Risk Taking during a Global Crisis: Evidence from Wuhan^{*}

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Abstract:

We conducted a repeated survey on risk taking behavior across a panel of subjects in Wuhan, China - ground zero of the Coronavirus pandemic - before and after the outbreak began. Our baseline survey was administered on October 16th, 2019 among graduate students in Wuhan prior to the COVID-19 outbreak. 47% of the students in our sample returned home to other provinces in China for semester break in early January before the province of Hubei and the city of Wuhan was locked down with strict quarantine orders on January 23rd, 2020. We administered a follow up survey to the same subjects, capturing their geolocation information on February 28th. We use variation in exposure across different Chinese cities and provinces to measure the impact of the Coronavirus pandemic on subjects' willingness to take risk. We find that subjects' allocations of wealth to hypothetical risky investments decrease monotonically based on the strength of their exposure to the pandemic. However, subjects uniformly report substantially lower general preferences for risk regardless of their exposure. Higher levels of exposure leads subjects to reduce beliefs in their own luck and sense of control and in turn, form more pessimistic beliefs on the economy and social conditions. We provide evidence that short-term changes in risk taking may stem more so from changes in beliefs and optimism than from general risk preferences. Our results suggest that more closely held formative experiences have large, negative, and *acute* effects on economic preferences *during* a crisis.

JEL Classifications: G50, G51, G11, D14, G41

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1. Introduction

A number of studies have provided evidence that formative experiences stemming from large shocks (e.g., financial crises, natural disasters, violence and trauma) may have long-term effects on economic preferences and risk taking behavior (Malmendier and Nagel, 2011; Kaustia and Knüpfer, 2008, 2012; Giannetti and Wang, 2016; Knüpfer, Rantapuska, and Sarvimäki, 2017; Guiso, Sapienza, and Zingales, 2018; Andersen, Hanspal, and Nielsen, 2019; and Brown, Cookson, Heimer, 2019). Most studies that investigate how these shocks affect behavior use observational data on field outcomes and posit through which channels behavior may have been affected. One missing aspect of these studies is how individual preferences may *acutely* change, in the midst of the experience or crisis itself. To that end, we know little about how the preferences and beliefs of individuals change *during* hard times.

Understanding how and why household risk taking and other preferences may change during a crisis is crucial for determining appropriate policy responses, particularly when the persistence of a downturn or crisis is unknown. If, for example, households' tolerance for risk decreases through time-varying beliefs and expectations, it may imply that observed changes in risk taking are temporary (e.g., financial market volatility and the business cycle). At the same time, an expectations-driven shock to risk taking may impact more strongly on consumption and consumer behavior. On the other hand, if changes in observed risk taking come from a more general shift in preferences, policy responses may need to be more structural in nature and may impact long term economic growth.

In this study, we examine how risk tolerance evolves from normal times, to the peak of a worldwide health-crisis.¹ We survey a large sample of subjects in Wuhan, China – ground zero of the COVID-19 novel Coronavirus pandemic. Our first survey wave took place on October 16th 2019, several weeks before initial reports of the virus in mainland China in December 2019 (Holshue *et al.*, 2020). By January 23^{rd} , 2020 all incoming and outgoing public transportation to and from the Hubei province (where Wuhan is the capital) was halted. Gatherings and events inside Wuhan were banned, and quarantine and isolation were established. By February 15th, 2020 Wuhan was in a state of complete and total quarantine with more than 56,000 reported cases of COVID-19 infections and 1,600 deaths. On February 28th 2020, we administered an online follow up survey to the same group of subjects with an 88% retention rate (N = 225/257).

¹ We plan to continue this study into the future, and further understand how risk taking and economic preferences continue to change or revert back to pre-crisis levels.

Our main sample consists of graduate students from Wuhan University of Science and Technology.² Winter break for the semester started at WUST on January 11th 2020 and most students from other provinces were able to return to their homes as planned for the Chinese Lunar New Year celebrations. As the province of Hubei became quarantined and effectively locked down shortly after, students from other provinces continued their study programs via distance learning (alongside their Wuhan-based peers) and we administered follow up online surveys on WeChat, capturing precise geolocation information from subjects. This source of geographical variation across China allows us to measure the intensity of exposure to the Coronavirus pandemic on our outcome measures of interest. Wave one of our survey holds constant all subjects in the city of Wuhan, while in wave two, 47% of subjects (N = 106) are in provinces outside of Hubei, in parts of China with substantially lower exposure to COVID-19. In fact, by the time our follow up study was administered, February 28th, the province of Hubei had 66,300 infection cases, while all other provinces across China had 12,600 in total. This variation allows us to explore if individuals who are more closely impacted by the Coronavirus pandemic, as proxied by the province and city of their quarantine location, differ in their preferences and beliefs as the crisis evolves.

Our study examines if individuals' tolerance for risk is affected due to their exposure to the pandemic. We first document that subjects who become quarantined in Wuhan hold subjective beliefs consistent with a higher level of exposure to the pandemic. These subjects believe that they have a higher exposure risk to the Coronavirus than those elsewhere. Subjects located in Wuhan during the quarantine state higher probabilities that they themselves are likely to be infected, as well as higher exposure to infections and deaths within their families and communities.³ Subjects across the province of Hubei also show higher levels of fear in the pandemic in general.

We examine how varying exposure affects allocations to risk via a hypothetical gamble elicited during the quarantine and peak of the Coronavirus pandemic in China during the first week of March 2020. Subjects are asked to provide an allocation to a risky investment (0-1000 RMB) invested with an equal probability of higher returns or a loss. Subjects quarantined in Wuhan, with greater subjective (and arguably objective) exposure to the virus

² As part of a separate project, we obtained additional survey data on perceptions of climate risk from both Wuhan and Guizhou, a province of China approximately 1,000 kilometers from Wuhan and one of the least affected areas from the Corona virus pandemic. This survey data was also collected in pre, and during-crisis waves similar to our main sample but is outside the scope of this particular paper.

³ We refer to these exposures to the virus as subjective perceptions about exposure because we can confirm that no individuals in our sample contracted the virus during our study period.

allocate significantly less to the risky investment option relative to those in other cities within the Hubei province (-67.0 RMB), and those in other provinces of China (-149.8 RMB). This represents an economically significant difference given a mean investment of 287.6 RMB, and constitutes a 45% smaller investment compared to subjects in other provinces.

We then attempt to disentangle the mechanism behind this observed difference in risk taking by analyzing repeat-measures from our survey waves across a number of outcomes. We find that on average all subjects surveyed first in Wuhan in October 2019, and later at their place of quarantine show a large and significant decrease in *general* preferences for risk. The decrease amounts to -0.63 on a 5 point scale and is highly significant at standard levels (*t*-stat = -13.09). While the decrease in risk preferences for those in Wuhan, with higher exposure to the pandemic, is slightly greater, the effect is economically and statistically small. This suggests that the observed differences in risk taking from heterogeneous experiences may not be entirely driven from the uniform decrease in general risk preferences.

We then examine several measures of optimism and beliefs in individuals' own luck and fortune prior to and during the Coronavirus pandemic and how they relate to risk taking. Compared to other subjects, those in Wuhan, with higher exposure to the pandemic, show a 10.2 percentage point decrease in Wuhan-based subjects in their belief about their own personal luck. An index based on questions that ask about the percentage of investors which would have better luck or higher returns in financial investments shows a similar prepandemic value, while subjects quarantined in Wuhan submit a substantial increase in the fraction of investors they believe are *better than* the subject him or herself (6.8 percentage points). For subjects with higher exposure, measures about individuals' sense of control are similarly negatively affected. In general, we find that exposure strongly affects individuals' optimism about their own outcomes.

