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Decision-making and risk preference in the aftermath of extreme conditions: Avoidance and aversion

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Article Info

Abstract

After experiencing extreme circumstances, people perceive the world around them differently; especially in terms of how they assess risk and their attitudes towards risk. In this paper, I study risk preference categorized as risk aversion (studied under the case of 9/11) and risk avoidance (studied under the case of COVID-19). Under risk aversion, a short-term escalation in fear-motivated risk aversion was observed, but a behavioural equilibrium was established as soon as three months afterwards. In the case of risk avoidance, there was a significant relationship established between the level of improvement in life satisfaction after the global pandemic and both higher and lower risk instruments. There was also a natural display of loss aversion and a noticeable effect of socio-demographic factors on risk perception.

Introduction

How do people modify their risk preferences after experiencing extreme conditions? I examine these conditions with a distinction made between cases involving risk responses: avoidance and aversion (Rose, 2021) [13]. Mandatory and voluntary avoidance is examined under the COVID-19 pandemic and the ensuing effects of lockdown, etc. Aversion is examined in the aftermath of various conflict environments such as the attacks of September 11, 2001.

There exists a wide variety of research on risk perception, preference and attitudes, but the strength of those results lies in the fact that they seek to explain everyday behaviour for the most part. This behaviour primarily includes buying behaviour, social interaction and common choice-making. In this paper, I intend to scrutinize unusual conditions that humans experience and the ramifications they have on common choice-making regarding travel, finance and the economy. While there is no shortage of literature on the devastating effects of the 9/11 attacks, this study aims to view the behavioural consequences in view of risk aversion, specifically.

The research surrounding COVID-19 and its effects predominantly focuses on the perception of the pandemic itself and behaviour during lockdowns, etc. Thus, the latter half of this paper probes behaviour in light of experience with the COVID-19 pandemic.

Objectives of the Study

This research paper aims to delineate the tendencies in risk preferences of individuals after extreme conditions of living, namely, the September 11 attacks and the COVID-19 global pandemic. In addition, this study aims to:
1. Explore to what extent these preferences are moderated by occupation, culture, background and income
2. Assess the speed of recovery from extreme conditions
3. Discover which factors have a greater bearing on perceived risk
4. Discuss differences in risk perception based on any framing effects.

Scope of the Study

This study employs both quantitative and qualitative analysis; a case study on the behavioural impacts on risk perception after the 9/11 attacks, as well as a statistical analysis of primary data collected via an online survey (n = 178).

The results from the case study cover impacts on the travel industry, investor behaviour and the economy after the 9/11 terrorist attacks. The statistical analysis was performed on primary data collected from a sample of 178 respondents (primarily Indian college students) between 20 September 2022 and 5 October 2022. This analysis is structured on the parameters of COVID-19 circumstances, contextual risk preference assessment (self-reported) and socio-demographic characteristics. The scope of this study does not include any strictly psychological factors (like personality traits) and does not portray a highly accurate model of the behaviour of those outside the age range of 18-23 (the sample data was found to be inhomogeneous).

Pressing Limitations
This research paper did not receive specific funding, and consequently, no monetary incentives were offered to respondents for participating in the survey. The methodology implemented does not consider inter temporal factors and consequently, preference stability across time frames. The study also employs the face value assumption, i.e., the assumption that respondents always truthfully answered the specific preference question intended to be asked. The sample data was also inhomogeneous as most respondents were younger, higher-income college students.

Flow of Presentation
The paper begins with a review of the existing theoretical and empirical literature surrounding risk perception, risk preference, stated and elicited risk preference, contextual risk assessment, behavioural consequences of disasters (and valuation of the same) and risk preference recorded in the circumstances of 9/11 and COVID-19. This is followed by the analysis performed, both quantitative and qualitative. The qualitative section is primarily a case study on the behavioural impacts of 9/11, while the quantitative section comprises a statistical analysis of primary data, presentation of output and a discussion of the results. The paper concludes with an inference on the findings of this paper and references.

Reviews
Review of Theoretical Literature
Risk attitudes vary with individual differences, especially across gender, age, income and similar factors. The definition of risk as described in psychology and economics have certain differences, especially concerning the measurement of risk. Risk preferences can be classified into three: risk averse, risk neutral, and risk seeking. While psychological risk preference measures the propensity to engage in behaviours or activities which are simultaneously rewarding as well as involving loss (like substance abuse), economic risk preference is more geared towards behaviours or activities resulting in a higher variance of returns in payoff contexts (Mata, Frey, Richter, Schupp, & Ralph, 2018). This study focuses on behavioural measures of risk, observed after a real-world incident, and self-report measures, which elicit stated preferences in response to a hypothetical situation. Both these measures of risk are highly contested due to the high specificity of response elicitation, the response gap between actual and hypothetical situations and the inability to adapt these responses into a model of human behaviour. People have a keen sense of where they stand in relation to others in certain fields; there is evidence that self-other knowledge asymmetry can explain some of the discrepancies

that exist between stated and revealed preferences (Arslan, *et al*., 2020) [2]. In this study, I incorporate both revealed (observed) and stated (elicited) preferences.

