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Risk-taking, resilience, and state anxiety during the COVID-19 pandemic: A coming of (old) age story

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ABSTRACT

The current COVID-19 pandemic has created an unprecedented hostile psychological environment for individuals. Against the backdrop of this exogenous shock and applying a Cumulative Prospect Theory framework, we examined a relationship between risk-taking, trait resilience, and state anxiety, wherein age moderates the relationship between trait resilience and risk-taking, on state anxiety during the pandemic. We assess risk-taking using a behavioral measure and assess trait anxiety, big five personality traits, and other demographic factors in a sample of 515 individuals in the United States. Regression analysis revealed that age moderates the relationship between risk-taking and state anxiety and that highly resilient, risk-tolerant individuals experience lower state anxiety than less resilient risk-averse individuals. In contrast, older, more resilient, risk-averse individuals experience lower state anxiety than their younger, more resilient, risk-averse counterparts. Study limitations are noted, and additional research is suggested.

1. Introduction

COVID-19 and the subsequent worldwide pandemic have created an unprecedented hostile psychological environment, and the adverse mental health effects of the virus likely will continue for some time to come. For example, existing research already suggests that the current pandemic COVID-19 and similar outbreaks have resulted in high levels of "schizophrenia, anxiety, depression, and acute stress disorder among both the healthcare personnel and the public" as a result of the virus and its economic and psychological implications (Arpaci, Karataş, & Baloğlu, 2020, p.1). However, the COVID-19 crisis has impacted some individuals differently than others. In particular, older individuals or those who have pre-existing conditions are considered at "high risk" of suffering more negative and sometimes even fatal effects from the virus (CDC, 2020). Have heightened physical risks resulted in more significant mental health effects on older individuals? In the present study, we examine possible traits and individual differences, such as trait resilience, to understand how those differences help mitigate pandemics' impact. Most importantly, we focus on the relationship between state anxiety and the interaction of trait resilience and risk-taking behavior while examining a moderating effect of age. We outline a set of hypotheses based on Cumulative Prospect Theory (Tversky & Kahneman, 1992) and discuss findings and implications.

2. Behavior during a pandemic and key individual differences

According to Cumulative Prospect Theory (CPT; Tversky & Kahneman, 1992), individuals derive utility from gains and losses relative to some reference point, e.g., the gain of returning to school/work compared to the loss of potentially falling sick versus remaining safe and healthy. While individuals seek profits and avoid losses, they are much more sensitive to losses, even small ones, than to potential gains. This contradicts the idea of expected utility as an aid to decision-making. Additionally, while people prefer gains to losses, they also prefer the risk of loss over a guaranteed loss, even when the potential loss is larger (a.k.a. diminishing sensitivity to losses). We expect that this paradigm can help explain behaviors during a pandemic, such as the ongoing COVID-19 crisis. For example, while the potential loss of becoming sick with COVID-19 (major illness, loss of work and income, hospitalization, and death) is considerable, it is still potentially a small risk compared to a significant chance that someone might experience gains by resuming their work-life activities (economic and social benefits). Hence, according to CPT, individuals will weigh the potential gains and losses associated with their behavior during a pandemic and will consider

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potential losses more than potential gains. This may result in risk-taking behavior consistent with risk acceptance or high tolerance for risk. At the same time, it is likely that more resilient individuals (i.e., individuals who score high on trait resilience) are more likely to cope effectively with an exogenous shock and resume their previous activities sooner, despite the potential risks associated with those activities. Hence, the interaction between these two traits might be particularly important in advancing our understanding of how individual differences lead to varying behaviors during a crisis. Finally, given the aforementioned higher impact of COVID-19 on the elderly population regarding decreased social contacts and increased state anxiety, we discuss previous research on risk-taking with a particular focus on age as a moderating factor.