The observed change in risk taking and in beliefs about self also affects broader beliefs about the future economy and social conditions. We find that subjects with higher exposure to the pandemic form more pessimistic beliefs on the economy in general, the stock market, their own health, and on the environment, relative to subjects in further removed provinces. A number of recent studies have focused on the importance of subjective beliefs on economic outcomes (e.g., Kuhnen and Miu, 2017; Ameriks *et al.*, 2018; Giglio *et al.*, 2019; Kuchler and Zafar, 2019; Das, Kuhnen, and Nagel, 2019; Andersen *et al.*, 2020). Our findings suggest that experiences may affect risk taking acutely through time-varying subjective beliefs. What is not yet clear in our setting, is if the higher exposure led individuals to form more or less precise forecasts, although recent evidence suggests experience affects in the opposite direction (Goldfayn-Frank and Wohlfart, 2019; Kuchler and Zafar, 2019).

Our paper contributes to the literature in economics and finance which examines how events and experiences can shape behavior. In a seminal paper, Malmendier and Nagel (2011) show that experiences with macroeconomic shocks affect financial risk taking well into the future. A further literature has shown that personal experiences make individuals refrain from opportunities to take risk (Knüpfer, Rantapuska, and Sarvimäki, 2017; Guiso, Sapienza, and Zingales, 2018; Giannetti and Wang, 2016; Kaustia and Knüpfer, 2008, 2012; Choi, Laibson, Madrian, and Metrick, 2009; Chiang, Hirshleifer, Qian, and Sherman, 2011; Bucher-Koenen and Ziegelmeyer, 2014; Hoffmann and Post, 2017). Andersen, Hanspal, and Nielsen (2019) highlight the importance of the degree to which individuals make experiences and show that personal first-hand experiences can make individuals actively change their attitudes toward risk. We contribute to this literature by providing evidence that closely experienced shocks, in the midst of a crisis, can acutely affect risk taking at least partially through a channel of beliefs and expectations. Relatedly, our findings contribute to a literature on time-varying risk aversion (e.g., Campbell and Cochrane, 1999; Brandt and Wang, 2003; Chetty and Szeidl, 2016; Brunnermeier and Nagel, 2008). We provide microlevel evidence of changing attitudes towards risk. We document that general risk preferences are uniformly negatively affected by the Coronavirus pandemic, while active risk taking decisions may be more affected by individual level experiences through changing beliefs and optimism.

We also contribute to a literature which uses survey or experimental data to measure preferences and how heterogeneity in experiences affect these measures. For example, Callen *et al.* (2013) find that risk aversion is exacerbated by violent wartime experiences, particularly when these memories are made salient with priming. In contrast, Voors *et al.* (2012) and Eckel *et al.* (2009) large shocks decrease risk aversion in their settings. Similarly, Fisman, Jakiela, and Kariv (2015) find individuals exposed to the recession exhibit higher levels of selfishness and in general that distributional preferences changed during the financial crisis of 2007-09. We contribute to this literature by using repeated survey measures of economic preferences and beliefs, and studying how risk taking is affected during times of crisis.

Finally, we contribute to a handful of recent studies which look at the effects of the COVID-19 pandemic on households' expectations.⁴ Binder (2020) surveys US households

⁴ Undoubtedly related to the Coronavirus pandemic is a number of studies which examine how beliefs about mortality affect economic decision making. The findings from this literature are mixed and use both individual surveys and life-cycle models (e.g., Hamermesh, 1985; Hurd and McGarry, 2002; Gan et al., 2015; Puri and

relatively early during the course of the pandemic's effects in the United States (March 3rd, 2020) and finds that subjects update their inflation and unemployment forecasts when provided information about the Federal Reserve's interest rates cuts. Fetzer *et al.*, (2020) elicit beliefs about mortality with two different information treatments and find that subjects overestimate mortality and contagiousness of the virus. We contribute to this literature by providing evidence of individuals' updating of beliefs and preferences around the Coronavirus pandemic, by using survey data on a repeat panel of subjects. Furthermore, our subjects are under strict quarantine conditions and in the midst of the crisis.

Our study proceeds as follows: the second section provides additional background on the Coronavirus setting in China. In Section 3 we detail our experimental setting, discussing the baseline and follow-up survey along with information about participant selection and the timing of events. In Section 4, we present our main findings along with various other empirical results. We discuss the ramifications of our findings and conclude in the final section.

2. Background

Our study focuses on how differences in exposure to the Coronavirus pandemic affect risk taking and other economic outcomes. An implicit assumption about our empirical approach and identification is that individuals located in different geolocations, i.e., the city of Wuhan, the province of Hubei, and other provinces across China, differ in their exposure to the Coronavirus pandemic. There are two, related, sources of variation by location which are important to discuss. The first is spatial heterogeneity in rates of infection and death caused by the COVID-19 Coronavirus. Figure 1 plots the cumulative infections (blue, left axis) and deaths (red, right axis) in the Hubei province of China, where the city of Wuhan is located. The dashed red and blue lines represent the cumulative sum of infections and deaths from all other provinces in China and are plotted on the same axes. We note that other provinces experienced significantly fewer infection cases and deaths compared to Hubei, and Wuhan, the epicenter of the pandemic, over time. This variation implies that individuals in some provinces of China will not have come into first-hand contact with the virus and are less likely to know people who have been infected or died. On the other hand, individuals in the city of Wuhan or the Hubei province are much more likely to experience the Coronavirus either first-hand, or indirectly through family and friends.

Robinson, 2007; Cocco and Gomes, 2012; Elder, 2013; Post and Hanewald, 2013; Heimer, Myrseth, and Schoenle, 2019).

Second, and related to the rates of infections and deaths, individuals across provinces and cities in China experienced stark differences in regulations and quarantine conditions during the Coronavirus pandemic. For example at the epicenter of the pandemic, in all cities across the Hubei province, citizens were not permitted to go outside and leave their living spaces under normal circumstances. Supermarkets, grocery stores, and pharmacies were not open to serve individuals. Rather, the government organized special personnel to purchase living materials for residents and distributed and delivered them throughout communities. All public transportation was completely shut down. Furthermore, the local police patrolled cities vigilantly and individuals found outside without permission were placed in government assigned quarantine stations for 14 days.⁵

For individuals in other provinces across China, the quarantine conditions differed substantially. In most areas, each household could assign a family member allowed to make purchases for basic food and living materials every two days. Supermarkets, grocery stores, and pharmacies remained open for individuals. Public transportation was only partially shut down or disrupted for short periods of time in most cities. Finally, citizens were still permitted to leave their communities for limited, necessary, activities. These differences in quarantine conditions are directly related to the severity of the pandemic, however it is likely that individuals experiencing the first-hand effects of the pandemic and the harshest quarantine conditions will be significantly affected compared to those with lower exposure to the virus itself as well as substantially more flexible living conditions.

3. Experimental design

a. Participant selection

In many universities across China students are grouped into cohorts in order to better supervise and manage the large number of incoming students. The size of these cohorts varies at different universities but are normally between 30 and 60 students. Once a cohort is formed, the students generally remain within the same cohort for the entire study period at their respective university. Cohorts differ from classes, and students from the same cohort do not always attend the same lectures or study programs. Each cohort is managed by a supervisor. This supervisor uses social networking apps and tools such as WeChat as a daily communication and management platform for the students. Specifically, supervisors create

⁵ Firsthand accounts suggest that the quarantine measures in the city of Wuhan were a strong deterrent. Video clips circulating on social networking sites display police in Hubei arresting citizens and placing them into forced quarantine.

a WeChat group for each class that they manage where students must join such that everyone can be informed about announcements made by their supervisors. We use these cohorts and WeChat groups to recruit and segment samples for participation in our study. To encourage students to complete the survey, we offered students a small participation incentive (5 to 10 RMB).

b. Baseline surveys

From October 16, 2019 to October 18, 2019 we conducted a survey based experiment with master students at Wuhan University of Science and Technology (WUST). The survey was conducted primarily for a study on how beliefs about luck and superstition affect risk taking and investment behavior.⁶ We administered the paper and pencil survey among 257 master's students in a classroom setting. Each postgraduate cohort at WUST typically comprises 30 to 40 postgraduate students. We randomly selected 8 postgraduate cohorts from a pool of more than 90. We collaborated with the cohort supervisors who organized that their students attend our survey sessions.