The revealed preference approach seeks to study choices under risk in the field and the laboratory. Observational studies of real behaviours provide insights into how people rely on their experiences to infer their risk preferences. Revealed preferences typically provide better control over confounding factors such as truth-telling inclination and cognitive dissonance, while still measuring actual behaviour. Within the traditional framework of measuring risk, individuals are categorized as risk-averse, risk-seeking and risk-neutral depending on their utility function, i.e., personality trait-based assessment of risk-taking. This method assumes that risks taken by an individual in one context, when analyzed, are predictive of risks taken by the same individual in other contexts when expressed as a general risk-taking score (computed over various scenarios). However, this method does not account for contextually-differentiated responses to risk and risk assessments. Risk-taking propensity can thus be shifted from a personality trait-based measurement to a situation-specific measurement, dependent on the context of the risk (Bran & Vaidis, 2019) [4].

The situation-specific domains that are traditionally studied under the revealed preference approach are financial, health/safety, ethical, recreational and social (Weber, Blais, & Betz, 2002); these domains are commonly encountered and thus serve to generalize risk scores. For this study, I have adopted the contextual scales of extreme situations, specifically terrorism. These are situations that do not occur on a regular basis and thus the risk preferences of those involved are of interest to this paper.

Since stated preference elicited through a survey is not incentive compatible, there is rampant skepticism regarding how behaviourally meaningful survey questions are. It is possible for respondents to distorted self-reported risk attitudes due to numerous factors such as self-serving biases, lack of attention and strategic motives (Dohmen, *et al*., 2011). This study also employs a simpler line of survey questioning than a traditionally complicated lottery-based hypothetical.

The literature behind elicitation of stated preference indicates that an agent answering a preference survey question must perceive the responses as potentially influencing their own actions. The agent must also care about the outcome of that action. Considering the limitations placed on this study, I adopt the controversial face value assumption for the interpretation of primary data collected via a questionnaire. The face value assumption can be formally defined as "the assumption that respondents always truthfully answered the specific preference question intended to be asked" (US National Centre for Environmental Economics, 2000). This assumption can be broken down into two components: respondents always truthfully reveal preferences, and that the specific question being asked is the one being answered. While these components are rather dubious in the context of strategic behaviour, this assumption is central to many fields dependent on survey research and will thus be employed in this study as well.

Review of Empirical Literature
1. Adam, Rose (2021) [13] in his paper 'Behavioural Economic Consequences of Disasters: A Basis for Inclusion in Benefit-Cost Analysis' aims to establish a framework to

include behavioural effects into BCA (Benefit-Cost Analysis) of disasters and their economic consequences. It provides a valuable delineation of behavioural responses affecting Business Interruption (BI) losses. This delineation is a valuable tool that I have adopted in the structure of the present paper: mandatory/voluntary avoidance, and aversion. The paper provides a background on behavioural impacts and risk, a categorization of behavioural effects and an economic welfare analysis. Economic effects of behavioural factors can be analysed using interpretations of demand, supply and consumer and producer surpluses with the addition of a welfare analysis.

2. Dohmen, Thomas; Falk, Armin; Huffman, David; Sunde, Uwe; Schupp, Jürgen & Wagner, Gert G. (2011) in their paper 'Individual Risk Attitudes: Measurement, Determinants and Behavioural Consequences' seek to capture the effects of individual differences (such as gender and age) on risk attitudes, and whether these attitudes can be reliably measured with survey questions. Their paper investigates responses to a survey asking individuals to judge their willingness to take risks; these responses complement the behaviour in real-life lotteries with stakes. Apart from using the 'general risk question', asked as: "How willing are you to take risks, in general?", the study also conducts a field experiment with the same general risk question as well as a real-stakes lottery experiment. They conclude that a survey line of questioning was a reliable predictor of actual risky behaviour and thus lends behavioural validity to this method of study. I use this validation of survey questioning to create my own questionnaire, as well as the study's emphasis on contextual lottery alternatives to create my research questions under risk avoidance; the contexts of risk surveys are specified in this study, as it takes up contextual scales such as car driving, financial matters, sports, career and health. I choose to focus my survey on the COVID-19 pandemic and risk-taking in its aftermath.

3. Wang, Albert Y. & Young, Michael (2016) in their paper 'Terrorist Attacks and Investor Risk Preference: Evidence from Mutual Fund Flows' seek to understand the role of changing risk preferences due to an increase in terrorist activity on individuals' portfolio choices. They measure the change in demand for risky investments following spikes in the number of terrorist attacks using mutual funds as a proxy for aggregate investor preferences. By analysing a comprehensive list of domestic and transnational terrorist attacks based out of the United States of America from 1970 to 2010, they find strong evidence that mutual fund investors exhibit a significant shift in their demand for risky mutual funds after an attack. They conclude that the significance of the proximity and saliency of the attacks lends to the idea that the fear induced by terrorism is the main force driving the shift to safer assets; the reactions shown by investors are more likely due to changing views on risk and not on their perception of future shocks. In my analysis of risk aversion as observed in the September 11 attacks, I bring forth their results to supplement the risk effects of terrorist attacks through the financial lens.

4. Bran, Alexandre & Vaidis, David C. (2019) [4] in their paper 'Assessing risk-taking: what to measure and how to measure it' recommend key points for researchers to keep in mind while constructing or using measures of risk-taking, in order to increase validity and predictive power of the same. The study emphasizes six key points: (a) to pay close attention to the terminology used in studies, (b) to distinguish measures of general and specific risk-taking, (c) to distinguish risk-taking from the appeal of risky activities, (d) to keep in mind the subjectivity of risk-taking, (e) to consider the measurement of passive risk-taking, and (f) to favour more realistic risk-taking tasks. The paper concludes with a reiteration of the need for vigilance regarding the terms and methodology used in studies involving risk measurement. I implement suggestion (b) in view of COVID-19-specific risk-taking under risk avoidance.

