ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
MSc Economics & Business
Specialization Financial Economics

Navigating Uncertainty: How COVID-19 Altered Financial Risk Tolerance

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Date final version: 28/07/2024

Preface and Acknowledgement

I want to extend my sincere thanks to Professor D. Karpati for his help in putting my ideas on paper. I would also like to acknowledge the efforts of several friends and family for proofreading my thesis. Furthermore, ChatGPT was used to improve spelling and sentence structures.

Abstract

This study investigated how the COVID-19 pandemic affected financial risk tolerance, using a difference-in-differences analysis of data from the Wharton CRSP Database and the Survey of Health, Ageing, and Retirement in Europe (SHARE). This analysis enabled us to examine the shift in financial risk tolerance, as well as its timeline, and to assess whether the shift differed for a disease group when compared to a healthy group. The disease group consisted of individuals who themselves, or through a close friend or relative, experienced hospitalization or death due to COVID-19. The healthy group consisted of individuals who did not come into close contact with COVID-19. We found a significant decline in financial risk tolerance from 2019 onwards for the whole sample population. The disease group showed an increased risk tolerance in 2021 compared to the healthy group. Furthermore, the disease group exhibited higher stock market participation to begin with, a marker for risk-taking behaviour. The results not only reinforce previously established links between financial risk tolerance and socioeconomic factors but also offer insights into how global health crises can shape financial behaviour. This understanding is crucial for policymakers to mitigate the economic fallout following a global health crisis.

Keywords: Financial Risk Tolerance, COVID-19 Pandemic, Behavioural Economics, Difference-in-Differences Model, Ordered Logistic Model

JEL Classification: E70, E71, E50

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1. Introduction

The COVID-19 pandemic had world-changing effects, not just limited to a worldwide health crisis. Unprecedented disruptions were caused across all aspects of life, with the ramifications extending to the economic and psychological spheres. The COVID-19 pandemic significantly increased mental health issues such as depression and anxiety (Hawes et al., 2021), due to confinement, loss of loved ones, lockdowns (Le & Nguyen, 2020), and financial instability. Concurrently, the global economy suffered a severe recession, marked by a 19.4% decline in the S&P 500 early in the pandemic (U.S. Bank, 2021). In response, governments worldwide implemented extensive fiscal stimulus measures to mitigate the economic damage. These stimulus packages had two main effects. On the one hand, they cushioned the immediate economic blow of the COVID-19 pandemic, instigating a rapid recovery of the stock market to pre-pandemic levels, which would persist even following interest rate hikes by the Federal Reserve in the United States of America. On the other hand, these measures changed the risks individuals were willing to take. Individuals with low financial risk tolerance tend to manage financial risks worse, leading to suboptimal financial decision-making (Gerrans, Faff, & Hartnett, 2015; Weber, Weber, & Nosić, 2013). In the broader picture, individual risk-taking is fundamental for fiscal stimulus when combatting a downward spiralling economy, as the effectiveness of fiscal stimulus heavily depends on the population's financial risk tolerance. Friedman (2021) reported that up to 46% of the recipients of the stimulus checks invested part of these funds in the stock market. Thereby, increasing the stock ownership percentage among U.S. citizens to a record high of 58% in 2022. Subsequently, the average net worth invested in stocks increased from 14% to 37% (Soni, 2023), suggesting a change towards a higher risk tolerance. Interestingly, stock market participation among households, often used as a proxy for financial risk tolerance, increased during the COVID-19 pandemic (Zheng et al., 2022; Fitzgerald, 2020), while there was a decline in gambling tendencies (Brodeur et al., 2021), suggesting a lowered financial risk tolerance. Bucciol et al. (2015) found that negative life events, such as the loss of a loved one or experiencing a financial crisis, lower an individual's risk tolerance. The COVID-19 pandemic caused many people to face these challenges simultaneously. This raises questions about the impact of the COVID-19 pandemic on financial risk tolerance and the underlying mental frameworks that shape it.

Most research in the field focused on how financial risk tolerance affects financial crises (Grable & Lytton, 2003; Gerrans et al., 2015). While others investigated the influence of demographic (Apicella et al., 2008; Hartog et al., 2002), socioeconomic (Chong & Martinez, 2019), and health-related factors (Bogg & Roberts, 2004; Shou & Olney, 2021). Following the unique conditions posed by the COVID-19 pandemic, several demographic, socioeconomic, and health-related factors were affected. For example, depression, which is shown to reduce risk tolerance (Palmer et al., 2019), increased following the COVID-19 pandemic (Hawes et al., 2021). In contrast, financial risk tolerance

seemed to increase based on the upward trend in market participation (Zheng et al., 2022; Fitzgerald, 2020). Further research showed that natural disasters, negative life events, and financial crises impact financial risk tolerance. Given the contradictory consequences observed caused by the unique conditions of the COVID-19 pandemic, a clear gap in research arises regarding the effects of a pandemic on financial risk tolerance.

Research Question: Did financial risk tolerance shift in response to the COVID-19 pandemic?

Understanding whether financial risk tolerance shifted in response to the COVID-19 pandemic is crucial for policymakers when combatting future global health crises. Lowered financial risk tolerance has a significant impact on financial recovery programs, decreasing the multiplier effect, as lower risk tolerance is associated with saving more and making less risky investments. Furthermore, a population with lower risk tolerance might not accept a government taking on high debt, lowering the government's ability to weather financial storms through stimulus programs. Moreover, this research helps to understand the subconscious thought processes that underly financial risk tolerance.

To answer the research question, this paper used a difference-in-differences analysis. This model allowed us to infer whether there is a shift in financial risk tolerance over time and compare between groups. The healthy group consisted of people who only experienced the general effects of the COVID-19 pandemic, such as the financial crisis, lockdowns, loss of social contact, and closed sports facilities. The disease group not only felt these general effects but also had direct contact with the disease through the hospitalization or death of themselves, a close relative, or a family member due to COVID-19.

Comparing these two groups allowed us to investigate the effects of the COVID-19 pandemic at different levels of exposure and provided insights into the timeframe of the potential shift in risk tolerance. This study hypothesizes that the COVID-19 pandemic has led to a decline in financial risk tolerance, with the disease group exhibiting a lower financial risk tolerance compared to the healthy group.

The data was obtained through the SHARE survey from SHARELIFE and the Wharton CRSP database were employed. The SHARE survey includes, among others, variables for financial risk tolerance, demographic factors, and socioeconomic factors, sourcing its' data from all over Europe. The Wharton CRSP database was used to obtain past returns of the S&P 500.

By exploring various dimensions of financial risk tolerance using a difference-in-differences model, this study seeks to offer insight into how a global crisis like the COVID-19 pandemic can fundamentally alter an individual's financial risk tolerance. We found a downward shift in financial

risk tolerance following the pandemic, however, this could be the persistence of a pre-pandemic trend. Furthermore, the results underlined the impact of socioeconomic factors on financial risk tolerance.

Structure of the Paper

This paper is structured into seven sections:

1. Introduction: Presents the topic by highlighting the world-changing effects of the COVID-19 pandemic, not only on global health but also on economic and psychological aspects.
2. Theoretical Framework: Delves into the behavioural finance theories that underpin the study. It covers key theories, and provides a historical timeline of financial risk tolerance research, laying the foundation for investigating the impact of COVID-19 on financial risk tolerance.
3. Data: Explains the data sources and variables used in the analysis.
4. Methodology: Presents the analytical methods used in the study, divided into the difference-in-differences model.
5. Results: Presents the findings from the analyses conducted using the difference-in-differences model. It includes the statistical results of the models and interprets these results in the context of existing literature, discussing the implications of the findings.
6. Extension: Provides extra analysis to increase understanding of the findings.
7. Conclusion: Summarizes the main findings of the study, the implications, and the limitations and looks at future avenues for research.

2. Theoretical Framework

This paper draws on behavioural finance theory, as the blend of psychological theories with financial decision-making provides a robust framework for investigating investor behaviour. This section aims to incorporate existing knowledge on behavioural finance theory and financial risk-taking, identify gaps, and establish a foundation for investigating the impact of the COVID-19 pandemic on financial risk-taking.