The survey consisted of several parts. First, students provided demographic information such as age, gender, date of birth, and birth province. After this information students were asked to answer a set of questions aimed to measure individual confidence (or over-confidence). Specifically, subjects answered 10 trivia, fact-based questions and were asked to provide a lower and upper bound for the 90 percent confidence interval of each provided answer. Following these questions, subjects were asked to provide answers to five standard and simple financial literacy questions on compounding interest, inflation, bond and mortgage markets, and diversification.⁷

We then asked 13 questions on beliefs in good luck following Darke and Freedman (1997). We then presented subjects a miscalibration exercise where we asked individuals to provide probabilities over the last 12 months of Shenzhen Stock exchange index, the Chinese top 300 stock index (CSI300), the S&P500 index, and GDP growth in China. We asked individuals how confident they were of their answers. This was coupled with survey questions asking how the subject would rank him or herself compared to others in their investment performance. We then asked subjects about gambling and luck behavior with a 10 item questionnaire (Wood and Clapham, 2005). Finally, we questioned subjects on their general

⁶ Work in progress by Bu et al., "Unlucky Beliefs: The Zodiac Birth Year Effect and Individual Investor Performance."

⁷ Refer to Online Appendix A for an English translation of they survey questions.

preferences for risk following (Dohmen *et al.*, 2018). Photos of students taking the paper and pencil survey are provided in Appendix Figure 1.⁸

From November 25, 2019 to December 3, 2019 we conducted a separate survey among master students at WUST focused on beliefs and preferences related to climate change. Similar to our main survey above, we administered this climate risk paper and pencil survey among 12 randomly selected post graduate classes comprising 466 participants. The sessions were administered with course counselors similar to described above. The focus of this survey was on perceived climate change risk and pro-environmental behavior. This sample is not included in our analysis and we plan to study this in a separate paper.

c. Follow up surveys

Shortly following the administration of our baseline survey, the city of Wuhan became the epicenter for a worldwide health-crisis, the COVID-19 Coronavirus pandemic. Reports suggest that the Coronavirus began in December 2019 in the Huanan seafood market in downtown Wuhan (WHO, 2020). Winter break for the semester started at WUST on January 11th, 2020. Wuhan was locked down on January 23rd, 2020, and by then most students from regions outside of Wuhan had left the city for holidays to celebrate China's Lunar New Year.

From February 28, 2020 to March 3, 2020, we administered an online follow up survey to the same subject pool as our first survey. The follow up was administered to 225 students from the original 257 student sample.⁹ All teaching activities were moved to online distance learning initiatives. We were therefore able to create an online version of our initial survey and students submitted their survey responses similar to their other course work. Again, we collaborated with the managers of the student cohorts, this time to share the survey link to the WeChat groups. The online survey tool allows us to capture precise information about subjects' location. We map the provided geolocation coordinates to cities and provinces across China. A translated screenshot of the online survey is provided in Appendix Figure 2.

⁸ In our experiment 130 students (51%) received a simple treatment while the other half acted as our control sample. The treated group of students were asked to read a short (approximately five-minute) excerpt from an article about the "Zodiac birth year" superstition, while the control group read a similar length article excerpt with content about the historical origin of Chinese New Year. This was for our original project on beliefs in luck and investment behavior. Controlling for, or studying sub-groups of within-sample have no economic or statistical effect on our results

⁹ At the same time, we randomly selected 25 new postgraduate cohorts from WUST for additional survey responses that we can follow into the future for related and follow up work. This sample is currently not part of our analysis. We also conducted follow up studies on our sample focused on beliefs and preferences related to climate change, however these subjects are not included in our main sample.

In addition to the questions from our baseline survey, we also included questions on generalized trust as found in the World Values Survey and Kosse *et al.* (2020) and Falk *et al.* (2018). In addition to the miscalibration exercise from the first wave, we also asked individuals to provide their probability assessment of future returns, i.e., their return expectations, of the same indexes listed previously. We also included questions on general uncertainty and subjects' experiences with the Coronavirus.

Table 1 provides descriptive statistics on the subjects in our main sample. Panel B shows the mean values of age, gender and financial literacy score for subjects from Wuhan and those from other provinces in wave one of our survey. We note that the sample is highly balanced along these variables.

4. Main results

a. Perceptions of exposure to the Coronavirus pandemic

The starting point of our study is to measure how individuals in our sample perceive their exposure to COVID-19. In Figure 2, we plot the mean response to survey questions asking subjects about exposure to infection cases. We compare the mean responses from students who are quarantined in Wuhan with students who are quarantined in the province of Hubei, outside of Wuhan, and with WUST students who returned to other provinces during semester and are quarantined in other, less effected, provinces of China. We largely find that students in Wuhan believe that they have a higher exposure to the Corona virus than students located elsewhere. Figure 2 plots this result across panels for suspected cases in the community where the subject is currently quarantined, confirmed cases in the community where the subject is currently where the subject is currently. Table 2 presents this results in a regression framework. We note that our main analyses uses OLS linear regressions however our results are robust to nonlinear methods or ordered logit regressions (as many of the survey questions are on ordinal scales).

The differences in subjective beliefs individuals have about their exposure to Coronavirus are likely to be realistic. As noted, Figure 1 plots the cumulative infections (blue, left axis) and deaths (red, right axis) in the Hubei province of China, where Wuhan is located. The dashed red and blue lines represent the cumulative sum of infections and deaths from *all other* provinces in China and are plotted on the same axes. The dashed gray line states the timing of our follow up survey wave. We note that other provinces experienced a significantly

fewer infection cases and deaths compared to Hubei, and Wuhan, the epicenter of the pandemic, at the time of our follow up survey.

b. Fear of the Coronavirus pandemic

Given that subjects in our sample have varying levels of exposure to the pandemic, we expect this to result in differences in perceived fear and risk of the virus itself. We test this in Table 3 and plot the results in Figure 3. Panel A displays the mean values of the question 'do you think you are likely to become infected with COVID-19?' Responses are on a scale between (1) and (5) for 'very unlikely to 'very likely.' Panel B plots the mean values of a question asking if the subject is afraid of the Coronavirus pandemic. Responses are on a scale between (1) and (5) for 'not afraid at all' to 'very afraid.' We find that subjects located in Wuhan during the quarantine state that they are more likely to be infected with COVID-19, and subjects in the provinces of Hubei and Wuhan are equally more afraid of the virus in general compared to those in other provinces.

c. Risk perceptions during the Coronavirus pandemic

Having established that individuals quarantined in Wuhan have higher exposure and more fear of the pandemic, the natural next step is to examine how subjects perceive risk, and if their tolerance to risk is affected due to varying exposure and experiences made during the pandemic.