5. Clark, David E.; McGibany, James M. & Myers, Adam (2009) in their work on 'The Effects of 9/11 on the Airline Travel Industry' seek to build on a long-run analysis of the impact of the 9/11 terrorist attacks on the U.S domestic airline industry. By modelling travel costs as a summation of time costs and psychic costs, the analysis indicated that news of airline disasters and terror threats against airlines result in a short-term decrease in airline travel due to the increase in short-term psychic costs of travel post-9/11. They conclude that while the attacks had a profound impact on the U.S airline industry, much of this impact was mitigated by time due to acclimatization to new security measures and erosion of psychological fear over time. In my analysis of risk aversion as observed in the September 11 attacks, I bring forth their results to supplement the risk effects of terrorist attacks as impact on the airline travel industry.

6. Lo Presti, Sara; Mattavelli, Giulia; Canessa Nicola & Gianelli, Claudia (2022) in their paper 'Risk perception and behaviour during the COVID-19 pandemic: Predicting variables of compliance with lockdown measures' aim to explore the psychological and cognitive factors modulating behaviour and intentions during the national lockdown in Italy by administering an online questionnaire investigating a host of risk-related attributes. They find that lockdown adherence was mostly predicted by internal locus of control, psycho-economic dimensions and personality traits related to cautionary behaviour. I employ the structure of their study in performing a quantitative analysis of risk preference in the aftermath of COVID-19.

7. Cicerale, Alessandro; Blanzien, Enrico & Sacco, Katiuscia (2021) in their paper 'How does decision-making change during challenging times?' focus on whether and how individual decision-making attitudes are prone to change in the presence of globally challenging events. Based on the Prospect Theory, this paper studies impacts after a terror attack, during the first COVID-19 lockdown in Italy, and after the first reopening. They conclude that the impacts can be explained by stress-related effects on decision-making rather than by other economic effects. These results are relevant to the present study on risk preference after extreme situations overall.

8. Stewart, Mark G.; Ellingwood, Bruce R. & Mueller, John (2011) [17] in their paper 'Homeland Security: A Case Study in Risk Aversion for Public Decision-Making' infer utility functions that reflect the level of risk averseness of regulatory agencies when adopting new safety measures – such as investing $75 billion per year of the Homeland security budget to avert terrorist attacks in the United States. It was found that the level of risk averseness needed to justify current expenditures for Homeland security is considerable. I bring forth this analysis to supplement the risk effects of terrorist attacks as impact on government decision-making.

9. Sacco, Katiuscia; Galletto, Valentina & Blanzieri, Enrico (2003) [14] in their paper 'How Has the 9/11 Terrorist Attack Influenced Decision Making?' investigate the effects of the

9/11 terrorist attacks on decision-making; they hypothesized that afterwards, people would make more conservative and less risky decisions, as a way of compensating for the feelings of insecurity caused by the disaster. Their results show the emergence of two tendencies, which are absent during 'normal' periods: a long-term search for security when outcomes are perceived as gains, and a medium-term risk-averse behaviour in the loss domain. I utilize these results to supplement the risk effects of terrorist attacks on investor behaviour.

10. Weber, Elke U.; Blais, Ann-Renée & Betz, Nancy E. (2002) in their paper 'A Domain-specific Risk-attitude Scale: Measuring Risk Perceptions and Risk Behaviors' present a psychometric scale that assesses risk-taking in five content domains: financial decisions, health/safety, recreational, ethical and social decisions. They concluded that respondents' degree of risk-taking was highly domain-specific, i.e., not consistently risk-averse or risk-seeking across all domains. I implement this result in specifying a domain or context for respondents in the quantitative analysis on risk avoidance after COVID-19.

Analysis
Aversion (9/11)

Under risk aversion, I undertake a qualitative analysis of the behavioural effects of the World Trade Centre attack on September 11, 2001.

One of the first ports of call after a tragedy such as 9/11 is an analysis of the economic consequences. This area is well-researched and most importantly, quantifiable. Behavioural consequences are, however, more deep-rooted and long-lasting. These consequences have the potential to permeate the financial, travel and employment decisions of individuals. The behavioural aspect that this paper will focus on is that of risk preference.

The impacts of 9/11 were multi-fold. It resulted in a marked tendency towards safer portfolio decisions by investors, portfolio shifts into more liquid and relatively safe short-term assets; reduction in airline travel and decreased sale of lottery tickets. This change was caused by both the one-off psychological shock of the attacks as well as a sudden escalation of uncertainties about future actions and reactions (Sacco, Galletto, & Blanzieri, 2003) [14].

Impacts on airline travel were particularly damaging since the attacks on the World Trade Centre and the Pentagon were carried out by hijacking commercial airlines. In light of the attack, the U.S Government grounded commercial flights for three days, resulting in a 31.6% reduction in travel volume in September 2001 as compared to September 2000 (Clark, McGibany, & Myers, 2009). There was a drastic increase in travel costs in terms of both time costs and psychological costs; the increased airport security increased the amount of time needed to travel by air, and the disutility associated with this increased security adds to the existing psychological discomfort. While the impacts are slowly mitigated over time, the airline industry continues to feel the effects, at least indirectly, even years after 9/11.

