)***	(0.134)	(0.027)***
Interv. FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Brackets	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.16	0.09	0.12	0.15	0.10	0.11
N Obs	750	752	1502	753	749	1502

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Dependent variable: rate of patience.

† Specification for income is $ln(income + 1)$.

Table A10: Intensity of earthquakes and risk preferences

	Tokens invested		
First Quake Light	-7.162	-	-7.155
	(2.971)**		(2.973)**
First Quake Strong	-9.097	-	-9.090
	(2.491)***		(2.493)***
First Quake V. Strong	-9.600	-	-9.599
	(2.466)***		(2.468)***
Second Quake	-15.065	-	-
	(2.393)***		
First Quake	-	-9.042	-
		(2.295)***	
Second Quake Strong	-	-15.187	-15.262
		(2.687)***	(2.691)***
Second Quake V. Strong	-	-14.504	-14.512
		(2.566)***	(2.568)***
First Quake Violent	-	-16.877	-16.869
		(3.507)***	(3.515)***
Age1525	13.964	13.993	13.998
	(3.621)***	(3.616)***	(3.622)***
Age2535	12.973	13.080	13.029
	(3.332)***	(3.324)***	(3.335)***
Age3545	12.603	12.713	12.674
	(3.526)***	(3.534)***	(3.532)***
Age4555	5.802	5.854	5.858
	(3.391)*	(3.392)*	(3.393)*
Age5565	8.276	8.355	8.343
	(3.737)**	(3.738)**	(3.740)**
Male	4.209	4.221	4.225
	(1.276)***	(1.277)***	(1.279)***
Marital Status	0.616	0.619	0.625
	(0.457)	(0.456)	(0.457)
Income†	0.525	0.523	0.524
	(0.193)***	(0.193)***	(0.193)***
Constant	31.487	31.567	31.457
	(4.469)***	(4.470)***	(4.470)***
Interv. FE	Yes	Yes	Yes
R^2	0.28	0.28	0.28
N Obs	1502	1502	1502

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

† Specification for income is $ln(income + 1)$.

Table A11: Intensity of earthquakes and time preferences

	Patience		
First Quake Light	-0.056	-	-0.056
	(0.011)***		(0.011)***
First Quake Strong	-0.048		-0.048
	(0.011)***		(0.011)***
First Quake V. Strong	-0.033	-	-0.033
	(0.011)***		(0.011)***
Second Quake	-0.052	-	-
	(0.010)***		
First Quake	-	-0.042	-
		(0.010)***	
Second Quake Strong	-	-0.056	-0.055
		(0.010)***	(0.011)***
Second Quake V. Strong	-	-0.050	-0.050
		(0.011)***	(0.011)***
Second Quake Violent	-	-0.046	-0.046
		(0.020)**	(0.020)**
Age1525	-0.032	-0.030	-0.032
	(0.023)	(0.023)	(0.023)
Age2535	-0.034	-0.033	-0.034
	(0.022)	(0.022)	(0.022)
Age3545	-0.026	-0.025	-0.026
	(0.023)	(0.023)	(0.023)
Age4555	-0.023	-0.022	-0.023
	(0.023)	(0.023)	(0.023)
Age5565	-0.022	-0.021	-0.022
	(0.024)	(0.024)	(0.024)
Male	0.009	0.009	0.009
	(0.005)*	(0.005)*	(0.005)*
Marital Status	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
Income †	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
Constant	0.099	0.097	0.099
	(0.026)***	(0.026)***	(0.026)***
Interv. FE	Yes	Yes	Yes
R^2	0.12	0.11	0.12
N Obs.	1502	1502	1502

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

† Specification for income is $ln(income + 1)$.

Table A12: Intensity of quakes and risk, daytime interviews excluded

	Tokens invested		
First Quake Light	-7.370	-	-6.595
	(4.337)*		(4.483)
First Quake Strong	-10.992	-	-10.777
	(2.975)***		(2.992)***
First Quake V. Strong	-8.889	-	-10.578
	(3.019)***		(3.117)***
Second Quake	-14.252	-	-
	(2.416)***		
First Quake	-	-9.338	-
		(2.302)***	
Second Quake Strong	-	-16.021	-15.711
		(3.919)***	(4.001)***
Second Quake V. Strong	-	-13.348	-11.517
		(3.571)***	(3.638)***
Second Quake Violent	-	-28.333	-23.669
		(3.062)***	(3.385)***
Age1525	11.768	14.629	13.017
	(4.804)**	(4.159)***	(6.493)**
Age2535	11.694	12.434	11.161
	(4.487)***	(3.806)***	(6.102)*
Age3545	12.008	13.787	14.795
	(4.629)***	(4.052)***	(6.242)**
Age4555	8.317	6.619	11.844
	(4.590)*	(3.889)*	(6.200)*
Age5565	10.992	7.891	11.913
	(5.038)**	(4.285)*	(6.734)*
Male	3.377	4.808	4.323
	(1.682)**	(1.444)***	(2.160)**
Marital Status	1.092	0.593	1.242
	(0.612)*	(0.515)	(0.770)
Income	0.622	0.692	1.005
	(0.246)**	(0.222)***	(0.311)***
Constant	33.614	28.643	27.085
	(5.568)***	(4.992)***	(7.109)***
Interv. FE	Yes	Yes	Yes
R^2	0.30	0.25	0.24
N Obs	850	1,273	621

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$..