2.1. Risk-taking behavior

Risk-taking is a ubiquitous yet frequently a controversial element in decision-making (Cox & Harrison, 2008). Based on the work by Leigh (1999) and Lejuez et al. (2002), we define risk-taking behaviors as those behaviors that "involve some potential for danger or harm while also providing an opportunity to obtain some form of reward" (Lejuez et al., 2002: 75). Individuals who are more likely to engage in risk-taking behavior are often referred to as risk-tolerant, while individuals who are more cautious and less likely to engage in risk-taking behavior are known as risk-averse. Risk-taking behavior is considered an essential human characteristic and has been studied in relation to economic activity (e.g., Mann, Krueger, & Vohs, 2020), decision-making (Boyer, 2006), and in a variety of contexts, including in the presence of exogenous shocks such as massive earthquakes (Llanos-Contreras, Alonso-Dos-Santos, & Ribeiro-Soriano, 2020) and significant floods (Cameron & Shah, 2015; Said, Afzal, & Turner, 2015). To better understand human risk-taking and decision making, experiments have often been employed as a research methodology (Cox & Harrison, 2008). These previous studies suggest that exogenous shocks result in a reduction of risk-taking behavior in the future and that this relationship may be more robust in older individuals.

The extant literature suggests that tolerance for risk-taking decreases with age (Caliendo, Fossen, & Kritikos, 2009; Deakin, Aitken, Robbins, & Sahakian, 2004; Henninger, Madden, & Huettel, 2010; Rolison, Hanoch, & Wood, 2012; Tymula, Belmaker, Ruderman, Glimcher, & Levy, 2013); however, research on this topic remains inconclusive. For example, some prior research found mixed results for the relationship between age and risk-taking (Best & Charness, 2015), including a meta-analysis encompassing 30 studies with a total of 4093 participants (Mata, Josef, Samanez-Larkin, & Hertwig, 2011). Research differences may be related to the decision task contexts and settings and whether the measure utilized assesses deliberative processes or experiential processes (Koscielniak, Rydzewska, & Sedek, 2016). The age differences in risk-taking appear to be related to tasks that involve calling on prior experience rather than related to tasks that require learning. During an exogenous shock, such as the COVID-19 crisis, individuals might engage in different risk-taking behaviors than they would normally. We stipulate that such behavior differences may be influenced by specific individual characteristics, such as trait resilience.

2.2. Trait resilience

Resilience has gained popularity only recently. Resilience refers to the tendency to maintain stable, healthy functioning after a potentially traumatic life event and is a dynamic process that includes positive adaption in the face of adversity (Oshio, Taku, Hirano, & Saeed, 2018). Studies suggested that the big five personality traits relate to resilience (Di Fabio & Saklofske, 2018; Oshio et al., 2018), as do other behavior-related outcomes like forgiveness (Halilova et al., 2020) and overall quality of life (Pyszkowska, 2020).

Based on initial research on age and resilience (Gerino, Rollè, Sechi, & Brustia, 2017), subsequent studies examined resilience as a characteristic of the community and found increased resilience as community members aged with the effects plateauing among 61 to 75-year-olds (Cohen et al., 2016). Previous research suggested that older individuals are more resilient, particularly with problem-solving and emotion regulation (Mather, 2006). However, the level of resilience among younger adults was related to their availability of social support (Gooding, Hurst, Johnson, & Tarrier, 2012).

2.3. State anxiety during a pandemic

Anxiety is an emotional state characterized by feelings of tension and worry, increases in blood pressure, and the anticipation of future threat or danger conceptualized as either state and trait anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). State anxiety comprises an emotional episode provoked by the anticipation of an imminent threat, while trait anxiety indicates the dispositional tendency to experience heightened anxiety in response to threat (Eysenck, 1983). Scholars have examined state anxiety and reduced cognitive functioning in healthy adults (e.g., Meissel & Salthouse, 2016), social popularity (Gruda & Hasan, 2018; Gruda & Hasan, 2019), personality, job characteristics, and depression (Booth, Murray, Marples, & Batey, 2013).

Prior research has also explored age differences in the manifestation of state anxiety (Kadoya & Khan, 2018; Lee, Gatz, Pedersen, & Prescott, 2016). It seems the relationship between state anxiety and age is complex, with the prevalence of state anxiety declining as people age from the 40s to the 60s, mildly increasing again after the 60s and plateauing in the 80s (Lee et al., 2016). Scholars also found that this relationship is impacted by other factors such as financial literacy, the presence of children, and having a current spouse (Kadoya & Khan, 2018).