Investor risk preference is another field in which such attacks have a drastic impact. According to Wang & Young (2016), investors exhibit a significant shift in their demand for risky mutual funds after an attack, with aggregate flows to equity funds dropping by 43% and aggregate flows to government bonds and money market funds increasing by 49% and 66% respectively. Investors located closer to an area attacked in

the recent past are more sensitive to the consequences of the attack; similarly, attacks with higher media coverage may also result in a greater emotional response translating as fear. Investors also prefer large market capitalization equity funds as compared to small and mid-cap funds following a spike in attacks. However, they find that the effects of the attack decline in magnitude after two months for equity funds, one month for bond funds and insignificant effects on money market funds after three months. Ultimately, they conclude that while some part of investors' reactions can be attributed to their perception of future shocks and cash flows, it is more likely to be due to their varying levels of risk aversion following a terrorist attack.

This tendency of risk aversion also translates into the nature of decision-making by governments and their regulatory agencies (Stewart, Ellingwood, & Mueller, 2011) [16]. High-consequence events such as 9/11 lead decision-making to be more risk-averse due to the catastrophic nature of the event. Generally, governments and regulatory agencies tend to take decisions in a risk-neutral manner, as confirmed by the U.S Office of Management and Budget (OMB) in 1992: "the standard criterion for deciding whether a government program can be justified on economic principles is net present value" (which is estimated based on unbiased data). However, on this basis, many security measures taken after 9/11 may fail a cost-benefit analysis; for example, the Federal Air Marshal Service fails a cost-benefit analysis even with a margin of error of more than 1000% (Stewart & Mueller, 2008) [17], illustrating the significant opportunity costs of the Federal Air Marshal Service. They recommend that such large expenditures as incurred by regulatory agencies may be used efficiently for other security and counter-terrorism programmes. Considering the multihazard environment today, such focused expenditure may be better used in a wider range of cost-effective risk reduction programmes.

Thus, the attacks of September 11 show the myriad effects of risk aversion on the economy, travel and financial markets. These fear-motivated responses result in a risk-averse reaction where 'people are inclined to refrain from various activities but can be induced to alter their behaviour' (Rose, 2021) [13]. This is validated by the fact that all impact was restricted to the short-term and eventually wore off in the long-term, albeit having lasting impacts. These effects translated into a more macroeconomic level of resiliency: the actual Gross Domestic Product (GDP) growth value for 2002 of 2.4% was much higher than the GDP growth forecast of November 2001 of -0.75%. (Roberts, 2009) [12]. While the contribution of errors and anticipated negative shocks that did not materialize must be noted, a significant reason for the recovery is the mitigation responses of both the private and public sectors. This resiliency in the short run but especially in the long-run exhibits the behavioural equilibrium that the economy tends to revert to after such a tragic incident.

Avoidance (COVID-19)

Under risk avoidance, I undertake a quantitative analysis of risk preference in the context of the COVID-19 global pandemic. This study is loosely based on the exploration of psychological and cognitive factors modulating behaviour during the national lockdown in Italy as performed by Lo Presti, Mattavelli, Canessa, & Gianelli in their paper 'Risk perception and behaviour during the COVID-19 pandemic: Predicting variables of compliance with lockdown measures' (2022).

Participants

The sample included 178 respondents who participated in the study between 20 September 2022 and 5 October 2022, i.e., in a time frame well after the last lockdown in January 2022 after the Omicron variant in the third wave (no fourth wave occurred). The demographic characteristics of the 178 respondents (65.73% women, 52,25% of age 18-23 years) are detailed in Table 1.

Table 1: Summary of the socio-demographic characteristics of the sample.

Gender	Man	54	30.34%
	Woman	117	65.73%
	Transgender	1	0.56%
	Non-binary	3	1.69%
	Prefer not to say	3	1.69%
Age	**Distribution**		
	13-17	8	4.49%
	18-23	93	52.25%
	24-32	12	6.74%
	33-45	10	5.62%
	45-59	52	29.21%
	>60	3	1.69%
	Mean	33.54	
	Standard Deviation	28.16	
Annual Household Income	Less than Rs 1,00,000	14	7.87%
	Rs 1,00,000 - 4,00,000	16	8.99%
	Rs 4,00,000 - 7,00,000	15	8.43%
	Rs 7,00,000 - 12,00,000	17	9.55%
	Rs 12,00,000 - 23,00,000	21	11.80%
	Rs 23,00,000 - 30,00,000	14	7.87%
	Rs 30,00,000 - 50,00,000	12	6.74%
	More than Rs 50,00,000	19	10.67%
	Prefer not to say	50	28.09%
Position during the pandemic	Essential Workers	153	85.96%
	Non-essential Workers	25	14.04%
Frequency of news-reading	Mean	3.53	

Design of the study

Primary data regarding risk-taking was elicited from respondents via an internet-based questionnaire administered using the online platform Google Forms in which anonymity was maintained and responses were confidential. While the survey intended responses from a varied population, it naturally elicited responses from primarily Indian college students. Respondents were obtained via social networks (WhatsApp and LinkedIn) and word of mouth. To avoid any response biases, the questionnaire only explicitly indicated research for a project while it was implicitly related to COVID-19. No restrictions were imposed on the participants and they could complete the form in less than three minutes, so as to avoid inaccurate answers provoked by a lengthy survey. Data were collected anonymously (no emails were collected) and stored offline for subsequent analysis.