We first study how differences in exposure affects financial risk taking by eliciting subjects' allocation to a risky investment from a hypothetical gamble. This measure of financial risk taking was elicited in our survey *during* the Coronavirus pandemic in March 2020. Subjects can chose an amount (0-1000 RMB) to be invested with 50% probability of a higher return (3000 RMB if all invested) or 50% probability of a loss (0 RMB if all invested). The alternative investment is a risk free payment (1000 RMB if all invested). We differentiate between students who are quarantined in Wuhan, versus those who are quarantined at home in Hubei, and those in different provinces in China. Panel A of Figure 4 shows that subjects in Wuhan, with greater exposure to the pandemic, allocate significantly less to the risky gamble. The mean (median) investment across the entire sample is 287.6 (200) RMB. Panel A of Table 4 highlights cross-sectional differences in exposure in the amount invested. The variables of interest are indicators for where the subjects are located during March 2020. In Columns 1 and 3, Hubei is defined as individuals in Hubei *and* Wuhan (anyone in the

province), while in Columns 2, 4, 5, 6 we code the variable as 1 for individuals in Hubei, but outside of Wuhan. Therefore, Column 1 provides an estimate of the difference in the risky allocation of subjects in Wuhan relative to those in Hubei. In Columns 2, 4, 5 and 6, we then quantify the difference between individuals in Wuhan and those in other provinces.¹⁰ In Columns 3-4 we add control variables (gender, age, financial literacy score), and in Column 5 (6) we analyze sub-samples of men (women). We note across the table, subjects in Wuhan allocate a significant less wealth to the risky financial lottery option. The effect is economically and statistically significant and represents a 45% decrease in investment relative to subjects in other provinces. We note that women with greater exposure to the pandemic in our sample allocate even less to the risky investment compared to those with further removed experiences. The heterogeneity in risk taking by gender is in line with previous findings (Croson and Gneezy, 2009; Charness and Gneezy, 2012; Andersen et al., 2020), and complements recent findings about how gender norms and experiences affect economic outcomes and forecasts (D'Acunto *et al.*, 2019; D'Acunto, Malmendier and Weber, 2020).

One question which arises is through which mechanism do contemporaneous experiences affect risk taking? A body of work has documented heterogeneity over the lifecycle and stability in general preferences (Dohmen *et al.*, 2017; Falk *et al.*, 2018). Recent literature has focused on potential explanations for changing observed measures of risk taking. Time-varying risk aversion may be a function of changing emotions, e.g., fear (Loewenstein *et al.*, 2001; Goetzmann, Kim, and Shiller, 2016; Guiso, Sapienza, and Zingales, 2019), and potentially time-varying beliefs or expectations. The latter has been discussed broadly, (e.g. Malmendier and Nagel, 2011), however are difficult to pinpoint empirically.

We therefore first investigate how general preferences for risk evolved *through* the Coronavirus pandemic. In Panels B and C of Figure 4, we plot the risk preference index score from two established survey questions on general attitudes to risk. The first question is a direct translation of the general risk preference question validated by Falk *et al.*, (2016, 2018), 'In general, how willing are you to take risks?' The second question is 'Will you take more risk this year compared to last year.' Both questions ask subjects to respond on a scale of 1 to 5. We combine the answers of both questions into an equally weighted scale which ranges from 1 (low willingness to take risk) to 5 (high willingness to take risk). These risk questions are elicited in October 2019, and repeated in March 2020 amongst our panel of

¹⁰ In Appendix Table 1, we present all regressions using our Column 1-definition of Hubei and note the relationship is statistically and economically significant. Across columns we also vary the definition of the risky allocation by dropping outliers and removing potential misinterpreted responses. The table shows that excluding these observations, and alternative specifications, have no quantitative effect on our results.

subjects. Panel B shows that the total sample of subjects elicited first in Wuhan and later at the place of the quarantine show a large and significant decrease in risk appetite (an increase to risk aversion). The decrease amounts to -0.64 on the 5 point scale and is significant at standard levels (t-stat = -13.09). Given a mean value in wave one of 2.54, this constitutes a substantial 25.2% decrease. When we consider if subjects in Wuhan compared to those in other regions further removed from the pandemic, reduce preferences for risk as measured by our general risk index, we find that all groups seem to decrease equally in their preferences of risk (Panel C). Our generalized measures of risk do not seem to vary more for subjects with higher exposure to the pandemic compared to those outside of the most affected province. This suggests that the observed differences in risk taking, as measured by allocation decisions, may not be driven solely by changes in general risk preferences. In Panel B of Table 4 we present these results in a traditional regression framework. Hubei subjects is an indictor variable which takes the value of one if subjects are quarantined in the Hubei province, while Wuhan subjects takes the value of one if subjects are quarantined within the city of Wuhan. Wave two indicates the timing of March 2020 from our second survey wave and the variables of interest are the interaction of the two location variables with the time trend. In Columns 3 and 7 the interaction term of Wuhan and Wave two is relative to Hubei subjects, while in Columns 4 and 8 it is relative to other provinces. We note that while the coefficients on our variable of interest, Wuhan subjects x wave two, is negative it is not statistically different from zero. As mentioned, the time trend indicator, wave two, is highly negative and statistically significant across specifications.

Our results show a large increase in risk aversion from before the Coronavirus pandemic to its peak in Wuhan. It is plausible that this effect is partially driven by an increase in fear as attributed to risk taking following the financial crisis of 2007-2009 (Guiso, Sapienza, and Zingales, 2018). However, as shown in Figures 2 and 3, higher fear and second-hand experiences (exposure to COVID-19 via family and community) are concentrated among individuals with higher levels of exposure.¹¹ Two additional, and related channels which we wish to examine are how optimism, beliefs about luck and fortune, and beliefs about the economy can influence risk taking. We explore these two channels in the following sections.

¹¹ We note that when we analyze changes in general risk taking by geolocation and second-hand experiences we find complementary evidence that *all* subjects reduce risk taking, regardless if they have experienced deaths or illnesses within their family and community, within Wuhan as well as in other provinces, however as the sample sizes are smaller the standard errors become large.

d. Optimism and beliefs about luck and fortune

As our initial study was formulated to study optimism, beliefs in individuals' own luck, and investment decisions, we elicited several measures of these behavioral traits prior to and during the Coronavirus pandemic. In Table 5 we explore how these measures evolved over time, and how experience with the pandemic may affect them. Figure 5 presents the results visually. In Panel A we plot the mean values of an index of optimism created based on individuals' belief in good luck from Darke and Freedman (1997),¹² which ranges from 0 (low belief in their own personal luck) to 1 (high belief in their own personal luck). The score was elicited in October 2019, and repeated in March 2020. As previously, we plot the values for both periods based on subjects' exposure, proxied by location in March. We examine the differences quantitatively in Table 5. As previous, the variables of interest are Hubei subjects, an indictor variable which takes the value of one if subjects are quarantined in the Hubei province, Wuhan subjects, which takes the value of one if subjects are quarantined in the city of Wuhan, and the interaction of the two location variables with the time trend. Across panels, in Column 3 the interaction term of Wuhan and wave two is relative to Hubei subjects, while in Column 4 it is relative to other provinces. In Column 2, we note a large decrease for subjects in Wuhan in their beliefs about how lucky they are personally (7.2 percentage points, *p*-value 0.003), while prior to the pandemic their belief in luck was statistically equivalent to subjects from other provinces. Note that this effect in Column 2 relates the difference to the average individual across other provinces as well as Hubei. Column 3 relates the difference to other subjects in Hubei outside of the city of Wuhan. The coefficient here is negative as expected, but not significant. In Column 4 the coefficient relates the difference in Wuhan to those in other provinces and outside of Hubei. The effect is -10.2 percentage points with a *p*-value < 0.0001.

Panel B similarly plots an index based on questions that ask about the percentage of investors who would have better luck or higher returns in financial investments. Again, we note a similar pre-pandemic value for all subjects, for those quarantined in Wuhan we observe a substantial increase from pre- to the midst of the pandemic, in the fraction of investors *better than* the subject (6.8 percentage points, *p*-value < 0.0001).

Finally, in Panel C we plot the mean value of an index on beliefs about subjects' control over their own outcomes and luck. The survey questions are based on the Drake

¹² The index is created based on statements that subjects agree or disagree with such as 'I consider myself to be a lucky person;' I believe in luck;' and 'I often feel like it's my lucky day.' Further information about the survey can be found in Online Appendix A.