To summarize, exogenous shocks are related to lower levels of risk-taking and risk tolerance and risk tolerance is reduced as individuals age. Trait resilience is associated with bouncing back after an adverse life event or external shock, and older individuals tend to display higher levels of resilience. State anxiety is an emotional episode based on anticipated threats, and state anxiety is lower in older individuals. During and following an exogenous shock like the current pandemic, feelings of anxiety are expected, risk-taking may decrease, especially among older people, and individuals with high levels of resilience may experience less state anxiety.

Accordingly, we hypothesize that trait resilience moderates the relationship between risk-taking behavior and state anxiety during the COVID-19 pandemic, such that highly resilient, risk-tolerant individuals experience lower state anxiety than less resilient risk-averse individuals. We further hypothesize that age moderates the relationship between trait resilience and risk-taking on state anxiety during the COVID-19 pandemic, such that older, more resilient, risk-averse individuals will experience lower state anxiety than their younger, more resilient, risk-averse counterparts.

3. Methodology

For the present study, participants were recruited on Amazon Mechanical Turk. In total, 539 participants completed the survey. However, after excluding participants for failing attention check questions (Meade & Craig, 2012), the final sample comprised 515 (222 female and 293 male) participants. The respective data was collected in May 2020. Participants were compensated between $1.75 – $2 US for each completed survey. The range in compensation was due to the inclusion of additional items and the data in this paper was part of a more extensive data collection process. Participants were 40.84 years old on average (SD = 12.34) and had 18.70 years of work experience on average (SD = 11.57). The majority (53.01%) of our participants were employees in a non-supervisory role.

3.1. Measures

3.1.1. State anxiety

State anxiety (α = 0.92) was measured using the short version (Marteau & Bekker, 1992) of the original State and Trait Anxiety Inventory, developed by Spielberger et al. (1983). This short-scale includes six items on a 4-point (1 = "Not at all" to 6 = "Very much") Likert scale. Scale instructions were modified to reflect that participants were to "read each statement and then indicate how [they] have been feeling throughout the pandemic."

3.1.2. Risk-taking behavior

Risk-taking behavior was measured using the Balloon Analogue Risk Task (BART). The BART is a computerized measure of risk-taking behavior, which "uses contingencies that simulate risk situations in the natural environment to identify an overall propensity for risk-taking rather than a unique likelihood of engaging in a particular type of risk behavior" (Lejuez et al., 2002: 83). In the task, participants are shown a balloon and offered a chance to earn points by pumping the balloon. Each pump (i.e., click) inflates the balloon, and points are added to a counter. However, at some point, the balloon will overinflate and explode; should the balloon explode, participants would lose all points for that round. Alternatively, participants can choose to "cash-out" their points for each round whenever they wish to do so, as long as the balloon has not exploded. Hence, although a higher number of pumps equal a higher potential reward, each additional pump also carries a greater risk that the balloon will burst. Ahead of the task, participants are not informed about the balloon breaking threshold. This is done for two main reasons: it allows researchers to examine initial task responses and respond to changes as participants complete the task over multiple rounds. Participants were asked to play ten rounds in total. The BART has also been administered to participants who have suffered from difficult and even traumatic experiences (Augsburger & Elbert, 2017).

Finally, we recognize that participants on the Amazon Mechanical Turk platform are encouraged to complete tasks as quickly as possible, which could skew our BART results. Hence, participants were informed that should they score in the top 10% of all participants on this task, they would have the chance to win an additional $10 bonus payment. The respective bonus payment was paid out after all responses had been collected.

3.1.3. Trait resilience

Trait resilience (α = 0.94) was measured using the Brief Resilience Scale (Smith et al., 2008). The scale is composed of six items, which are scored on a 5-point (1 = "Strongly disagree" to 5 = "Strongly agree") Likert scale. Example items include "I tend to bounce back quickly after hard times" and "It does not take me long to recover from a stressful event."