Baseline Factors in Consideration

The following factors were considered as baseline approximators for risk behaviour as structured in the questionnaire.

Covid-19 circumstances. Participants first indicated whether they were an essential/frontline worker during the COVID-19 pandemic. Then, on a linear scale of 1 to 10, they were asked, 'How much financial/employment difficulty would you say you experienced during the pandemic?'. Similarly, on a scale of 1 to 10, they were asked, 'How much has your overall life satisfaction improved compared to during the pandemic?' I introduced these measures since: (a) frontline workers who perhaps experienced difficulties during the pandemic may be able to subjectively evaluate their present happiness when reminded of their past, and (b) non-frontline workers who may not have experienced severe difficulties may be able to revise their potentially inflated assessment of the adversity they faced (when contrasted with frontline workers).

Contextual risk preference assessment. Participants were then proposed two scenarios, one after the other: (a) 'Assume a COVID-free climate, but there is a 10% chance of COVID returning. You are offered a first-mover advantage to invest in a new financial instrument. This costs roughly 5% of your annual household income, and you have a 60% chance of doubling it in the next year. How likely are you to invest? Assume you have full control over your finances.' and (b) 'Assume a COVID-free climate, but there is a 30% chance of COVID returning. You are offered a first-mover advantage to invest in a new financial instrument. This costs roughly 5% of your annual household income, and you have an 80% chance of doubling it in the next year. How likely are you to invest? Assume you have full control over your finances.' These scenarios are aimed at measuring the change in risk preference when moderated by a changes in external factors (varying probability of COVID-19 returning), and potential returns from the financial instrument (60% as opposed to 80%) with investment principal kept constant.

Socio-demographic data. The final part of the survey aimed to collect socio-demographic data of the participants: gender, age, annual household income, level of education and frequency of news-reading, in addition to whether they are essential workers or not. These characteristics have been detailed in Table 1.

Statistical Analysis

A primary analysis of the collected data has been performed,

involving regression analysis, analysis of variance (ANOVA) and simple hypothesis testing. This analysis aims to clarify the relationship between socio-demographic characteristics, COVID-19 circumstances and contextual risk preference assessment, i.e., the baseline predictors in consideration.

Lower risk: 10% risk of COVID-19 returning, level of financial/employment difficulty. The following section details the regression analysis, ANOVA (Table 2) and line of best fit (Figure 1) for the relationship between the level of financial difficulty and the likelihood of investing in the instrument with a 60% chance of doubling in the next year with 10% chance of COVID-19 returning. (The mean likelihood of investing in this scenario was computed at 6.38 (on a scale of 1 to 10)).

To test the overall significance of the model, the following hypotheses are assumed:

H_0: There is no significant relationship between the level of financial difficulty and the likelihood of investing in the instrument with a 60% chance of doubling in the next year and with 10% chance of COVID-19 returning.

Table 2: Regression Model

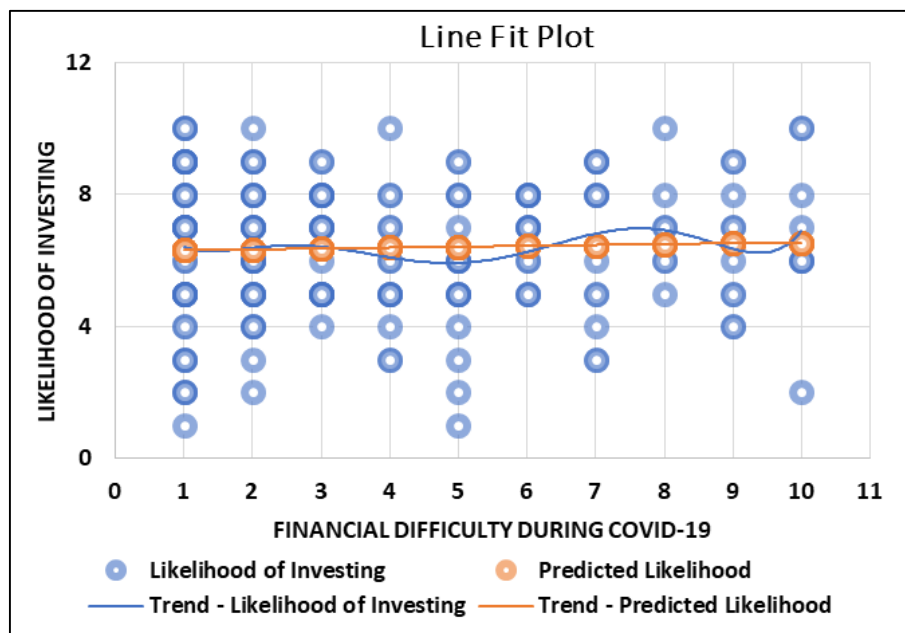| X: Level of Financial Difficulty; Y: Likelihood of Investing (Chance of COVID Returning: 10%)						
Multiple R	**0.036400869**					
R Square	0.001325023					
Adj R Square	-0.004349266					
S.E	2.062969884					
Observations	178					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	*F-crit*
Regression	1	0.993797208	0.993797208	0.233513502	0.629531366	**1.28176528**
Residual	176	749.0286747	4.255844743			
Total	177	750.0224719				

Fig 1: Line of Best Fit

H_1: There is a statistically significant relationship between the level of financial difficulty and the likelihood of investing in the instrument with a 60% chance of doubling in the next year and with 10% chance of COVID-19 returning.