Beliefs about Chance (DRC) Inventory (Wood and Clapham, 2005) and contain a battery of statements such as 'If I concentrate hard enough I might be able to influence whether I win when I play (game),' and 'If I am well prepared, I have very large likelihood to win a gamble.' We note that subjects from Wuhan show lower beliefs in their individual sense of control as measured by the DRC survey statements from pre-pandemic to its peak, relative to subjects in other provinces. The economic magnitude of the mean effect is significant, -6.9 percentage points, and is highly statistically significant, *p*-value = 0.003.

In general, our findings suggest that higher exposure to the Coronavirus pandemic, and therefore more direct and acute experiences, have a strong negative effect on individuals' beliefs, optimism, and sense of individual control. We argue that these beliefs are an important component of risk taking.¹³ In the following section we examine how exposure to the pandemic may affect broader beliefs about future economic activity and social conditions.

e. Beliefs and expectations on economic indicators

Our findings thus far suggest that experiences may affect risk taking acutely through pessimistic subjective beliefs. A number of recent studies have focused on the importance of subjective beliefs on economic outcomes (Kuhnen and Miu, 2017; Ameriks *et al.*, 2018; Giglio *et al.*, 2019; Kuchler and Zafar, 2019; Das, Kuhnen, and Nagel, 2019; Andersen *et al.*, 2020). In Table 6, we study how subjects in our setting vary in their future expectations on economic indicators based on their exposure to the Coronavirus pandemic.

We study expectations in two ways: first we measure scale-based survey questions on future economic outcomes, i.e., 'compared to last year, China's economy (your health; China's natural environment) will become better in the next 12 months.' The scale ranges from (1) to (5) for 'strongly disagree' to 'strongly agree.' Secondly we ask subjects to assign probabilities to market returns from 6 scenarios and form a probability distribution. We create a measure of expected returns using the midpoints of these probability bins for the Shanghai Stock Exchange index (SSE). All measures were elicited in our March 2020 survey wave.

¹³ In Appendix Table 2 we examine to what extent changes in general risk taking and changes in beliefs explain lower risk allocations. Across the table the coefficient on decreases in optimism (and reduced general risk taking) largely correlate with lower risk allocations, however the standard errors are large and the coefficients are not precisely estimated. We do note that the coefficients on our exposure measures, subjects from Hubei and Wuhan, remain economically and statistically significant and absorb the variation from the more pessimistic belief variables confirming that those who reduce their optimism are indeed those with higher exposure.

In Figure 7 we plot the mean values of these two types of expectation measures for subjects quarantined in Wuhan, subjects in Hubei outside of the city of Wuhan, and for subjects in other provinces of China. We note that subjects currently in Wuhan and therefore arguably more closely experiencing the Coronavirus pandemic largely form more pessimistic beliefs in the general economy, social conditions, and financial market indices, relative to subjects in provinces further removed from the pandemic. Table 7 presents these results. As these expectations are forward looking, we cannot ascertain if individuals with more acute experiences provide more accurate responses, perhaps because they have more local and relevant information, or if they are more likely to provide biased forecasts. In the first wave of our survey we elicited miscalibration estimates of financial indices rather than forecasts and found that individuals from different geolocations (prior to their exposure and experience to the pandemic) did not differ statistically in their responses. Recent evidence suggests experience may cause subjects to provide more imprecise forecasts (Goldfayn-Frank and Wohlfart, 2019; Kuchler and Zafar, 2019). However, it is a research area which is understudied and we hope to revisit this question in future survey waves. In general, our results show that subjects with higher exposure to the pandemic form more pessimistic beliefs on the economy, the stock market, their own health, and on the environment, relative to subjects in further removed provinces.

5. Conclusion

In this paper, we study how risk taking and economic preferences evolve from normal times to the peak of a worldwide health-crisis. We use repeated survey data from a panel of subjects based in Wuhan, China. Our identification strategy exploits the fact that winter break for the semester started on January 11th 2020 and students from other provinces were able to return to their homes as planned for the Chinese Lunar New Year celebrations, providing quasi-random variation in the exposure to the pandemic and quarantine conditions individuals experience across China.

We find that subjects in Wuhan, with objectively higher exposure to the Coronavirus pandemic, also believe that they have a higher exposure risk to the virus than those elsewhere. They state higher probabilities that they are likely to be infected, and show higher levels of fear in the pandemic in general. We then show that subjects more closely experiencing the pandemic in Wuhan, reduce risk taking in an investment allocation task. At the same time, experience does not differentially affect general preferences for risk – instead, on average, *all* subjects surveyed first in Wuhan and later at their place of quarantine show a large and

significant decrease in general risk appetite. We argue that this can be partially explained by changes in optimism and beliefs about their own luck and sense of control. Furthermore, higher exposure leads individuals to form more pessimistic beliefs on the economy, their health, and the environment in general.

Our results present an important contribution to a large literature on risk taking behavior after large shocks and formative experiences. While we provide confirmatory evidence that risk taking behavior is indeed an artifact of experiences, we also show that changes in risk taking seem to be more linked to time-varying beliefs and optimism than general preferences for risk. In general our results help explain why individual level experiences have a more pronounced effect on behavior than further removed experiences. At the same time, our findings provide important supporting evidence for policy decision making. If observed risk taking of households changes via time-varying beliefs and expectations, the effects may only be temporary. On the other hand, changes in household risk taking from more of a general shift in preferences may require policy that are larger, and more structural, and may reflect a larger impact on long term economic growth.

Our work is an early study on the large consequences we expect to occur from the global Coronavirus pandemic. Future work in our field and within our own research agenda will study how these beliefs and preferences further evolve over time, link these measures to field behavior, and exploit further heterogeneity in personal experiences.

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Figure 1: Coronavirus infection cases and deaths in the Hubei province and across China

In the following figure we plot the cumulative infections (blue, left axis) and deaths (red, right axis) in the Hubei province of China, where Wuhan is located. The dashed red and blue lines represent the cumulative sum of infections and deaths from *all other* provinces in China and are plotted on the same axes. The dashed gray line states the timing of our follow up survey wave.



Figure 2: Subjects' perceptions of exposure to Coronavirus

In the following figures we plot the mean response to survey questions asking subjects about exposure to Coronavirus cases. We plot responses by subjects who are quarantined in Wuhan, subjects who are quarantined in the province of Hubei (but outside of Wuhan), and subjects in different provinces in China. In Panel A (top left) we plot the mean value to a question if there are suspected cases in the community where the subject is currently quarantined (yes/no). In Panel B (top right), if there are confirmed cases in the community where the subject is currently (yes/no), Panel C asks if there are confirmed cases among family and friends, and Panel D asks if there are confirmed deaths from Coronavirus in the community where the subject is currently. The survey was taken in March 2020. 95% confidence intervals are displayed.



Figure 3: Subjects' self-perceived fear of the Coronavirus pandemic

In the following figure we plot subjects' self-perceived fear of Coronavirus. We plot responses by subjects who are quarantined in Wuhan, subjects who are quarantined in the province of Hubei (but outside of Wuhan), and subjects in different provinces in China In Panel A we plot the mean values of the question 'do you think you are likely to be infected with COVID-19?' Responses are on a scale between (1) and (5) for 'very unlikely to 'very likely.' Panel B plots the mean values of a question asking if the subject is afraid of the Coronavirus pandemic. Responses are on a scale between (1) and (5) for 'very afraid.' 95% confidence intervals are displayed.