3.1.4. Trait anxiety

trait anxiety (α = 0.96) was measured using the State and Trait Anxiety Inventory (Spielberger et al., 1983). The scale includes 20 items, which are scored on a 5-point (1 = "Almost Never" to 6 = "Almost Always") Likert scale. Example items include "I get in a state of tension or turmoil as I think over my recent concerns and interests" and "I worry too much over something that really doesn't matter." Participants were instructed to indicate "how [they] generally feel."

3.1.5. Personality (big five)

Participants completed the mini-IPIP scale (Donnellan, Oswald, Baird, & Lucas, 2006). The mini-IPIP scale is composed of 20 items in total, measuring openness to experience (α = 0.81), conscientiousness (α = 0.73), extraversion (α = 0.86), agreeableness (α = 0.85) and neuroticism (α = 0.82) on a 5-point (1 = "Very inaccurate" to 5 = "Very accurate") Likert scale.

4. Results

Correlations of main variables are displayed in Table 1.

Results (Model 1, Table 2) show that the relationship between state anxiety and the interaction of age, trait resilience, and risk-taking behavior is only marginally significant (b = 0.001, SE = 0.00, p = .066). However, in this initial model, we do not yet account for trait anxiety, which theoretically (and empirically) overlaps with state anxiety. While state anxiety measures anxiety over a certain amount of time, trait anxiety measures the frequency of anxiety. Naturally, individuals who score high on trait anxiety also experience higher state anxiety levels at any given point in time. Once trait anxiety is included (Model 2, Table 2), the main interaction significantly predicts state anxiety (b = 0.001, SE = 0.00, p = .03). The interaction is significant after controlling for covariates such as household income and job level (Model 3, Table 2) or personality and gender (Model 4, Table 2). To understand these results better, we graph the main interaction (Model 4, Table 2). Given that our participants are between 21 and 79 years of age, we chose to graph a ten-year interval, starting from 21, in the figure below (Fig. 1).

Simple slope analysis of the interaction (±1SD, Fig. 1) across the six different age intervals shows that the interaction effect exhibits the largest changes in older individuals a) 51–79 and more risk-averse individuals (i.e., exhibit low risk-taking behavior). Hence, risk-averse participants who score high on trait resilience report lower state anxiety compared to individuals who score low on trait resilience, however, these slopes are only significant in older participants (at 51 year of age: simple slope = −0.11, SE = −0.05, t = −2.37, p = .018; at 61 years of age: simple slope = −0.17, SE = 0.06, t = −2.72, p = .007; at 71 years of age: simple slope = −0.24, SE = 0.08, t = −2.79, p = .005). On the contrary, there seems to be little difference concerning the main interaction and state anxiety, regardless of risk-taking behavior (e.g., at 21 years of age: simple slope = 0.07, SE = 0.06, t = 1.17, p > .10).[1]

5. General discussion

The COVID-19 pandemic has impacted individuals in different ways. Prior research suggests that critical individual differences may allow people to experience different levels of state anxiety and resilience and help them cope better during ongoing health, economic, and mental health crises (e.g., Malesza & Kaczmarek, 2021; Moroń & Biolik-Moroń, 2021). In keeping with the findings of Macatee et al. (2015), we find that risk-taking behavior and trait resilience serve as two possible key characteristics as they significantly predict experienced state anxiety. However, as supported by previous research (Cavanagh et al., 2012; Koscielniak et al., 2016), we also find that age is an essential moderator of this relationship. Compared to younger populations, more risk-averse and highly resilient older individuals show the lowest state anxiety levels. In other words, while younger, more resilient, and risk-averse individuals may experience increased state anxiety during this pandemic, this relationship reverses across the life span such that elderly, more resilient, and risk-averse individuals experience less state anxiety during the COVID-19 pandemic. It seems that trait resilience and risk aversion may be beneficial to the elderly population. Two potential explanations for this finding include prior learning and heightened reward sensitivity.