Significance F, i.e., the p-value of the F-test at significance level $\alpha = 0.05$, is greater than α (0.62>0.05). Thus, the sample data does not provide sufficient evidence to conclude that the regression model fits the data better than a model with no independent variables and thus the null hypothesis H_0 cannot be discredited. Further, the F-value as computed in the ANOVA is lower than the critical F-value at degrees of freedom 176 and 177 (0.23<1.28), and therefore the model is not statistically significant and alternative hypothesis H_1 is rejected.

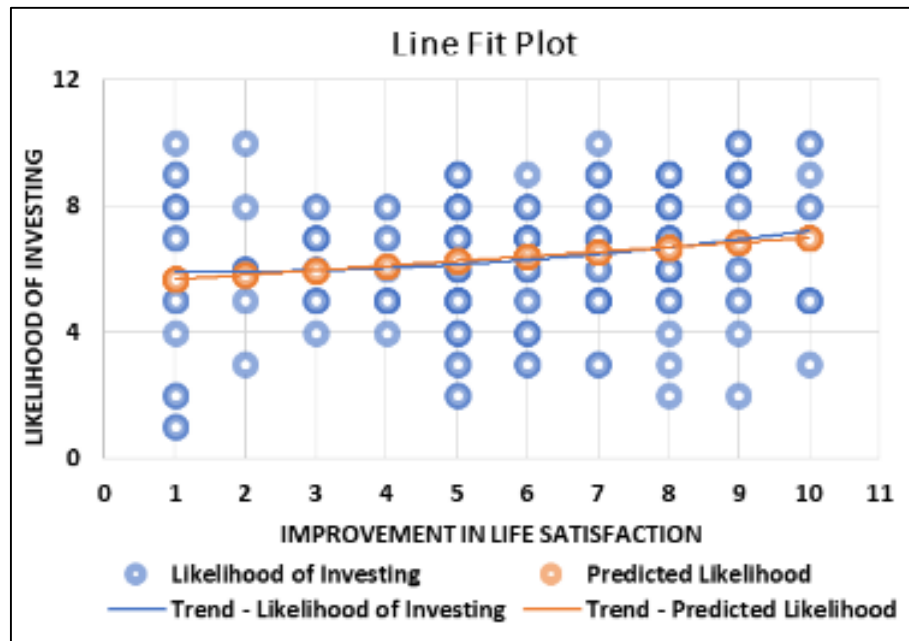**Lower risk: 10% risk of COVID-19 returning, improvement in life satisfaction.** The following section details the regression analysis, ANOVA (

Table 3) and line of best fit (Fig 2) for the relationship between the level of improvement in life satisfaction and the likelihood of investing in the instrument with a 60% chance of doubling in the next year with 10% chance of COVID-19 returning. (The mean likelihood of investing in this scenario was computed at 6.38 (on a scale of 1 to 10)).

Table 3: Regression Model

X: Level of Improvement in Life Satisfaction; Y: Likelihood of Investing (Chance of COVID Returning: 10%)						
Multiple R	0.180876722					
R Square	0.032716389					
Adjusted R Square	0.027220459					
Standard Error	2.030288332					
Observations	178					
Anova						
	df	SS	MS	F	Significance F	F-crit
Regression	1	24.53802664	24.53802664	5.952839812	0.015685245	1.28176528
Residual	176	725.4844453	4.122070712			
Total	177	750.0224719				

Fig 2: Line of Best Fit

To test the overall significance of the model, the following hypotheses are assumed:

H_0: There is no significant relationship between the level of improvement in life satisfaction and the likelihood of investing in the instrument with a 60% chance of doubling in the next year and with 10% chance of COVID-19 returning.

H_1: There is a statistically significant relationship between the level of improvement in life satisfaction and the likelihood of investing in the instrument with a 60% chance of doubling in the next year and with 10% chance of COVID-19 returning.

Significance F, i.e., the p-value of the F-test at significance level $\alpha = 0.05$, is lesser than α (0.01<0.05). Thus, the sample data provide sufficient evidence to conclude that the regression model fits the data better than a model with no independent variables and thus the null hypothesis H_0 can be discredited. Further, the F-value as computed in the ANOVA is higher than the critical F-value at degrees of freedom 176 and 177 (5.95>1.28), and therefore the model is statistically significant and null hypothesis H_0 is rejected.

Higher risk: 30% risk of COVID-19 returning, level of financial/employment difficulty. The following section details the regression analysis, ANOVA (

Table 4) and line of best fit (Fig 3) for the relationship between the level of financial difficulty and the likelihood of investing in the instrument with an 80% chance of doubling in the next year with 30% chance of COVID-19 returning. (The mean likelihood of investing in this scenario was computed at 6.02 (on a scale of 1 to 10)).

To test the overall significance of the model, the following hypotheses are assumed:

H_0: There is no significant relationship between the level of financial difficulty and the likelihood of investing in the instrument with an 80% chance of doubling in the next year and with 30% chance of COVID-19 returning.

H_1: There is a statistically significant relationship between the level of financial difficulty and the likelihood of investing in the instrument with an 80% chance of doubling in the next year and with 30% chance of COVID-19 returning.