Figure 4: Risk taking during the Coronavirus pandemic

In the following figures we plot survey measures of risk tolerance. We plot responses by subjects who are quarantined in Wuhan, subjects who are quarantined in the province of Hubei (but outside of Wuhan), and subjects in different provinces in China. In Panel A, we plot the allocation to a risky investment from a hypothetical gamble (0-1000 RMB) elicited in March 2020. In Panel B we plot the mean general risk preferences index score from two survey questions on risk preferences based on survey questions on risk motivated by Falk *et al.* (2018). The score ranges from 1 (low willingness to take risk) to 5 (high willingness to take risk) and were elicited in October 2019, and repeated in March 2020 amongst a panel of subjects. Panel C plots the mean index of general risk score for all subjects in October 2019, and March 2020, by their exposure to the pandemic proxied by location. 95% confidence intervals are displayed.











Figure 5: Subjects' beliefs in optimism during the Coronavirus pandemic

In the following figure we plot subjects' beliefs about their own luck and relative fortune. We plot responses by subjects who are quarantined in Wuhan, subjects who are quarantined in the province of Hubei (but outside of Wuhan), and subjects in different provinces in China. In Panel A we plot the mean values of an index of belief in individual good luck based on Darke and Freedman (1997), which ranges from 0 (low belief in individual luck) to 1 (high belief in individual luck). The score was elicited in October 2019, and repeated in March 2020 amongst a panel of subjects. Panel B plots an index based on questions that ask about the percentage of investors which have better luck or higher returns than you. Panel C plots mean values of an index on beliefs about subjects' sense of control based on the Drake Beliefs about Chance Inventory (Wood and Clapham, 2005). 95% confidence intervals are displayed.











Figure 6: Expectations and beliefs during the Coronavirus pandemic

In the following figures we plot survey measures of beliefs and expectations on financial and economic indicators. We plot responses by subjects who are quarantined in Wuhan, subjects who are quarantined in the province of Hubei (but outside of Wuhan), and subjects in different provinces in China. Expectations were elicited in March 2020 amongst a panel of student participants. We measure Panels A, B, and C with scale based survey questions, i.e., 'compared to last year, China's economy (your health; China's natural environment) will become better in the next 12 months.' The scale ranges from (1) to (5) for 'strongly disagree' to 'strongly agree.' In Panel D we ask subjects to assign probabilities to market returns from 6 scenarios and form a probability distribution. We create a measure of expected returns using the midpoints of these probability bins and plot the mean values for the Shanghai Stock Exchange index (SSE) (S&P500 and China's GDP growth are unreported). Expected returns are for November 2019 to November 2020.













Table 1: Summary statistics

In Panel A, we report descriptive statistics: mean, median, min, and max for all subjects in wave one of the survey questionnaire and who also participate in wave two of the survey (225/257 subjects.). For each individual, we observe demographic characteristics detailed below from October 2019. Panel B reports characteristics by subjects who are quarantined in Wuhan (4), subjects who are quarantined in the province of Hubei (but outside of Wuhan) (3), subjects in different provinces in China (2), and a *t*-test of differences between subjects in Wuhan and other provinces in China (5).

Panel A:				
	Mean	Median	Min	Max
	(1)	(2)	(3)	(4)
Age	23.24	23.0	22.0	25.0
Male	0.64	1.0	0.0	1.0
Financial literacy score	2.89	3.0	0.0	5.0
Hubei Subjects	0.53	1.0	0.0	1.0
Wuhan subjects	0.09	0.0	0.0	1.0
Subjects	225			

Panel B:

	Full sample	Other provinces	Hubei	Wuhan	<i>t</i> -test
	(1)	(2)	(3)	(4)	(4)-(1)
Age	23.24	23.19	23.30	23.24	0.00
	(0.93)	(0.94)	(0.92)	(0.94)	[0.01]
Male	0.64	0.63	0.64	0.71	-0.08
	(0.48)	(0.48)	(0.48)	(0.46)	[-0.70]
Financial literacy score	2.89	2.94	2.83	2.95	-0.07
	(1.21)	(1.23)	(1.19)	(1.24)	[-0.23]
Hubei subjects	0.53	0.00	1.00	1.00	-
	(0.50)	(0.00)	(0.00)	(0.00)	-
Wuhan subjects	0.09	0.00	0.00	1.00	-
	(0.29)	(0.00)	(0.00)	(0.00)	-
Subjects	225	106	98	21	225

Table 2: Subjects' perceptions of exposure to Coronavirus

The following table reports regression results analyzing how subjects' perceptions of exposure to Coronavirus differ by experience. *Hubei subjects* is an indictor variable which takes the value of one if subjects are quarantined in the Hubei province, outside of the city of Wuhan. *Wuhan subjects* takes the value of one if subjects are quarantined in Wuhan. The dependent variable in Column 1 an indicator variable for a survey question if there are suspected cases in the community where the subject is currently quarantined (yes/no). In Column 2 it indicates if there are confirmed cases among family and friends, and Column 4, if there are confirmed deaths from Coronavirus in the community where the subject is currently. The survey was taken in March 2020. Standard errors are clustered at the individual level. * p < .1, ** p < .05, *** p < .01

Dependent variable:	Suspected	Confirmed	Family	Deaths
	(1)	(2)	(3)	(4)
Hubei subjects	0.08^{**}	0.14***	0.20***	0.02
	(0.04)	(0.05)	(0.06)	(0.03)
Wuhan subjects	0.11	0.24**	0.28**	0.14
	(0.08)	(0.11)	(0.11)	(0.09)
R ²	0.03	0.05	0.07	0.02
Observations	225	225	225	225

Table 3: Subjects' self-perceived fear of the Coronavirus pandemic

The following table reports regression results analyzing how subjects' perceptions of exposure to Coronavirus differ by experience. *Hubei subjects* is an indictor variable which takes the value of one if subjects are quarantined in the Hubei province, outside of the city of Wuhan. *Wuhan subjects* takes the value of one if subjects are quarantined in Wuhan. The dependent variable in Column 1 an ordinal variable for the survey question 'do you think you are likely to be infected with COVID-19?' Responses are on a scale between (1) and (5) for 'very unlikely to 'very likely.' In Column 2 it is a question asking if the subject is afraid of the Coronavirus pandemic. Responses are on a scale between (1) and (5) for 'not afraid at all' to 'very afraid.' The survey was taken in March 2020. Standard errors are clustered at the individual level. * p < .05, *** p < .01

Dependent variable:	Infected	Fear
-	(1)	(2)
Hubei subjects	0.27	0.30*
	(0.17)	(0.17)
Wuhan subjects	0.60**	0.23
	(0.28)	(0.24)
\mathbb{R}^2	0.02	0.01
Observations	225	225

Table 4: Risk taking during the Coronavirus pandemic

The following table reports regression results analyzing how risk tolerance is affected by experiencing the Coronavirus pandemic in Wuhan. In Panel A, the dependent variable is the allocation to a risky investment from a hypothetical gamble (0-1000 RMB). In Columns 1 and 3, Hubei is defined as individuals in Hubei and Wuhan (anyone in the province). In Columns 2, 4, 5, 6 it takes the value of 1 for individuals in Hubei, but outside of Wuhan. Column 1 therefore provides an estimate of the difference in the risky allocation between subjects in Wuhan and those in Hubei, whereas in Columns 2, 4, 5, 6 it is the difference between individuals in Wuhan and those in other provinces. Columns 3-4 include controls for gender, age, and financial literacy score. Column 5 (6) focuses on sub-samples of men (women). In Panel B, the explanatory variables are Hubei subjects, an indictor variable which takes the value of one if subjects are quarantined in the Hubei province. Wuhan subjects takes the value of one if subjects are quarantined in the city of Wuhan. Wave two indicates the timing of March 2020 from our second survey wave and the variables of interest are the interaction of the two location variables with the time trend. The dependent variable is a general preferences for risk index score from two survey questions on risk preferences motivated by Falk et al., (2018). The score ranges from 1 (low willingness to take risk) to 5 (high willingness to take risk) and were elicited in October 2019, and repeated in March 2020 amongst a panel of subjects in Wuhan. In Columns 3 and 7 the interaction term of Wuhan and Wave two is relative to Hubei subjects, while in Columns 4 and 8 it is relative to Other provinces. Columns 5-8 include control variables. Standard errors are clustered at the individual level. * *p* < .1, ** *p* < .05, *** *p* < .01