2.1 Risk Tolerance

To understand what influences risk tolerance, we start by examining risk-taking behaviour. In psychology, risk-taking behaviour is defined as "any behaviour that puts an individual or others around them at an increased chance of harm, where the individual weighs up the possible outcomes of their actions" (Sitkin & Pablo, 1992). Numerous studies have investigated how and why individuals engage in risk-taking behaviour, using metrics such as suicide and substance abuse (e.g. drugs, alcohol, tobacco), as well as risky sexual, driving and investment behaviour (Sitkin & Pablo, 1992; Madden & Bickel, 2010; Borhan et al., 2018; Grable, 2000).

Other factors contributing to risk-taking behaviours include demographic variables such as age, income, gender, and education. For instance, Borhan et al. (2018) found these factors to be influential in risky behaviour, using dangerous driving behaviour as a metric. Additionally, Langille et al. (2003) found that lower socioeconomic status increases risk-taking behaviour when using unhealthy habits as a measure. Cultural and country-specific factors also play a role, as highlighted by Scott-Parker and Oviedo-Trespalacios (2017), who studied risky driving behaviour. They also underline the importance of demographic and socioeconomic factors.

Health factors are another significant contributor. Bogg and Roberts (2004) found that traits related to conscientiousness are negatively associated with all risky health-related behaviours and positively associated with beneficial health-related behaviours.

While this study focuses on financial risk tolerance, many elements that shape risk-taking behaviour in general apply to financial contexts as well. Understanding these factors provides a foundation for exploring financial risk tolerance.

2.2 Emotions and Impulsivity

The two main drivers of risk-taking are emotions and impulsivity. The latter refers to acting without thinking, was first explored by Eysenck and Eysenck (1977). Studies such as Hamilton et al. (2015) demonstrated this concept by showing that individuals often choose a smaller immediate reward over a larger delayed reward, indicating a tendency towards impulsivity. Madden and Bickel

(2010) further explain that humans have a propensity to increase the value of an immediate reward while diminishing the value of a distant one, a phenomenon known as delay discounting. This tendency is reinforced by the fact that humans focus more on immediate positive outcomes while paying little attention to long-term negative consequences all of which drive risk-taking behaviour.

The influence of emotions should not be underestimated as strong emotions can increase the chance of risky behaviour (Scott-Parker & Oviedo-Trespalacios, 2017). More precisely, positive emotions like happiness and excitement are linked with increased risk-taking behaviour as individuals with these emotions are more likely to perceive the rewards more favourably and downplay the risks. Negative emotions like anger can lead to increased risk-taking as individuals tend to be more optimistic about the outcomes of risky decisions or take risks as a way of coping with their emotions (Lerner et al., 2015; Herman et al., 2018). Furthermore, Herman et al. (2018) show that negative emotions can also increase impulsivity, which in turn leads to higher risk-taking.

2.3 Demographics

The connection between demographic factors and risk-taking behaviour has been studied extensively. The main demographic factors studied are age, gender, and marital status. Most research on the relationship between age and risk tolerance indicates a negative correlation between age and risk tolerance (Grable, 2000; Harbaugh et al., 2002; Dohmen et al., 2017; Hallahan et al., 2004). The negative relationship between risk tolerance and age is linear and continuous up until the age of 65, as found by Dohmen et al. (2017). This could be explained by older individuals being more conservative in their decision-making, as proposed by Hallahan et al. (2004).

For the effects of gender on risk tolerance, the general consensus is that men exhibit higher risk tolerance than women, as several studies find that men are more risk-seeking than women (Apicella et al., 2008; Hartog et al., 2002; Thanki et al., 2022; Weber et al., 2002). Male investors displayed higher financial risk tolerance compared to female investors in a study by Thanki et al. (2022). Similarly, Weber et al. (2002) reported that men were more likely to engage in riskier financial behaviours than women. These findings are consistent with D'Acunto (2015), who explored biological and social factors contributing to higher risk tolerance in men, noting that men are generally more overconfident and risk-tolerant compared to women. However, more recent studies challenge this view, finding no significant differences in risk preferences between men and women ((Daruvala, 2007; Tanaka et al., 2010). Studies like Morrongiello and Hillier (1998) suggest that gender differences in risk-taking behaviour may be context-specific. Morrongiello and Hillier (1998) found that when controlling for variables such as financial literacy and experience, gender differences in risk tolerance are less pronounced, indicating that risk preferences could be converging as the world becomes more equal.

The link between marital status and risk tolerance is also well-studied; however, the direction of the impact of marital status on risk tolerance varies. Grable and Joo (2004) found that marrying is associated with higher levels of risk tolerance. They explain that the greater financial capacity and shared financial responsibilities that a married couple has could encourage taking on more financial risk. Wong (2011) also supports this view, suggesting that marriage provides individuals with a larger safety net that allows for increased risk tolerance. On the other hand, we see that single individuals might be willing to take on more risk as their financial decisions only impact themselves, reducing the perceived consequences (Hallahan et al., 2004; Roszkowski et al., 2005). The trend between marital status and risk tolerance seems to be consistent over time (Koekemoer, 2018).

2.4 Socioeconomic

Other elements that shape risk tolerance are socioeconomic factors. Variables like education level, income, market participation, and cash holdings are all investigated by previous research. Education is also found to decrease risk tolerance (Dohmen et al., 2011; Chong & Martinez, 2019; Eeckhoudt et al., 2018; Caliendo et al., 2009). Chong and Martinez (2019) found that educated individuals are more risk-averse, a statement supported by Caliendo et al. (2009), who reported higher education was linked with reduced risk tolerance when looking at entrepreneurs.

Income is seen as a critical aspect of risk-taking, extensively covered in economic papers due to its role in financial decision-making. Generally, higher income is associated with increased risk tolerance, though the extent of this relationship varies among studies (Grable, 2000; Schooley & Worden, 2015; Gerrans et al., 2015; Chiang & Xiao, 2017; Bucciol & Zarri, 2015). Schooley and Worden (2016) noted that an increased income increases an individual's financial safety net, which allows individuals to take on more risk without jeopardizing their financial stability. Gerrans et al. (2015) gave a similar reason as they explain the link between increased risk tolerance and income by saying that income serves as a buffer for potential losses. The relationship between income and risk tolerance goes both ways as not only do higher-income individuals show higher risk tolerance (Chiang & Xiao, 2017), but lower-income individuals also show a decreased risk tolerance due to financial insecurity (Bucciol & Zarri, 2015).

Related to income, the relationship between cash holdings and liquidity also impacts risk tolerance in many of the same ways that income impacts risk tolerance. Cash holdings also provide an increased financial safety net, allowing individuals to take on more risk (Schooley & Worden, 2016; Grable, 2000). Similarly, Bucciol et al. (2015) indicated that individuals with substantial cash holdings are more likely to engage in risky financial behaviour, as liquidity enables investors to capitalize on high-risk, high-reward opportunities. However, in economic downturns, even those with significant cash reserves are likely to exhibit reduced risk tolerance (Gerrans et al., 2015).

Often used as a measure to test risk tolerance, stock and bond market participation are linked with higher risk tolerance (Malmendier & Nagel, 2011; Brunnermeier & Nagel, 2008). This relationship is driven by taking risks for the potential for higher returns, which selects individuals who are willing to take on greater risks.

2.5 Health

The relationship between health and risk tolerance has been a subject of interest in both the field of behavioural finance and psychology. Research shows that both physical and mental health significantly impact risk tolerance. Grable and Lytton (2001) found that poorer physical health can lead to a decrease in risk tolerance, as individuals with poor health might have increased stress and the need to preserve financial resources to pay for medical bills. Shou and Olney (2021) found that individuals who engage in unhealthy lifestyle behaviours, such as smoking and alcohol consumption, tend to show a higher risk tolerance. Furthermore, a decrease in self-assessment of health also causes a lower financial risk tolerance (Bucciol et al., 2015). Mental health impacts risk tolerance specifically in conditions like anxiety and depression, which can affect an individual's risk perception and decision-making processes, generally leading to a reduction in risk tolerance (Palmer et al., 2019). As supported by Marum et al. (2013), who found that psychological distress caused by trauma can decrease life satisfaction which in turn reduces financial risk tolerance. Fluctuations in mental health could lead to risk tolerance changes over time as studied by Guillemette and Finke (2014). They noted that when an individual's mental health is improving, risk tolerance might increase as they gain confidence and stability, whereas deteriorating health might cause individuals to become more risk averse. The interplay between genetic factors and mental health shows that genetic predispositions can influence both mental health conditions and risk tolerance (Beauchamp et al., 2019). Generally, a reduction in both physical and mental health are linked with a lowered risk tolerance, with the direction and extent of the effect varying based on changes in health status over time.