Table 4: Regression Model

X: Level of Financial Difficulty; Y: Likelihood of Investing (Chance of COVID Returning: 30%)						
Multiple R	0.084024542					
R Square	0.007060124					
Adj. R Square	0.00141842					
S.E	2.339219017					
Observations	178					
Anova						
	df	SS	MS	F	Significance F	F-crit
Regression	1	6.847685358	6.847685358	1.251416927	0.264806522	**1.28176528**
Residual	176	963.062427	5.471945608			
Total	177	969.9101124				
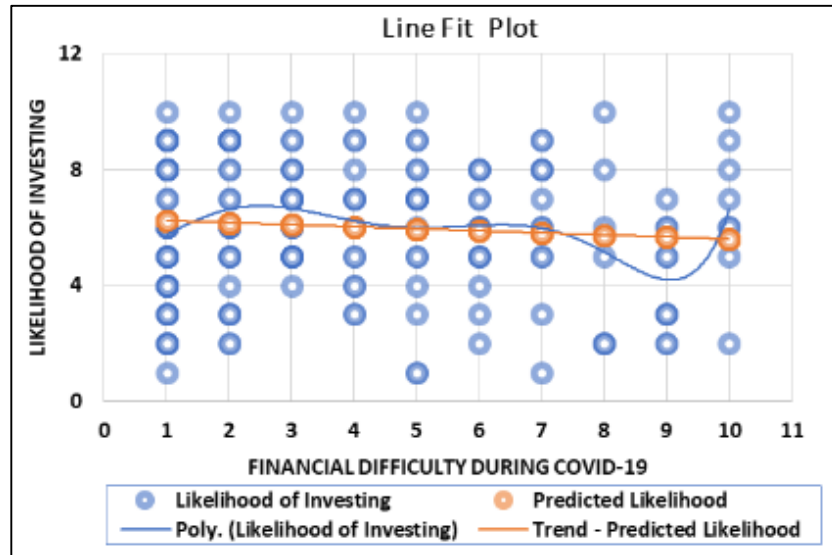
Fig 3: Line of Best Fit

Table 5: Regression Model

X: Level of Improvement in Life Satisfaction; Y: Likelihood of Investing (Chance of COVID Returning: 30%)						
Multiple R	0.163269505					
R Square	0.026656931					
Adj. R Square	0.021126573					
S.E	2.316020398					
Observations	178					
ANOVA						
	df	SS	MS	F	Significance F	F-crit
Regression	1	25.85482727	25.85482727	4.820109236	0.029437805	**1.28176528**
Residual	176	944.0552851	5.363950483			
Total	177	969.9101124				

Significance F, i.e., the p-value of the F-test at significance level $\alpha = 0.05$, is greater than α (0.26>0.05). Thus, the sample data does not provide sufficient evidence to conclude that the regression model fits the data better than a model with no independent variables and thus the null hypothesis H_0 cannot be discredited. Further, the F-value as computed in the ANOVA is lower than the critical F-value at degrees of freedom 176 and 177 (1.25<1.28), and therefore the model is not statistically significant and alternative hypothesis H_1 is rejected.

Higher risk: 30% risk of COVID-19 returning, improvement in life satisfaction. The following section details the regression analysis, ANOVA (Table 5) and line of best fit (Fig 4) for the relationship between the level of improvement in life satisfaction and the likelihood of investing in the instrument with an 80% chance of doubling in the next year with a 30% chance of COVID-19 returning. (The mean likelihood of investing in this scenario was computed at 6.02 (on a scale of 1 to 10)).
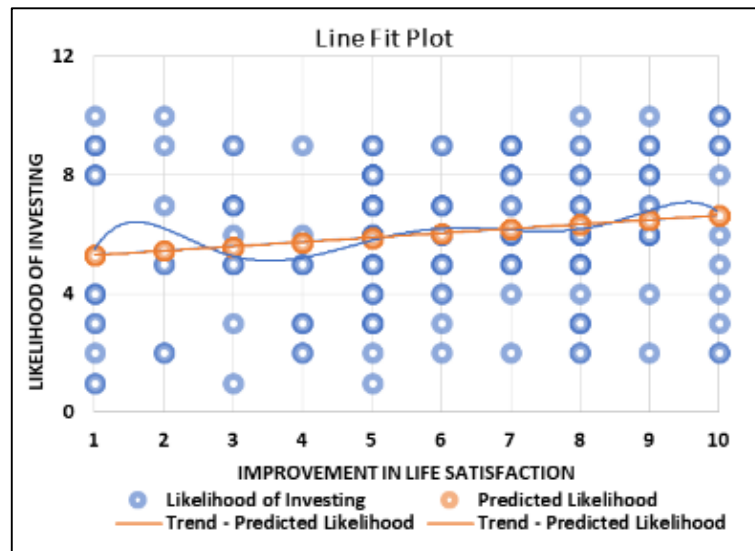
Fig 4: Line of Best Fit

To test the overall significance of the model, the following hypotheses are assumed:

H_0: There is no significant relationship between the level of improvement in life satisfaction and the likelihood of investing in the instrument with an 80% chance of doubling in the next year and with 30% chance of COVID-19 returning.

H_1: There is a statistically significant relationship between the level of improvement in life satisfaction and the likelihood of investing in the instrument with an 80% chance of doubling in the next year and with 30% chance of COVID-19 returning.