† Specification for income is $ln(income + 1)$.

Table A13: Intended emigration, earthquakes and preferences

	(1) Full	(2) C	(3) T1	(4) T2	(5) Full	(6) Full	(7) Full
Tokens Invested	-0.002	-0.003	-0.001	-0.012	-0.002	-0.003	-0.005
	(0.002)	(0.006)	(0.003)	(0.006)*	(0.004)	(0.002)	(0.004)
Patience	-1.899	0.754	-2.701	-4.338	-2.070	-0.006	0.283
	(0.621)***	(1.551)	(0.779)***	(1.988)**	(0.629)***	(1.191)	(1.288)
Risk× First Q.	-	-	-	-	0.001	-	0.005
					(0.004)		(0.004)
Risk× Sec. Q.	-	-	-	-	-0.013	-	-0.009
					(0.005)**		(0.005)*
Patience× First Q.	-	-	-	-	-	-2.145	-2.858
						(1.370)	(1.498)*
Patience× Sec. Q.	-	-	-	-	-	-5.437	-4.892
						(2.268)**	(2.318)**
Age	-0.076	-0.119	-0.077	-0.059	-0.076	-0.075	-0.075
	(0.008)***	(0.028)***	(0.009)***	(0.021)***	(0.008)***	(0.008)***	(0.008)***
Male	0.106	-0.452	0.060	0.418	0.102	0.096	0.086
	(0.132)	(0.408)	(0.164)	(0.299)	(0.132)	(0.132)	(0.133)
Income†	-0.077	-0.191	-0.044	-0.121	-0.075	-0.073	-0.071
	(0.020)***	(0.070)***	(0.023)*	(0.046)***	(0.020)***	(0.020)***	(0.020)***
Years of Schooling	-0.028	-0.138	-0.033	0.016	-0.035	-0.030	-0.037
	(0.025)	(0.075)*	(0.032)	(0.060)	(0.026)	(0.026)	(0.026)
Nber Children	0.082	0.236	0.098	-0.193	0.067	0.080	0.059
	(0.091)	(0.350)	(0.107)	(0.245)	(0.092)	(0.091)	(0.092)
Ever Migrated	0.459	-0.117	0.467	0.603	0.440	0.450	0.430
	(0.164)***	(0.472)	(0.199)**	(0.418)	(0.164)***	(0.165)***	(0.165)***
Relatives Migr.	0.298	0.032	-0.222	1.117	0.241	0.306	0.263
	(0.381)	(1.221)	(0.533)	(0.693)	(0.381)	(0.381)	(0.381)
Marital Status	-0.070	0.003	-0.096	-0.073	-0.075	-0.068	-0.072
	(0.050)	(0.161)	(0.063)	(0.110)	(0.050)	(0.050)	(0.051)
Constant	3.986	9.023	4.498	2.288	4.242	4.003	4.210
	(0.677)***	(2.163)***	(0.879)***	(1.501)	(0.684)***	(0.680)***	(0.686)***
N Obs	1499	198	997	304	1499	1499	1499

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Dependent variable is a dummy variable capturing whether individual would like to leave Albania.

Estimation results from Logit estimation.

C refers to Control group (before first earthquake).T1 refers to group interviewed after first earthquake and before second one. T2 refers to group interviewed after second earthquake.

† Specification for income is $ln(income + 1)$.

B Additional information about data

Table B1: Main preferred locations

Country	(1) Preferred Location	(2) Proportion in sample
United States	453	30.2%
Albania	427	28.4%
Germany	153	10.2%
Canada	133	8.9%
UK	88	5.9%
Australia	55	3.7%
Italy	25	1.7%
Switzerland	17	1.1%
Turkey	15	1.0%
Sweden	14	0.9%
France	13	0.9%
Austria	13	0.9%
Norway	11	0.7%
New Zealand	7	0.5%
Spain	7	0.5%
Belgium	6	0.4%
United Arab Emirates	5	0.3%
Denmark	5	0.3%
China	4	0.3%
Greece	4	0.3%
Luxembourg	4	0.3%
Others	21	1.4%

Columns (1) and (2) give respectively the number and the proportion of subjects choosing the destination as their preferred location. Albania means that these subjects did not express a willingness to emigrate.