2.6 Negative Life Events

Partially linked to several other factors that are previously mentioned, such as mental health, physical health and financial security, and negative life events can lower an individual’s willingness to take financial risks. Furthermore, Bucciol et al (2015) found that the severity of the trauma matters for the size of the effect. The findings of Marum et al. (2013) support this idea as they find that psychological distress can decrease life satisfaction which in turn reduces risk tolerance. Similarly, Mangelsdorf et al. (2019) found that negative life events like personal loss or trauma led to a decreased risk tolerance as individuals became more cautious to avoid further adverse outcomes. A study investigating parental separation and other negative life events found that a negative life event lowers risk tolerance through an increase in anxiety (BMC Public Health, 2021). Furthermore, Monroe et al. (1999) noted that cumulative negative experiences lead to a sustained decrease in risk

tolerance Moreover, the effects of trauma are found to be long-lasting (Christelis and Dobrescu, 2018). However, some studies highlight that some individuals might become more risk-seeking as a coping mechanism to deal with the negative life events they experienced (Shupp et al., 2017). An aspect of the relationship between negative life events and risk tolerance is also highlighted by researchers at Child and Adolescent Psychiatry and Mental Health (2021), who found that the ability to cope with past trauma significantly moderates the impact of a negative life event on risk tolerance. To summarize, negative life events are generally linked with a decreased risk tolerance, with the sign and the extent of the effect being dependent on the level of trauma and the ability to cope with trauma.

2.7 Natural Disasters

Related to negative life events, a branch of research on risk tolerance looks at the effects of natural disasters on risk tolerance. As natural disasters are a form of negative life events, they also reduce risk tolerance (Jaramillo, LaFave, & Novak, 2023; Mangelsdorf et al., 2019; Cameron & Shah, 2015; Cassar, Healy, & von Kessler, 2017; Hanaoka, Shigeoka, & Watanabe, 2018). Extreme weather events reduce individuals' risk tolerance due to heightened awareness of potential future losses as demonstrated by Jaramillo, LaFave, and Novak (2023). Furthermore, they find that this reduced risk tolerance can persist for years as communities recover and rebuild. A finding supported by Hanaoka, Shigeoka, and Watanabe (2018) who argued that the increase in risk aversion following a natural disaster can have lasting effects on economic behaviour and investment decisions. Their research investigated the aftermath of the Great East Japan Earthquake, which demonstrated that individuals who experienced significant losses were less likely to engage in risky investments even several years after the event. On the other hand, Cassar, Healy, and von Kessler (2017) agree that risk tolerance decreases as a result of a natural disaster, yet they found that as the immediate threat recedes the risk tolerance shifts back to pre-disaster levels. Cameron and Shah (2015) investigated earthquakes and floods, they found that exposure to natural disasters leads to a long-term increase in risk aversion. In line with previously discussed studies, Mangelsdorf et al. (2019) noted that individuals who have experienced natural disasters tend to become more cautious in their decision-making process, attributing this change to trauma and uncertainty. Generally, the consensus is that natural disasters decrease risk tolerance, with the length of this change up for debate.

2.8 Financial Crises

The effect of financial crises on risk tolerance is extensively studied in the field of economics. Most studies point out that financial crises lead to reduced risk tolerance (Gerrans, Faff, & Hartnett, 2015; Gibson, Michayluk, & Van de Venter, 2013; Grable & Lytton, 2003; Weber, Weber, & Nosić, 2013; Weber, Weber, & Nosić, 2013; Chiang & Xiao, 2017; Guiso, 2012). The financial crisis of 2007 was found to significantly decrease risk tolerance immediately as examined by Gerrans, Faff, and Hartnett (2015). They attributed this decline to uncertainty and loss aversion, a sentiment shared by

Gibson, Michayluk, and Van de Venter (2013) and Grable and Lytton (2003). This notion was challenged by Gerrans et al (2015) who found the downward trend to be slow and gradual, instigated mainly through changes in demographic and socio-economic factors. Weber, Weber, and Nosic (2013) observed that financial crises have a long-lasting impact on risk-taking behaviour. Furthermore, financial crises erode the trust in financial institutions, which also causes financial risk tolerance to recover slowly (Guiso, 2012). Hence, we see that in an economic crisis elements that influence the financials of individuals seem to be impactful in the mental framework that constitutes financial risk tolerance, as shown by the impact of income and wealth. The general consensus is that financial crises decrease risk tolerance through many of the factors mentioned before, such as financial distress, anxiety, and negative life events.

2.9 Country

The country of residence also affects risk tolerance through several measures. Societal norms and national policies can lead to significant differences in financial risk tolerance across countries, indicating that economic stability and governance play significant roles (Allanjawi et al., 2023). Individuals who experience a multitude of risky situations are more likely to support a proactive government to limit potentially harmful situations, reducing their risk tolerance as investigated by Gerber and Neeley (2005). Furthermore, Mishra and Mishra (2014) found that governmental policies that promote economic stability can lead to a higher risk tolerance as economic stability reduces uncertainty, an effect that was also noted for entrepreneurs (Hvide and Panos, 2013). This is supported by Statman (2010) who found that policies that encourage transparency and reduce corruption increase public trust and increase willingness to take risks. Brinca et al. (2017) noted that higher fiscal risks caused by governmental policy led to precautionary savings which are related to a reduced effectiveness of savings. Many of these effects are linked to risk tolerance in previously discussed ways, like resolving uncertainty and increasing the safety net. Furthermore, strict policy seems to increase the effect of policy on risk tolerance.

2.10 Financial Risk Tolerance

The measure of how much risk an individual is willing to take across all fields is called risk tolerance, from here on referred to as general risk tolerance. Financial risk tolerance is more specific and looks at how much risk an individual is willing to take in their financial decisions. Furthermore, general risk tolerance is often tested through risky investments and financial decisions, a measure commonly used for financial risk tolerance in economics. To compare general and financial risk tolerance, this section will exclusively look at studies on financial risk tolerance to investigate whether findings from general risk tolerance are applicable to financial risk tolerance.

Financial risk tolerance is also influenced by emotions and impulsivity as Jean Lee (2013) demonstrated that emotions like fear and excitement significantly impact financial risk-taking behaviours. Zaleskiewicz (2001) found that impulsivity, driven by emotional states, increases financial risk-taking. These findings align with studies on general risk tolerance, which show that impulsivity and strong emotions (positive or negative) lead to riskier behaviours

Demographic factors play a crucial role in financial risk tolerance as research shows that age, gender, and marital status significantly influence financial risk tolerance. Older individuals exhibit lower risk tolerance compared to younger individuals (Grable, 2000). Gender differences in financial risk tolerance are well-documented, with males generally displaying higher risk tolerance than females (Apicella et al, 2008). Furthermore, Restana and Komalasari (2023) indicated a positive impact on investor risk tolerance related to gender and mood. Marriage is also found to increase financial risk tolerance, while divorce showed decreased financial risk tolerance (Christiansen, Joensen, and Rangvid, 2014) The influence of these demographic factors is stable over time (Gerrans et al., 2015).

Socioeconomic factors like income and wealth levels, education and debt, and savings all significantly impact financial risk tolerance similarly to general risk tolerance. Higher education levels tend to decrease risk tolerance (Chong & Martinez, 2019). Income and wealth provide a financial safety net, increasing risk tolerance, a relationship observed in both general and financial contexts (Grable, 2000; Schooley & Worden, 2015). These factors influence risk behaviour by altering perceived financial security and ability to absorb potential losses.

Physical and mental health significantly impact financial risk tolerance in ways that parallel their influence on general risk tolerance. Poor physical health leads to lower financial risk tolerance due to increased stress and the need to conserve resources for medical expenses (Grable & Lytton, 2001). Mental health conditions like depression and anxiety reduce risk tolerance by affecting risk perception and decision-making (Palmer et al., 2019).

Natural disasters also reduce financial risk tolerance. Jaramillo, LaFave, and Novak (2023) demonstrated that extreme weather events decrease financial risk tolerance by raising awareness of potential losses. Hanaoka, Shigeoka, and Watanabe (2018) found that this effect can persist for years, affecting economic behaviour and investment decisions. These findings are consistent with studies on general risk tolerance, which show that natural disasters increase caution and reduce risk-taking.