Significance F, i.e., the p-value of the F-test at significance level $\alpha = 0.05$, is lesser than α (0.03<0.05). Thus, the sample data provide sufficient evidence to conclude that the regression model fits the data better than a model with no independent variables and thus the null hypothesis H_0 can be discredited. Further, the F-value as computed in the ANOVA is higher than the critical F-value at degrees of freedom 176 and 177 (4.82>1.28), and therefore the model is statistically significant and null hypothesis H_0 is rejected.

Results

It follows from the above analysis that the level of improvement in life satisfaction has a larger bearing on the likelihood of investing (and therefore risk-taking) than financial difficulty; both models involving a 10% chance of COVID-19 returning and a 30% chance of COVID-19 returning were statistically significant only in relation to improvement in satisfaction. This may be attributable to a variety of factors: (a) by framing the questionnaire such that respondents were asked about difficulties first and happiness next, their reference points were lower than they would have been if they were not reminded of the adversity they may have faced; (b) due to the salience of a positive element as opposed to a negative element, respondents may be induced to seek risk more than they would have normally and (c) in general, many are dulled to the effects of COVID-19 due to prolonged exposure over a period of two years and may thus not moderate their preferences according to it.

At this juncture, it is important to note the roles of anchoring and behavioural inattention: respondents were faced with two clear-cut risk probabilities of 10% and 30% and may have

been more risk-seeking as they considered 10% as the anchor or reference point. Using this lower anchor, they may have considered 30% to be a 'bigger number' and automatically moderated their preference without processing what those probabilities reflect in their decision-making. Further, it is highly likely that the chances of doubling the investment were considered as 'less important' factors due to natural inattention; the numbers 10% and 30% are easier to fixate on, compared to adding 60% and 80% which were more deeply embedded in the questions of the survey. However, these roles are, for the most part, conjecture and thus do not have any statistical backing.

The relationship between contextual risk-taking and level of improvement in life satisfaction was exhibited to be positive in both cases: the regression coefficient was +0.146 when the chance of COVID-19 returning was 10% and the chance of doubling was 60%, and +0.149 when the chance of COVID-19 returning was 30% and the chance of doubling was 80%. That is, with every successive improvement in the level of life satisfaction of an individual, they are more likely to undertake both low-risk and comparatively higher-risk investments.

However, this was not the case for the relationship between contextual risk-taking and financial difficulty faced during COVID-19: the regression coefficient was +0.026 when the chance of COVID-19 returning was 10% and the chance of doubling was 60%, and -0.071 when the chance of COVID-19 returning was 30% and the chance of doubling was 80%. That is, when financial difficulty increases, the likelihood of investing in a lower-risk instrument increases, whereas the likelihood of investing in a higher-risk instrument decreases. This is a natural display of loss aversion: the tendency to prefer avoiding losses to acquiring equivalent gains. Thus, the crucial tenet of loss aversion is maintained in this sample. With reference to socio-demographic factors, women showed a larger gap in choosing lower versus higher risk investments, (6.18 versus 5.94) compared to men, transgender and non-binary respondents. Further, respondents in the age group of 33-45 had the largest difference in choosing lower versus higher risk investments (1.30), followed by those in the age group of 24-32 (0.58). Those in the age group of 18-23 had a difference of exactly 0, showing the variance of risk appetite across age groups and a gradual increase of risk aversion with

age. Respondents who had completed/are pursuing Bachelors, completed/pursuing secondary schooling and none of the above had a higher propensity for risk-taking as measured on the risk scale in both scenarios (6.43, 6.11; 6.9, 5.85) as compared to those who completed/pursuing a Masters or PhD (6.12,5.87). Respondents who had a news-reading frequency score of 1-2 were more risk averse (5.57, 5.60) as compared to those who had a score of 3 (6.34, 6.06) and 4-5 (6.68, 6.19). This may be attributed to the lack of COVID-19 news in current news as compared to a year or two ago (when scorers of 1 and 2 were more likely to watch the news as compared to now).

As indicated in the section on the pressing limitations of this study, the findings of this analysis must be considered in light of those facts. The online format of the survey required simplified lines of questioning as well as fewer questions; due to lack of funding, respondents would not be otherwise incentivized to participate in the survey. There are many confounding factors involved in this study that could not be accounted for; individual experiences during the global pandemic, domestic conditions of respondents and any other extenuating circumstances. The sample was also inhomogeneous as it naturally attracted younger, higher-income respondents. The employment of a crucial assumption, the face value assumption, is essential to a survey-based study but has its pitfalls when it comes to the individual psyches of respondents. The endurance of the results of this study also depends on the variance in results of other online surveys compared to laboratory studies.

Conclusion

This research paper highlighted changes in risk preference across extreme situations that humans do not encounter regularly – terrorist attacks (9/11) and a global pandemic (COVID-19) – categorized under risk aversion and risk avoidance. In the case of risk aversion, there was a short-term escalation in fear-motivated risk aversion, but a tendency to return to behavioural equilibrium as soon as three months afterwards was exhibited. In the case of risk avoidance, there was a stronger relationship established between the level of improvement in life satisfaction after the global pandemic and both higher and lower risk instruments, than with the level of financial difficulty faced during the pandemic. There was also a natural display of loss aversion and a noticeable effect of socio-demographic factors on risk perception. From a wider perspective, the present results seek to bridge the gap in research on risk perception in the aftermath of COVID-19 as opposed to towards COVID-19, as well as augment the existing research reinforcing the relevance of behavioural factors in disaster recovery and risk perception.

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