On the one hand, this may be related to the tendency of older individuals to experience less state anxiety when faced with exogenous shocks if they can use prior experience to predict outcomes rather than needing to utilize learning to anticipate the consequences of the current situation (Koscielniak et al., 2016). Since young people typically lack the accumulated experience of their older counterparts, they are less able to anticipate likely outcomes. This difference is exacerbated by high levels

[1] In subsequent analyses, we also examined another possible moderator, namely gender. These results are provided as Supplementary material.

Table 1
Pairwise correlations of main and control variables.

Variables	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) State anxiety	2.17	0.80	(0.92)											
(2) Trait resilience	3.56	1.07	−0.62***	(0.94)										
(3) Risk score	9.42	4.08	0.00	−0.04	0.04									
(4) Age	40.84	12.34	−0.13**	0.12**		−0.22***	(0.96)							
(5) Trait anxiety	1.90	0.68	0.77***	−0.77***	−0.00			(0.81)	(0.73)					
(6) Openness to experience	4.02	0.90	0.19***	−0.31***	0.06	−0.06	0.33***			(0.86)				
(7) Conscientiousness	3.97	0.81	0.26***	−0.34***	−0.03	−0.07	0.43***	0.24***	0.09*		(0.85)			
(8) Extraversion	2.58	1.10	0.29***	−0.34***	0.06	−0.08	0.35***	0.19***	0.18***	0.28***		(0.82)		
(9) Agreeableness	3.83	0.91	0.11*	−0.17***	0.08	−0.11*	0.22***	0.39***	0.43***	0.31***	0.18***		0.23***	
(10) Neuroticism	2.21	0.95	0.68***	−0.75***	−0.015	−0.16***	0.84***	0.33***	−0.06	−0.27***	−0.07	−0.13**		
(11) Job level	2.17	1.46	−0.13**	0.15***	−0.00	0.05	−0.16***	−0.13**	−0.20***	−0.19***	−0.07	−0.18***	0.12**	0.03
(12) Household income	6.41	3.05	−0.10*	0.21***	0.00	−0.05	−0.21***	−0.11*	0.04	−0.11*	0.21***	−0.14**		
(13) Gender	1.57	0.50	−0.18***	0.11*	0.03	−0.12**	−0.11*	−0.04						

Note: gender was coded as female (1) or male (2); Cronbach alphas in parentheses on diagonal (where appropriate); $n = 515$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 2
Regression interaction between age, trait resilience and risk-taking on state anxiety.

Variable	Model 1	Model 2	Model 3	Model 4
Age	0.03	0.04*	0.04*	0.04**
	(1.23)	(2.43)	(2.33)	(2.71)
Trait resilience	−0.10	0.34	0.31	0.38*
	(−0.44)	(1.86)	(1.70)	(2.13)
Risk-taking	0.09	0.10	0.09	0.12*
	(1.37)	(1.64)	(1.58)	(2.17)
Age X trait resilience	−0.01	−0.01*	−0.01*	−0.01**
	(−1.65)	(−2.48)	(−2.28)	(−2.62)
Age X risk-taking	−0.00	−0.00*	−0.00	−0.00*
	(−1.55)	(−1.99)	(−1.83)	(−2.33)
Trait resilience X risk-taking	−0.03	−0.03	−0.03	−0.03*
	(−1.68)	(−1.82)	(−1.66)	(−2.12)
Age X trait resilience X risk-taking	0.001	0.001*	0.001	0.001*
	(1.84)	(2.18)	(1.92)	(2.32)
Trait anxiety		0.85***	0.85***	0.83***
		(16.24)	(16.38)	(12.03)
Household income (0-$29,999)			(*base level*)	(*base level*)
Household income ($30,000–$49,999)			0.13	0.11 (1.29)
			(1.52)	
Household income ($50,000–$79,999)			0.14	0.11 (1.24)
			(1.60)	
Household income ($80,000–$149,999)			0.19*	0.14 (1.57)
			(2.07)	
Household income (>$150,000)			0.43*	0.42*
			(2.66)	(2.59)
Job level (employee)			(*base level*)	(*base level*)
Job level (entry-level supervisor)			−0.01	−0.01
			(−0.12)	(−0.11)
Job level (lower middle management)			−0.03	−0.02
			(−0.46)	(−0.25)
Job level (middle management)			0.03	0.04 (0.60)
			(0.40)	
Job level (upper middle management)			−0.10	−0.08
			(−0.54)	(−0.45)
Job level (top-level management)			−0.17	−0.18
			(−1.35)	(−1.33)
Openness to experience				0.06*
				(2.10)
Conscientiousness				0.08*
				(0.03)
Extraversion				−0.01
				(−0.59)
Agreeableness				0.00 (0.10)
Neuroticism				0.08 (1.77)
Gender (male)				−0.13*
				(−2.49)
Constant	2.83***	−0.74	−0.83	−1.68*
		(−1.04)	(−1.17)	(−2.38)
R^2	0.38***	0.59***	0.60***	0.62***
n	515	515	514	509