Financial crises significantly decrease risk tolerance, a trend observed in both general and financial risk studies. Gerrans, Faff, and Hartnett (2015) found that risk tolerance declined sharply during the 2007-2009 financial crisis due to heightened uncertainty and loss aversion. This aligns with Gibson, Michayluk, and Van de Venter (2013), who noted a substantial reduction in risk tolerance during financial crises. The impact of financial crises on risk behaviour is similar in both contexts, driven by increased financial uncertainty and erosion of trust in financial institutions.

Past financial experiences and expectations of future market behaviour also affect financial risk tolerance. Individuals who have experienced positive financial returns may develop a higher risk tolerance due to positive reinforcement, whereas those who have faced losses may become more risk-averse (Malmendier, 2011).

To conclude, the factors influencing general risk tolerance also affect financial risk tolerance, with the direction of these effects generally consistent across both domains. This similarity suggests that general and financial risk tolerance share enough similarities to generalize the findings between the two areas.

2.11 The COVID-19 Pandemic

The COVID-19 pandemic was a unique event signified by a financial as well as a health crisis. While the impact of the COVID-19 pandemic on financial risk tolerance has not been directly tested, there has been a lot of research on negative life events, natural disasters, financial crises and many of the foundational elements that are linked with financial risk tolerance as previously discussed.

To dive into how COVID-19 potentially impacted financial risk tolerance we look at some of the consequences of the COVID-19 pandemic. Le and Nguyen (2020) noted that women are especially susceptible to the adverse effects of lockdown policies, as they showed the health of females worsened more significantly than the health of males during a lockdown. Nigatu (2023) looked at individuals debt levels following the COVID-19 pandemic in Canada. They found that 17.5 % of households had their debt increase, lowering financial security and stability. Other studies indicated a worsening of mental health and an increase in anxiety and depression due to the COVID-19 pandemic, which can significantly affect decision-making processes and risk perceptions (Nelson, 2020; Romero-Rivas, 2021). Additionally, Roeloffs (2024) reported a lowered life expectancy as a

result of the COVID-19 pandemic. Yao et al (2022) also linked the lockdown policies in response to COVID-19 to significant adverse mental health effects[1]. The consequences of the COVID-19 pandemic such as reduced financial security, decreased mental and physical health, and lowered life expectancy, all put downward pressure on financial risk tolerance, with the effects of trauma on financial risk tolerance shown to be long-lasting (Christelis and Dobrescu, 2018).

During the COVID-19 pandemic, individuals' health concerns significantly influenced their risk tolerance, not only in financial domains but also in everyday behaviour choices (van der Werf et al., 2021). After many individuals worldwide initially were forced to live an inactive lifestyle due to curfews and the closing of gyms and other sports areas, a trend towards healthier lifestyles started. Pandey et al. (2023) noted an uptake in healthy choices following the COVID-19 pandemic as people ate healthier and slept better. This finding suggests an increased financial risk tolerance as health increases in the medium run.

Furthermore, Zheng, Li, Huang, and Chen (2022) examined the impact of the COVID-19 pandemic on stock market participation and found that despite the economic uncertainty, there was an increase in market participation, suggesting a shift towards higher financial risk tolerance. This trend aligns with findings by Fitzgerald (2020), who noted that government stimulus packages during the pandemic encouraged greater stock market participation, reflecting increased risk-taking behaviour. Furthermore, Fluharty, M., Paul, E., and Fancourt, D (2022) found an increase in gambling behaviour after the pandemic, which also suggests an increase in financial risk tolerance, possibly induced by an emotional coping mechanism (Lerner J. et al. 2015; Herman et al., 2018). In the financial crisis, we see that socioeconomic factors such as wealth, debt and income are continuously linked with the drop of financial risk tolerance in the financial crises. However, the noted increase in market participation indicates an increase in financial risk tolerance.

The lack of direct research on the impact of COVID-19 on financial risk tolerance is laid bare by the diverging consequences of the COVID-19 pandemic. On the one hand we identify a decrease in (mental) health, a decrease in financial security, and a reduced life expectancy, which previous research suggested should decrease financial risk tolerance. While on the other hand, we see an uptake in market participation paired with an increase in gambling behaviour, both markers of an increased financial risk tolerance. This discrepancy elicits the need for research on the topic, as financial risk tolerance is pivotal for creating financial policy due to its effects on stimulus programs (Akitoby and Stratmann, 2006; Brinca et al., 2017).

[1] However, this effect is not noted in countries with a voluntary lockdown (Eguchi et al., 2021).

3. Methodology

This paper aims to investigate whether financial risk tolerance has shifted in response to the COVID-19 pandemic. To test for individuals' financial risk tolerance the SHARE Survey included the following question:

"What statement comes closest to the amount of financial risk they are willing to take on investments"

(1) not willing to take any financial risk

(2) take average financial risks expecting to earn average returns

(3) take above-average financial risks expecting to earn above-average returns

(4) take substantial financial risks expecting to earn substantial returns

The responses to this question were the base of the regression and served as the independent variable, financial risk tolerance. To analyse the significance of this shift in financial risk tolerance we employed a difference-in-difference analysis. The difference-in-differences model allowed us to compare groups and see which effects COVID-19 impact financial risk tolerance. Figure 1 and Figure 2 present an indication of how financial risk tolerance shifted over time. In Figure 1 the average financial risk tolerance per year is shown, indicating an initial increase when the COVID-19 pandemic started followed by a decline in financial risk tolerance to the lowest point in the data. Yet, the movement direction remains ambiguous after 2020.

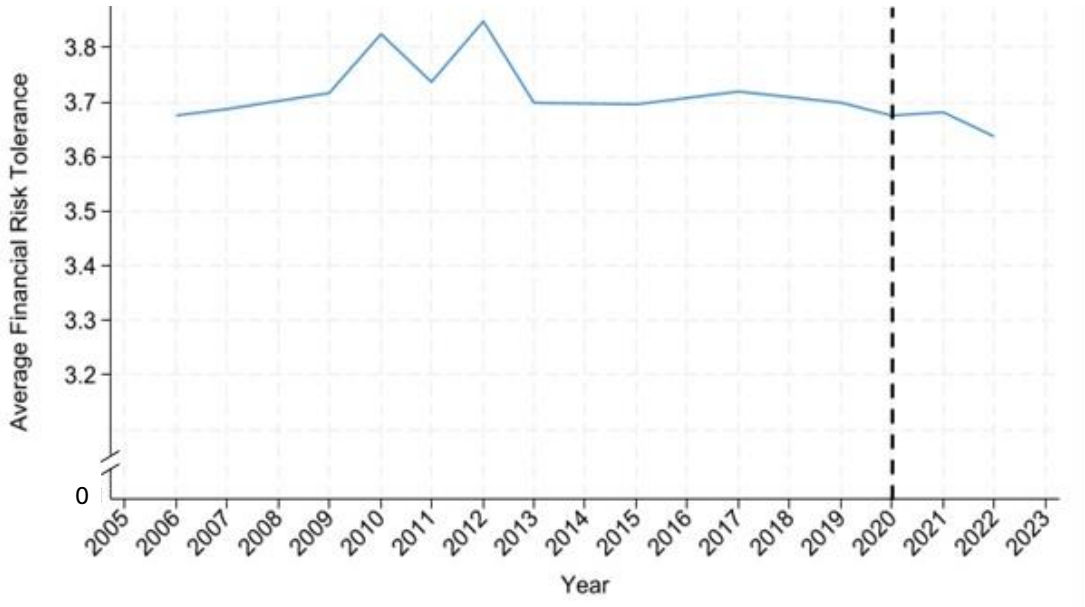

Figure 1. Average financial risk tolerance over time. The average is calculated as the mean of financial risk tolerance for all observations by year. The dashed line indicates the start of the COVID-19 pandemic.