Dependent variable:		R	isky allocatio	on: March 2020)	
-		All sul	bjects		Men	Women
	(1)	(2)	(3)	(4)	(5)	(6)
Hubei subjects	-67.03*	-67.03*	-64.85	-64.85	-50.40	-88.75
	(39.10)	(39.10)	(39.39)	(39.39)	(50.84)	(65.61)
Wuhan subjects	-82.74*	-149.77***	-84.99*	-149.83***	-128.56**	-212.24**
	(42.40)	(45.67)	(43.40)	(46.34)	(49.93)	(102.22)
Financial literacy score			7.76	7.76	13.19	-7.35
-			(14.85)	(14.85)	(20.63)	(21.32)
Male			7.54	7.54	-	-
			(38.13)	(38.13)		
Age			-12.63	-12.63	-28.95	20.33
0			(18.91)	(18.91)	(22.49)	(33.48)
R ²	0.03	0.03	0.03	0.03	0.04	0.05
Observations	225	225	225	225	145	80

Panel B:

Dependent variable:			G	eneral risk	preferenc	es		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wave two	-0.64***	-0.59***	-0.59***	-0.59***	-0.64***	-0.60***	-0.60***	-0.60***
	(0.05)	(0.07)	(0.07)	(0.07)	(0.05)	(0.07)	(0.07)	(0.07)
Hubei subjects		0.07	0.13	0.13		0.07	0.13	0.13
		(0.11)	(0.11)	(0.11)		(0.11)	(0.11)	(0.11)
Hubei subjects x Wave two		-0.09	-0.08	-0.08		-0.09	-0.08	-0.08
		(0.10)	(0.10)	(0.10)		(0.10)	(0.10)	(0.10)
Wuhan subjects			-0.35*	-0.22			-0.35*	-0.22
			(0.19)	(0.19)			(0.19)	(0.19)
Wuhan subjects x Wave two			-0.05	-0.12			-0.04	-0.12
			(0.20)	(0.19)			(0.20)	(0.19)
Controls	No	No	No	No	Yes	Yes	Yes	Yes
R ²	0.16	0.16	0.18	0.18	0.17	0.17	0.18	0.18
Observations	450	450	450	450	450	450	450	450

Table 5: Beliefs in optimism and sense of control during the Coronavirus pandemic

The following table reports regression results analyzing how beliefs in individual luck are affected by experiencing the Coronavirus pandemic in Wuhan. The explanatory variables are *Hubei subjects*, an indictor variable which takes the value of one if subjects are quarantined in the Hubei province. *Wuhan subjects* takes the value of one if subjects are quarantined in the city of Wuhan. *Wave two* indicates the timing of March 2020 from our second survey wave and the variables of interest are the interaction of the two location variables with the time trend. The dependent variable in Panel A is an index of belief in good luck based on Darke and Freedman (1997), which ranges from 0 (low belief in personal luck) to 1 (high belief in luck). In Panel B it is an index based on questions that ask about the percentage of investors which have better luck or higher returns than you, and in Panel C an index on beliefs about subjects' sense of control based on the Drake Beliefs about Chance Inventory (Wood and Clapham, 2005). Scores was elicited in October 2019, and repeated in March 2020 amongst a panel of student participants in Wuhan. Across panels, in Column 3 the interaction term of *Wuhan* and *Wave two* is relative to *Hubei* subjects, while in Column 4 it is relative to *Other provinces*. Standard errors are clustered at the individual level. * p < .1, ** p < .05, *** p < .01

Panel A:				
Dependent variable:		Good	d luck	
-	(1)	(2)	(3)	(4)
Wave two	-0.02***	-0.05***	-0.02***	-0.02***
	(0.01)	(0.01)	(0.01)	(0.01)
Hubei subjects	0.00		-0.00	-0.00
	(0.02)		(0.02)	(0.02)
Hubei subjects x Wave two	-0.07***		-0.06***	-0.06***
	(0.01)		(0.01)	(0.01)
Wuhan subjects		0.01	0.02	0.01
		(0.03)	(0.03)	(0.03)
Wuhan subjects x Wave two		-0.07***	-0.04	-0.10***
		(0.02)	(0.03)	(0.02)
Controls	Yes	Yes	Yes	Yes
R ²	0.09	0.06	0.09	0.09
Observations	450	450	450	450

Panel B:

Dependent variable:		Wors	e luck	
•	(1)	(2)	(3)	(4)
Wave two	0.02***	0.05***	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)
Hubei subjects	0.01		0.01	0.01
	(0.02)		(0.02)	(0.02)
Hubei subjects x Wave two	0.06***		0.06***	0.06***
	(0.01)		(0.01)	(0.01)
Wuhan subjects		0.03	0.03	0.04
		(0.04)	(0.05)	(0.04)
Wuhan subjects x Wave two		0.04**	0.00	0.07***
		(0.02)	(0.02)	(0.02)
Controls	Yes	Yes	Yes	Yes
R ²	0.07	0.06	0.07	0.07
Observations	450	450	450	450

Panel C:

Dependent variable:		Sense of	f control	
	(1)	(2)	(3)	(4)
Wave two	0.01	-0.02***	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Hubei subjects	-0.00		0.01	0.01
	(0.02)		(0.02)	(0.02)
Hubei subjects x Wave two	-0.06***		-0.06***	-0.06***
	(0.01)		(0.01)	(0.01)
Wuhan subjects		-0.06	-0.06*	-0.05
		(0.04)	(0.04)	(0.04)
Wuhan subjects x Wave two		-0.04*	-0.01	-0.07***
		(0.02)	(0.02)	(0.02)
Controls	Yes	Yes	Yes	Yes
R ²	0.06	0.06	0.07	0.07
Observations	450	450	450	450

Table 6: Expectations and beliefs during the Coronavirus pandemic

The following table reports regression results analyzing how expectations and beliefs on aggregate outcomes differ by experience. *Hubei subjects* is an indictor variable which takes the value of one if subjects are quarantined in the Hubei province, outside of the city of Wuhan. *Wuhan subjects* takes the value of one if subjects are quarantined in Wuhan. Expectations were elicited in March 2020 amongst a panel of student participants in Wuhan. The dependent variable in Column 1 (2) (3) are scale-based survey questions, i.e., 'compared to last year, China's economy (your health; China's natural environment) will become better in the next 12 months.' The scale ranges from (1) to (5) for 'strongly disagree' to 'strongly agree.' Column 4 asks subjects to assign probabilities to market returns from 6 scenarios and form a probability distribution. We create a measure of expected returns using the midpoints of these probability bins and plot the mean values for the Shanghai Stock Exchange index (SSE). Expected returns are for November 2019 to November 2020. Standard errors are clustered at the individual level. * p < .1, ** p < .05, *** p < .01

Dependent variable:	Economy	Health	Environment	SSE
	(1)	(2)	(3)	(4)
Hubei subjects	-0.30*	-0.48***	-0.43***	-0.02
	(0.16)	(0.17)	(0.16)	(0.02)
Wuhan subjects	-0.47**	-0.62**	-0.84***	-0.03
	(0.22)	(0.28)	(0.23)	(0.02)
Controls	Yes	Yes	Yes	Yes
R ²	0.03	0.06	0.07	0.02
Observations	225	225	225	225

Appendix for

"Risk Taking during a Global Crisis: Evidence from Wuhan"

Appendix Figure 1: October 2019 survey sessions in Wuhan, China

The figures below show pencil and paper survey wave one sessions at WUST in October 2019.