Note: *t*-statistics in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

of environmental uncertainty (Grupe & Nitschke, 2013). Alternatively, younger adults may possess lower emotional regulation competency and less well-developed prefrontal cortexes since the prefrontal cortex continues to develop unto middle age (Mather, 2006). These factors may help explain why younger adults, despite being both resilient and risk-averse, still experience more anxiety than their older counterparts. Younger adults are both less effective at regulating their feelings of anxiety and less able to rationally assess the situation, apply prior learning, and predict outcomes.

On the other hand, an alternative view in the literature suggested that the explanation might be due to age-related differences concerning heightened reward-sensitivity and the initial perception of risk (Cavanagh et al., 2012; Wood, Busemeyer, Koling, Cox, & Davis, 2005). These studies suggested that increasing age is associated with higher

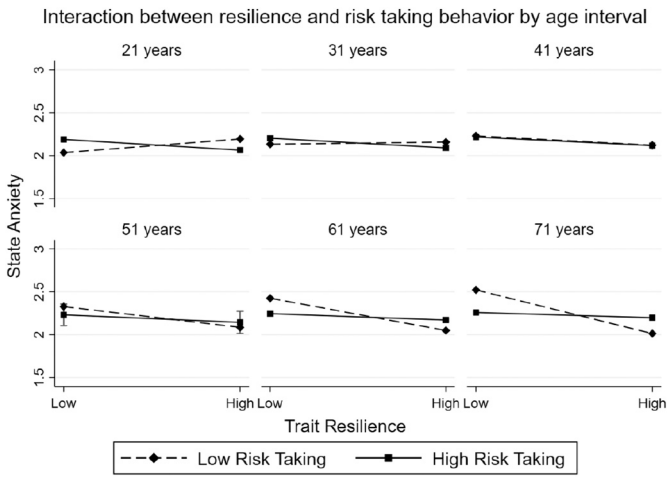

Fig. 1. Regression interaction between trait resilience, risk-taking behavior and age on state anxiety.

levels of reward-motivated risk-taking (Cavanagh et al., 2012), and older adults appear to be more motivated by potential rewards when considering whether to take risks. Future research should further investigate this phenomenon by attempting to disentangle potential causal relationships between the variables.

This study is not without limitations. The study design is not longitudinal, and the effects of the pandemic on individuals likely changes over time. Future research may wish to examine state anxiety during a pandemic over time and how adjusting to a "new normal" could reduce state anxiety, even though the relative amount of danger has not changed. This additional research could also incorporate the concept of psychological coping as a moderator.

Finally, we also did not take into account the geographical location of the participants, although it is likely that populations in different geographic areas have experienced a disparate impact from the pandemic and may experience state anxiety differently for this reason. We encourage future research to continue to consider the contexts and settings, particularly when examining risk-taking behavior.

6. Conclusion

In this study, we examined the interaction between risk-taking behavior and trait resilience as predictors of state anxiety during the COVID-19 pandemic. We find that these traits significantly predict lower levels of state anxiety, while a significant moderation effect of age was observed. Results show that high levels of trait resilience and risk aversion are most beneficial for the elderly, compared to younger demographics.

CRediT authorship contribution statement

Jim McCleskey: Conceptualization, Writing - original draft, Writing - review & editing. **Dritjon Gruda:** Methodology, Formal analysis, Writing - review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2020.110485.

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