Then we separated the data into two groups, the healthy group, which consisted of people who only experienced the general effects of the COVID-19 pandemic, and the disease group which included individuals who experienced not only the general but also the effects of first-hand contact with the disease. The rationale is that some consequences of the pandemic impacted all individuals, such as the financial crisis, lockdowns, loss of social contact, sports centres closed, etc., while other consequences are attributed to a first-hand experience of the disease, which is defined as a close relative or family member being hospitalized/dying of COVID-19. This categorization allowed us to identify how COVID-19 impacted financial risk tolerance. Figure 2 indicates a large difference in financial risk tolerance as well as a direction change when comparing the disease and healthy groups. The disease group indicated a steep decline in financial risk tolerance, while the healthy group showed an increase in financial risk tolerance. To investigate whether the changes in financial risk tolerance are significant for each of the groups we performed the difference-in-differences analysis. Furthermore, the controls are added in groups to see which impact financial risk tolerance. For the robustness of the analysis, the four main assumptions needed to use a difference-in-differences model were checked. To increase the reliability of the analysis we used robust standard errors clustered on country level.

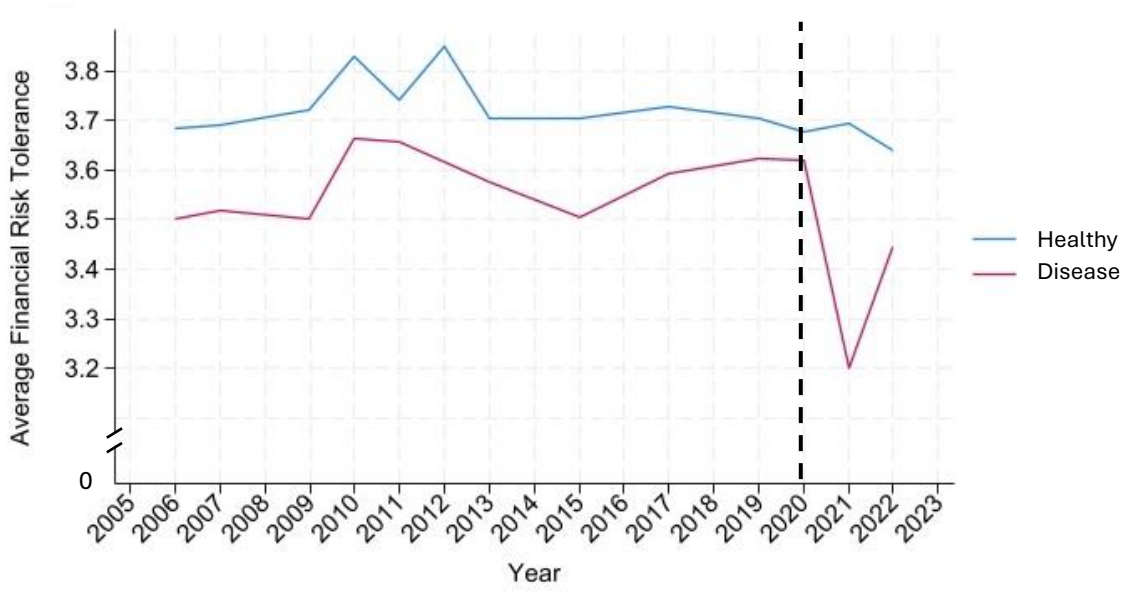

Figure 2. Average financial risk tolerance over time grouped by healthy and disease groups. The healthy group (blue line) individuals who only experience the general effects of the COVID-19 pandemic. The disease group are individuals who experience both the general effects of the COVID-19 pandemic and the direct effects of first-hand experience of the disease through infection/hospitalization of themselves, a relative or a close friend (red line). The lines show the mean of financial risk tolerance of all individuals within a group. The dashed line indicates the start of the COVID-19 pandemic.

3.1. Summary statistics

Table 1: Summary Statistics

Variable	#Obs.	Mean	Std. dev.	Min	Max
Financial Risk Tolerance	16,602	3.57	0.66	1	4
Gender	16,602	0.55	0.50	0	1
Age	16,602	60.24	7.77	31	99
Married	16,602	0.65	0.48	0	1
Health	16,602	2.71	1.06	1	5
Unhealthy habit(s)	16,602	0.50	0.50	0	1
Limited due to health	16,602	2.59	0.64	1	3
Depression	16,602	0.37	0.48	0	1
Diploma	16,602	0.99	0.08	0	1
Total yearly income household	16,602	72,953	210,808	0	8,761,967
Cash holdings household	16,602	59,320	1,676,009	0	100,000,000
Bond market participation	16,602	0.05	0.22	0	1
Stock market participation	16,602	0.13	0.34	0	1
Life expectancy	16,602	86.07	12.35	50	100
Hopes for the future	16,602	0.90	0.30	0	1
COVID-19	16,602	0.04	0.20	0	1
N	16,602				

Table 1: Summary Statistics. The sample period is 2004-2022. However, wave 3 was excluded as it had a different set of variables. Financial risk tolerance is a categorical variable that spans from 1 to 4, with 1 being not willing to take any financial risk and 4 being willing to take substantial financial risks expecting to earn substantial. Gender is a dummy that equals 1 for males and 0 for females. Age is calculated by subtracting the date of birth from the date of the interview. Married equals 1 if an individual is married and 0 if not married. Health is a categorical variable, with a range from 1 to 5, where 5 is excellent health and 1 is very bad health. Unhealthy habit(s) is a dummy variable that equals 1 if an individual has a drinking/smoking problem or both. Limited due to health is a categorical variable, with a range from 1 to 3, with 1 being not limited and 3 being severely limited. Depression is a dummy variable that equals 1 if the individual was ever diagnosed with depression. The Diploma is a dummy variable that equals 1 if the individual has at least 1 diploma. Income is the euro value of the yearly income of the household. Cash is the euro value of the total cash holdings of a household. Bond and stock market participation are dummy variables that equal 1 if an individual has any funds invested in the bond or stock market. Life expectancy is the age an individual expects to become. Hopes is a dummy variable that equals 1 if the individual indicates at least one hope for the future. Income and cash holdings are both expressed in euros.

Table 1 presents the summary statistics with the variables categorized as described in the data section. The table reveals that 55% of the sample is male and 45% is female, with no other gender options available. This male predominance is higher than the global male population percentage of 50.4% reported by the United Nations, Department of Economic and Social Affairs, Population Division (2022). The participants' average age is notably high at 60.24 years, with 65% being currently married. The health variable averages between "good" and "very good" (for further details, refer to the data section above). Additionally, 50% of participants report daily smoking and/or a drinking problem, evident from the "unhealthy habit" variable. The average score of 2.59 on the “limited due to health” scale suggests the average is in between "limited, but not severely" and "severely limited" due to health issues. Depression affects 37% of participants in the past or currently.

Given the diversity of education across Europe, we created a dummy called “Diploma” which indicates the possession of any diploma, with 99% of our sample in possession of any diploma. The average household income per year stands at 72,953 euros. Participation in financial markets is low, with 5% active in the bond market and 13% in the stock market. The average life expectancy reported is 86.07 years; responses equal to or less than the current age were excluded to correct misunderstandings about the survey question's intent.[2]. Moreover, 90% of participants expressed having hopes for the future, and 4% have felt or will feel the consequences of first-hand contact with COVID-19 (disease group).

It is important to note the absence of 2008 data, as wave 3 of the SHARE survey employed different variables. Given the high average age and male predominance, variables such as depression, health limitations, and income may be slightly skewed. For instance, research indicates that depression is more prevalent among females (Shi et al., 2021), potentially lowering the reported depression rate. Conversely, as males generally earn higher incomes (Picatoste et al., 2022), this might inflate the income figures. Self-reporting surveys also introduce biases; notably, several participants reported implausibly high cash holdings, prompting us to disregard any claims of cash above one billion euros[3]. Nevertheless, as our analysis focuses not on direct effects but on the association with risk tolerance elicited through likelihood ratios, these biases should not impact our findings.

[2] Values equal to or below the current age were removed as some respondents might have thought the question was how many more years do you expect to live as opposed to how many years do you expect to live.
[3] Several respondents reported cash holding above one billion euros, while one even reported a value of more than a trillion.

3.2. Assumptions Difference-in-Differences Analysis

To analyse whether there has been a shift in financial risk tolerance we employed a difference-in-differences analysis. The difference-in-differences analysis was chosen due to the insight it gives into through what effects COVID-19 affects financial risk tolerance. However, before we could do a difference-in-differences analysis we first went over the four assumptions that need to be met to do a difference-in-differences estimation.