Appendix Figure 2: Online survey conducted in March 2020

The figures below shows an example screen from the online wave two survey (translated into English) while subjects are in quarantined.

○ A. 1	○ B. 2	○ C. 3	○ D. 4	○ E. 5	
9. Compared v roval degree	with last year, my	health will be bet	ter in the next 12	months: 1 ~ 5 increas	e in
⊖ A. 1	○ B. 2	○ C. 3	○ D. 4	○ E. 5	
0. Compared v ns: 1 ~ 5 increa	with last year, Chi ase in approval de	na's natural envir egree	onment will becon	ne better in the next 1	1 <mark>2</mark> m
⊖ A. 1	○ B. 2	⊖ C. 3	O D. 4	○ E. 5	
1. Age					
 Age Gender A. Male 					
 Age Gender A. Male B. Female 					
1. Age 2. Gender A. Male B. Female 3. Horoscope					

Appendix Table 1: Risk allocation during the Coronavirus pandemic

The following table reports regression results analyzing how risk tolerance is affected by experiencing the Coronavirus pandemic in Wuhan. The dependent variable is the allocation to a risky investment from a hypothetical gamble (0-1000 RMB). In Columns 1, 3, 5, and 7 *Hubei* is defined as individuals in Hubei and Wuhan (anyone in the province). In Columns 2, 4, 6, and 8 the variable *Hubei* takes the value of 1 for individuals in Hubei, but outside of Wuhan. In Columns 1-2 the risky allocation variable is our baseline measure where we recode 13 observations with missing values in the risky lottery, but 1000 allocated to the safe lottery as zero. In Columns 3-4 we omit 4 observations where the risky allocation was stated as greater than 1000 (these are top coded to 1000 in Columns 1-2). In Columns 5-6 we omit these top coded observations. In Columns 7-8 we omit all of the previous mentioned observations. Standard errors are clustered at the individual level. * p < .05, *** p < .01

Dependent variable:	Risky allocation: March 2020										
-	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)			
Hubei subjects	-64.85	-64.85	-55.37	-55.37	-66.37*	-66.37*	-62.52	-62.52			
	(39.39)	(39.39)	(35.58)	(35.58)	(37.38)	(37.38)	(39.99)	(39.99)			
Wuhan subjects	-84.99*	-149.83***	-69.99*	-125.36***	-79.28*	-145.65***	-89.11*	-151.63***			
	(43.40)	(46.34)	(41.58)	(45.11)	(42.07)	(45.81)	(45.80)	(48.07)			
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
\mathbb{R}^2	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03			
Observations	225	225	221	221	225	225	212	212			

Appendix Table 2: Risk allocation during the Coronavirus pandemic

The following table reports regression results analyzing how risk tolerance is affected by experiencing the Coronavirus pandemic in Wuhan. The dependent variable is the allocation to a risky investment from a hypothetical gamble (0-1000 RMB). We control for the October 2019 to March 2020 change in general risk preference score as well as changes in optimism and beliefs in luck. In Columns 4-6 the variable *Hubei* takes the value of 1 for individuals in Hubei, but outside of Wuhan. Standard errors are clustered at the individual level. * p < .05, *** p < .01

Dependent variable:	Risky allocation: March 2020							
	(1)	(2)	(3)	(4)	(5)	(6)		
Decrease in risk tolerance score	-61.49	-66.24	-66.22	-61.09	-63.58	-64.83		
	(45.96)	(44.34)	(44.04)	(45.16)	(43.54)	(43.57)		
Decrease in beliefs in good luck	-33.41			-4.06				
	(40.27)			(40.20)				
Increase in beliefs of worse luck		-7.19			41.42			
		(38.14)			(40.50)			
Decrease in control over luck			-4.07			29.65		
			(36.77)			(39.28)		
Hubei subjects				-62.02	-82.01**	-73.64*		
				(39.15)	(41.50)	(42.37)		
Wuhan subjects				-142.84***	-166.97***	-156.32***		
				(48.17)	(50.01)	(48.17)		
Control variables	Yes	Yes	Yes	Yes	Yes	Yes		
R ²	0.02	0.02	0.02	0.04	0.05	0.05		
Observations	225	225	225	225	225	225		

Online Appendix A: Sample survey questions translated into English

<u>Belief on good luck</u> Darke and Freedman (1997)

Likert-scale which ranges from strongly disagree (1) ... strongly agree (5).

Some people are consistently lucky, and others are unlucky. I consider myself to be a lucky person. I believe in luck. I often feel like it's my lucky day. Nobody can win at games of chance in the long-run. I consistently have good luck. It's a mistake to base any decisions on how lucky you feel. Luck works in my favour, especially this year. I don't mind leaving things to chance because I'm a lucky person. Even the things in life I can't control tend to go my way because I'm lucky. In general I am lucky. There is such a thing as luck that favours some people, but not others. Luck is nothing more than random chance.

Beliefs about luck

If you make investment on stocks this year, what percentage of other investors have better luck than you at investing stocks with above average performance? (Please give a number between 0% and 100%)

If you make investment on stocks this year, what percentage of other investors had higher returns than you? (Please give a number between 0% and 100%)

Control over luck

Drake Beliefs about Chance Inventory; Wood and Clapham (2005)

Participants indicate the extent of their agreement using Likert-scale which ranges from strongly disagree (1) ... strongly agree (5).

If I well prepared, I would have very large likelihood to win a gamble. Some gamblers are just born lucky.

The longer I've been losing, the more likely I am to win.

The chances of winning a substantial amount of money at the Casino are quite high

I think I'll win a good prize in sport lottery (over \$10,000) one day

One day I'm going to strike it lucky at gambling

If I concentrated hard enough I might be able to influence whether I win when I play the pokies I can/could stick to a budget when/if I gamble

<u>Risk taking</u>

Falk et al., (2018)

Risk measures were elicited through two qualitative questions and one quantitative question:

In general, how willing are you to take risks? On a scale of 1(not willing at all) - 5(very willing to)

Will you take more risk this year compared to last year? On a scale of 1(less risk) - 5 (more risk)

Imagine you have an extra 1,000 yuan in your pocket, and you have to options with how to use it:

- a. Use an amount of the money to invest in a lottery (with a 50% chance that you can win up to 2,000 yuan (including the principal of 1,000 yuan), and a 50% chance of zero additional winnings)
- b. Don't make any investment.

Please fill in the following boxes how you will allocate the 1,000 yuan in these two options:

_____Yuan in lottery investments _____Yuan in keep in cash

Economy expectations

All questions on scale of strongly disagree (1) ... strongly agree (5).

Compared to last year, China's economy will become better in the next 12 months Compared with last year, my health will be better in the next 12 months Compared with last year, China's natural environment will become better in the next 12 months

Stock market expectations

Stock market expectations: in the following we present you with 6 scenarios of how the annual percentage change of stock indices could be during this year (between Nov 2020-Nov 2021). Please indicate how likely you think the individual scenarios are. Assign a probability to each of the scenarios, and make sure the sum of the probability to be 100%.

Shanghai Stock exchange index

-20% -10-20% 0-10% 0 +10 % 10-20% +20%

Questions on trust

WVS; Kosse *et al.*, (2020) All questions on scale of strongly disagree (1) ... strongly agree (5).

In general, the vast majority of people in the society can be trusted In general, no one else can be trusted, I can only rely on myself We'd better stay vigilant when dealing with strangers Others treat me with good intentions

Additional questions

Are there confirmed COVID-19 cases among your family member and friends? Yes/no Are there any confirmed COVID-19 cases in the community where you currently live? Yes/no Are there any suspected cases in the community where you currently live? Yes/no Has anyone in your community died from the COVID-19? Yes/no

Are you afraid of this epidemic? 1)Not afraid at all 5)Very afraid Do you think you are likely to be infected with COVID-19? 1)Very unlikely 5)Very likely