To mitigate spillover effects the disease group was defined using strict criteria. It only included individuals who, themselves or through a close friend or relative, experienced hospitalization or death due to COVID-19. This stringent definition helped ensure that the groups are distinctly categorized based on the direct and severe impacts of the virus, thereby minimizing the likelihood of spillover effects where the treatment or exposure might indirectly influence members of the healthy group. By focusing on extreme cases, we aimed to enhance the clarity of the causal relationships investigated, reducing the potential for confounding influences that might arise from less direct exposures.

To demonstrate that the intervention is unrelated to the outcomes at baseline, Table 2 presents a side-by-side comparison of summary statistics for both the disease group (I) and the healthy group (II). In the column “Difference” the statistical significance of the differences between the groups were tested. While Table 2 indicates statistically significant differences for most measures the differences are generally small. There is however quite a large statistically significant difference in income between the two groups. “Cash” also showed a large difference between groups, however this finding is largely statistically insignificant. Lastly, there is a difference in market participation with the disease group having higher market participation in both stock and bond markets. To account for the difference in income we added the controls in the final model incrementally to investigate whether that difference posed a problem. Besides the difference in income, there seems to be no systematic bias in the allocation of individuals to the disease and healthy groups. This supports the premise that the intervention (exposure to severe COVID-19) was likely not determined by these baseline characteristics.

Table 2: Summary Statistics Divided by Healthy and Disease Group

	(I)		(II)		Difference		
	#Obs.	**Mean**	**#Obs.**	**Mean**	**(I) - (II)**	**T-statistic**	**P-value**
Financial Risk tolerance	675	3.45	15,927	3.58	-0.12	15.67	<0.0001
Gender	675	0.56	15,927	0.55	0.01	-12.91	<0.0001
Age	675	58.33	15,927	60.32	-1.99	29.84	<0.0001
Married	675	0.69	15,927	0.65	0.04	33.89	<0.0001
Diploma	675	0.99	15,927	0.99	0.00	-2.78	0.005
Health	675	2.56	15,927	2.71	-0.15	28.87	<0.0001
Unhealthy habit(s)	675	0.52	15,927	0.49	0.02	8.50	<0.0001
Limited due to health	675	2.61	15,927	2.59	0.02	-15.38	<0.0001
Depression	675	0.40	15,927	0.37	0.03	-4.01	<0.0001
Cash holdings household	675	40,293.48	15,927	60,126.21	-19,832.73	-0.02	0.985
Total yearly income household	675	103,800.30	15,927	71,645.48	32,154.82	-12.91	<0.0001
Bond market participation	675	0.08	15,927	0.05	0.03	-2.53	0.012
Stock market participation	675	0.20	15,927	0.13	0.07	-17.00	<0.0001
Life expectancy	675	85.39	15,927	86.10	-0.71	3.63	<0.0001
Hopes for the future	675	0.92	15,927	0.90	0.02	4.86	<0.0001
N	675		15,927				

Table 2: Summary Statistics Divided by Healthy and Disease Group. Summary statistics of the group that was not in direct contact with COVID-19 and the group that has been in direct contact with COVID-19. The groups were created by looking at an individual's COVID survey in w8 and w9 of the SHARE data, then if they, a family member or a close friend were hospitalized the coviddummy would equal 1. Then, we looked at whether they had filled in the survey before, if they did then for all their previous survey responses maxcoviddummy is set to 1. The maxcoviddumy of 1 means group I and a maxcoviddumy of 0 means group II. The sample period is 2004-2022. However, wave 3 (2008) was excluded as it had a different set of variables. Financial risk tolerance is a categorical variable that spans from 1 to 4, with 1 being not willing to take any financial risk and 4 being willing to take substantial financial risks expecting to earn substantial. Gender is a dummy that equals 1 for males and 0 for females. Age was calculated by subtracting the date of birth from the date of the interview. Married equals 1 if an individual is married and 0 if not married. Health is a categorical variable, with a range from 1 to 5, where 5 is excellent health and 1 is very bad health. Unhealthy habit(s) is a dummy variable that equals 1 if an individual has a drinking/smoking problem or both. Limited due to health is a categorical variable, with a range from 1 to 3, with 1 being not limited and 3 being severely limited. Depression is a dummy variable that equals 1 if the individual was ever diagnosed with depression. The Diploma is a dummy variable that equals 1 if the individual has at least 1 diploma. Income is the euro value of the yearly income of the household. Cash is the euro value of the total cash holdings of a household. Bond and stock market participation are dummy variables that equal 1 if an individual has any funds invested in the bond or stock market. Life expectancy is the age an individual expects to become. Hopes is a dummy variable that equals 1 if the individual indicates at least one hope for the future. Income and cash holdings are both expressed in euros.

Lastly, the parallel trend assumption was tested through the main analysis by looking at the years before the treatment. The regression results in Table 4 suggest no significant deviations from the parallel trends assumption. This was done by looking at the significance of the interaction of "Disease" with the years before the COVID-19 pandemic. This lack of significant deviations is crucial for the validity of the difference-in-differences model. Specifically, the interaction terms between disease and the various periods indicate non-significant differences in pre-treatment trends between the disease and the healthy group. This non-significance supports the contention that the observed post-treatment differences in risk tolerance can plausibly be attributed to the impact of COVID-19, rather than pre-existing differences between the groups. Thus, the parallel trends assumption is met and we could proceed with the difference-in-differences analysis.

3.3 Difference-in-Differences Model

A difference-in-differences model uses data from a treatment group and a control group at least one time period before and after the "treatment". In this paper the treatment group is the disease group and the control group is the healthy group. The treatment itself is the hospitalization or death due to COVID-19 for the individual themselves or through a close friend or relative. The outcome variable for both groups is then measured before and after the groups have received to the "treatment", this allows for the calculation of the normal difference between the groups and how the relative difference changed due to the treatment.

Our setup incrementally added groups of control variables to assess the impact of the control variables on the estimated effect of COVID-19 on financial risk tolerance. We started with a model with no controls then we gradually added demographic, health, and socioeconomic factors. The last model also controls for past financial returns, future expectations and country-specific effects. This stepwise approach allowed us to observe how the groups of controls influenced the strength and size of our findings. We started with Model I.

$$(1)\quad Y_{it} = \beta_0 + \beta_{1\mathrm{Post}_t} + \beta_{2\mathrm{Disease}_i} + \beta_3(\mathrm{Post}_t \times \mathrm{Disease}_i) + \epsilon_{it}$$

The goal was to estimate the shift in financial risk tolerance and compare between the groups the healthy and the disease groups. In Model I Y_{it} is the outcome variable, denoted by financial risk tolerance, for individual *i* at time *t*. The β_0 is the intercept, which gives us the baseline level of the outcome when all explanatory variables are zero. The $\beta_{1\mathrm{Post}_t}$ captures the time effect, here a binary is created to see whether it is before or after the COVID-19 pandemic started. This is set to 1 if the COVID-19 pandemic had already started and 0 if it had not. The $\beta_{2\mathrm{Disease}_i}$ measures the effect of being part the disease group, represented by a value of 1, compared to the healthy group, represented by a value of 0. The most important part of the setup for a difference-in-differences is the $\beta_3(\mathrm{Post}_t \times \mathrm{Disease}_i)$, this is an interaction term that analyses the effect of being in the disease group as well as the post-COVID-19's start. Therefore, this term isolates the causal impact of the treatment from other time-related trends. Lastly, the error term, ϵ_{it}, captures the random fluctuations of the outcome variable that are not captured by the model and are clustered on a country level. The initial model included no controls.

Additional controls were added in a stepwise manner, which allowed us to isolate the effect of the treatment from the effects of confounding factors. Furthermore, this approach helped us understand the effect of each set of controls on the outcome variable. In Model 2 the demographic controls of age, gender and marital status were added through $\sum_k \beta_{4k} D_{kit}$. The $\sum_k$ encapsulates the

demographic controls that there are, while β_{4k} is the effect of each individual's demographic control. The rest of the model remains as the previous model.

$$(2)\ Y_{it} = \beta_0 + \beta_{1\text{Post}_t} + \beta_{2\text{Treatment}_i} + \beta_3(\text{Post}_t \times \text{Treatment}_i) + \sum_k \beta_{4k} D_{kit} + \epsilon_{it}$$

In model 3 health controls were added to capture whether the observed effect is due to health factors. The health controls were health, unhealthy habits, limited due to health and depression and were captured by $\sum_l \beta_{5l} H_{lit}$. The rest of the model remains as the previous model.

$$(3)\ Y_{it} = \beta_0 + \beta_{1\text{Post}_t} + \beta_{2\text{Treatment}_i} + \beta_3(\text{Post}_t \times \text{Treatment}_i) + \sum_k \beta_{4k} D_{kit} + \sum_l \beta_{5l} H_{lit} + \epsilon_{it}$$

In model 4 the socioeconomic controls of income, cash holdings, market participation and education were added to capture whether the observed effect was due to socioeconomic factors. The socioeconomic controls are denoted by $\sum_m \beta_{6m} S_{mit}$.

$$(4)\ Y_{it} = \beta_0 + \beta_{1\text{Post}_t} + \beta_{2\text{Treatment}_i} + \beta_3(\text{Post}_t \times \text{Treatment}_i) + \sum_k \beta_{4k} D_{kit} + \sum_l \beta_{5l} H_{lit} + \sum_m \beta_{6m} S_{mit} + \epsilon_{it}$$

Lastly, in model 5 the final controls were added to the model. These include past returns, future expectations and country-specific controls and are denoted by $\sum_n \beta_{7n} R_{nit}$.

$$(5)\ Y_{it} = \beta_0 + \beta_{1\text{Post}_t} + \beta_{2\text{Treatment}_i} + \beta_3(\text{Post}_t \times \text{Treatment}_i) + \sum_k \beta_{4k} D_{kit} + \sum_l \beta_{5l} H_{lit} + \sum_m \beta_{6m} S_{mit} + \sum_n \beta_{7n} R_{nit} + \epsilon_{it}$$

Together these five iterations give us insight into how COVID-19 impacted financial risk tolerance, whether the level of exposure to COVID-19 is impactful and we see which control variables mitigate these effects. Furthermore, a sensitivity analysis was done by excluding the socioeconomic factors one by one to dissect which variable changes the significance and magnitude of the found effect.

4. Data

The key variables for analysis are the financial risk tolerance from households, as well as demographics, health, socioeconomic, country and expectations microdata. Our analysis required data that spans at least a few years before the COVID-19 pandemic and as many after as available. Then we require historical and current data on the stock market to calculate the moving average return.

4.1. Wharton CRSP Database

For the stock market data, we employed the Wharton CRSP Database to extract data for analysing stock market moving average returns. This comprehensive database houses detailed records of monthly stock returns and the market values of the S&P 500, with historical data stretching back to April 1926. To assess trends and patterns in the stock market, we constructed the variable moving average return. This variable represents the moving average of stock market returns, calculated as an equally weighted average of the ten most recent yearly returns of the S&P 500. This calculation is performed monthly to ensure a higher level of accuracy in the analysis.

4.2. Survey of Health, Ageing and Retirement in Europe (SHARE)

For household-level microdata, the SHARE survey from SHARELIFE was used, which provides panel data on financial risk tolerance, demographics, health and socioeconomic factors. Furthermore, because the SHARE survey is commissioned by the European Union, data from many countries around Europe is available. The SHARE surveys are conducted in waves, with the first wave (w1) being conducted in 2004 and the latest wave (w9) being conducted in 2021/2022. For our analysis, all waves, except for wave 3 as it did not include the necessary variables, are merged using the provided mergeid. The mergeid stays the same for the same individual across waves. The SHARE survey also did two additional surveys during the COVID-19 pandemic. These surveys are also used as they give insight into how COVID-19 has impacted an individual's life. Altogether this gives us data from 2004 until 2022 across 29 countries. To collect accurate retrospective information the SHARE survey uses a Life History Calendar (LHC) approach, an approach that is designed to help respondents remember past events. The way this works is that life events are displayed on a "calendar" allowing the interviewers to cross-reference life events with each other.

To measure financial risk tolerance the survey asks respondents what statement comes closest to the amount of financial risk they are willing to take on investments: (1) not willing to take any financial risk, (2) take average financial risks expecting to earn average returns, (3) take above average financial risks expecting to earn above average returns, (4) take substantial financial risks expecting to earn substantial returns. It should also be noted, for the use of self-reported financial risk tolerance instead of inferred financial risk tolerance, that previous research suggests that inferred risk tolerance and self-reported risk tolerance are relatively similar (Grable & Roszkowski, 2007) with some factors like gender causing some discrepancy between elicited and real risk tolerance. Hence, by controlling for these factors, we account for the problems of the use of a proxy for financial risk tolerance.

As previously mentioned this paper distinguished between a disease group and the healthy group. The disease group was defined as individuals who fit one or more of the following criteria: (1) I have been hospitalized due to COVID/COVID-like symptoms, (2) a family member has been hospitalized due to COVID-19/COVID-19-like symptoms, (3) a close friend has been hospitalized due to COVID-19/COVID-19 like symptoms. The healthy group, was defined as all individuals who have not been in direct contact with the disease. The groups were made using panel data. We created a dummy variable (maxcoviddummy) that equals 1 if a person was ever/will ever be directly exposed to COVID-19 for all observations of the same individual. The general effect of the COVID-19 pandemic we defined as the effect living in a time of COVID-19 had on financial risk tolerance. Hence, this was defined as any observation after 2020. The SHARE data held two separate surveys purely focused on COVID. This allowed us to distinguish between people who did or did not experience a COVID-19 infection.

The demographic factors used were age, gender, education and marital status. For education, we created a diploma dummy as the original values of education included 25 different country-specific categories of education. The transformation we made was to change respondents who did not want to answer or did not know to a null value. Then we changed all respondents with some form of education to a one and those with no education to a zero. For the age of the participant we created a date variable which was a combination of the interview month and interview year, then we subtracted the birth month and birth year of the individual of the date giving us an age value accurate on a monthly scale.

For the socioeconomic factors in the analysis, variables such as yearly income, stock holdings, bond holdings, mutual fund holdings, cash holdings, and debt were initially considered. However, to address issues of strong collinearity, which can undermine the reliability of regression results, mutual fund holdings, debt, and savings were excluded from the final analysis. Furthermore, both bond and stock holding variables were transformed into dummy variables for easier

interpretation. In this conversion, a value of 1 indicates that the household holds bonds or stocks, while a value of 0 indicates they do not. The income of the household was converted from a monthly to a yearly value, while unrealistic outliers for cash were removed[4].

For the health factors we used health as measured by a self-reported health status: (1) Excellent, (2) Very Good, (3) Good, (4) Fair, (5) Poor. We also made an unhealthy lifestyle dummy as a proxy for health. This dummy was created by compounding "smoked daily" and "drinking problem" dummies from the SHARE survey into a dummy that equals 1 if an individual has one or more unhealthy habits and 0 if they have no unhealthy habits. Alongside that, we used "limited due to health" as a measure of current health status. Here the values are as follows: (1) Severely Limited, (2) Limited, but not severely, (3) Not limited.

Several mental health factors like depression, mental fatigue, suicidal feelings, and mental diseases were also considered. In the end, only depression was used as many of the other measures of mental health have a strong collinearity with depression and the link between depression and risk tolerance is the best documented in research. This is a dummy variable of whether the individual has ever had a depression.

Lastly, several measures for future expectations were considered for the analysis. These include life expectancy, expectation of living standards and hopes for the future. The expectation of living standards was dropped due to data availability issues. The life expectancy was included with the number simply being the age the individual expects to live to. Hopes for the future were converted to be a dummy variable that equals 1 if any hopes were mentioned and zero if no hopes were mentioned.

To control for cultural and country-specific effects a country control variable was added to the analysis. This is a variable in which each country has a unique country code.

[4] Anything above a billion in cash as several respondents reported cash holding above one billion euros, while one even reported a value of more than a trillion.

5. Results

To investigate whether financial risk tolerance shifted in response to the COVID-19 pandemic and whether this shift varied between individuals who experienced COVID-19 first-hand (disease group) and those who experienced just the general effects (healthy group) of the COVID-19 pandemic, we performed a difference-in-differences model. The dependent variable in the model was financial risk tolerance, and the model was run in 5 iterations to incrementally add groups of control variables.

Figure 3 provides a graphical representation of the difference-in-differences model results. The orange line represents the trendline of financial risk tolerance for the healthy group, and the blue line represents the trendline for the disease group. The orange and blue dashed lines show the projected pre-COVID trendlines if no changes occurred post-COVID-19. The black dashed line marks the start of the COVID-19 pandemic. Post-pandemic, both groups experienced a decline in financial risk tolerance, with the disease group showing a more pronounced decline.

Table 3 demonstrates the significance of yearly changes tested using the difference-in-differences model. We see that in models I, II, and III, the results align with Figure 3, showing a large difference between the healthy and disease groups in 2021. The disease group were in a lower financial risk tolerance category in 2021 when compared to the healthy group, as shown by the -0.5 ($P < 0.010$), -0.631 ($P < 0.010$), and -0.462 ($P < 0.010$) categories for models I, II, and III respectively. However, as socioeconomic controls were added in Model IV, this effect diminished and became non-significant.

To understand which socioeconomic control caused this shift, we examined Table 4. In Table 4, models I to IV are the same as Model IV from Table 3, but each model excludes one socioeconomic control. We found that when the stock market participation control was excluded in Model IV, the 2021 * Disease effect remained negative and significant at -0.446 ($P < 0.050$), while in all other models, it remained closer to Model IV from Table 3 and was not significant. This indicates that stock market participation explains part of the downward shift reported in models I, II, and III of Table 3. Furthermore, when past return controls, expectation controls, and country-specific controls were added, the effect of 2021 * Disease even became positive and significant with a coefficient of 0.251 ($P < 0.100$).

Additionally, we observed a significant effect in 2017 * Disease in the first three models; however, this effect disappeared as more controls were added. The effects of being in the disease group on financial risk tolerance were close to 0 and not statistically significant.

Model V of Table 3 shows that from 2019 to 2022, there was a statistically significant decrease in financial risk tolerance, with values of -0.136 ($P < 0.100$), -0.124 ($P < 0.100$), -0.186 ($P <$

0.100), and -0.166 ($P < 0.05$) respectively. Again, the effects of the Disease group on financial risk tolerance were close to 0 and not statistically significant.

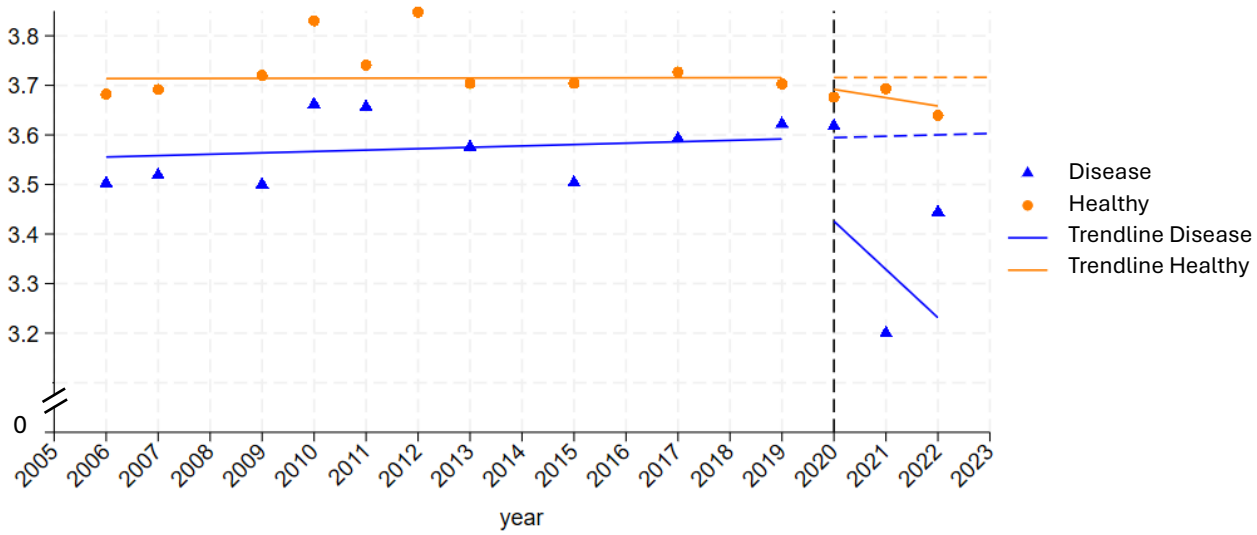

Figure 3: Trend Comparison of Financial Risk Tolerance Between Healthy and Disease groups. The orange line and dots represent the healthy group (individuals experiencing only the general effects of the COVID-19 pandemic). The blue line and triangles represent the disease group (individuals experiencing both the general and direct effects of the COVID-19 through infection/hospitalization of themselves, a relative, or a close friend). The dashed line indicates the start of the COVID-19 pandemic.

Interpretation

Our results indicated a statistically significant decrease in financial risk tolerance following the onset of the COVID-19 pandemic when all controls were added (Table 3, Model V). However, it should be noted that the downward trend started a year prior to the COVID-19 pandemic. This suggests that either a downward trend in financial risk tolerance persisted when the COVID-19 pandemic began and continued until 2022, or that the general effects of the pandemic caused a continuous decline in financial risk tolerance. In support of the latter we noted that the decline became larger in 2021 and 2022 when compared to 2019 and 2020. This suggests that the COVID-19 pandemic did lower financial risk tolerance.

In 2021, the Disease group (individuals who themselves or their close relatives experienced severe COVID-19 outcomes) showed a decrease in financial risk tolerance compared to the Healthy group in models I to III of Table 3. However, when socioeconomic controls were introduced in Model IV of Table 3, the magnitude and significance of this effect decreased. This reduction highlights the importance of socioeconomic factors in shaping financial risk tolerance, suggesting that the initial heightened risk aversion may partly be attributed to economic instability or increased financial stress. This aligns with the idea that higher wealth often leads to greater risk tolerance due to a greater safety net that reduces the potential consequences of loss (Grable, 2000).

When examining which socioeconomic control caused this change, we found that the lowered financial risk tolerance for the disease group in 2021 was largely explained by stock market participation, as the disease group had higher stock market participation to begin with (Table 2). This suggests that the disease group may have been more risk-taking in general, supported by the results of Model V from Table 3, where a significant positive effect of being in the disease group for 2021 was found. The shift in significance and direction between the fourth and fifth models indicates a potential impact of country-specific factors on financial risk tolerance, which will be examined in section 6.2.

The decrease of financial risk tolerance due to the COVID-19 pandemic (Table 3, Model V) is in line with previous research which indicated a lowered risk tolerance in times of crisis. This result suggests that the pandemic induced a general sense of caution and conservatism in financial decision-making. Which could be due to the high stress, anxiety and uncertainty that followed the COVID-19 pandemic. Among those in the disease group, the short-term increase in risk tolerance could be attributed to psychological effects related to a lack of future perspective, aligning with findings by Jacobs-Lawson and Hershey (2005). In the medium to long term, as individuals' health and outlook improve, financial risk tolerance levels may normalize. Alternatively, the disease group could have an increased financial risk tolerance as a coping mechanism for negative life events, as suggested by Shupp et al. (2017). The short-term increase in financial risk tolerance challenges the hypothesis that immediate, life-threatening experiences reduce financial risk tolerance, potentially due to an altered perception of mortality and urgency as suggested by Cassar, Healy, and von Kessler (2017).

The finding that financial risk tolerance shifts downward in response to the COVID-19 pandemic is important for policymakers, financial planners, individual investors, and healthcare professionals. For policymakers, a lowered financial risk tolerance impacts financial recovery programs by lowering the multiplier effect, as lower risk tolerance is associated with increased saving and less risky investments. Additionally, a population with lower risk tolerance may not support a government taking on high debt, limiting the government's ability to manage financial crises through stimulus programs. Financial planners and individual investors can benefit from understanding how crises like the COVID-19 pandemic impact their own or their clients' financial risk tolerance, as helps to make to more informed investment decisions. For healthcare professionals, recognizing the link between a health crisis and financial risk tolerance provides insight into the broad impact of a health crisis on their patients' lives.

Table 3: Difference-in-Differences Analysis

	(I)	(II)	(III)	(IV)	(V)
	Coefficient	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
2007	0.041	0.049	0.065	0.082	0.046
2009	0.042	0.040	0.094	0.261**	0.434***
2010	0.380***	0.285*	0.229	0.169	0.093
2011	0.208	0.179	0.176	0.143	0.012
2012	-0.458***	-0.586***	-0.625***	-0.706***	-0.941***
2013	0.059	0.041	0.054	0.043	0.028
2015	0.154	0.147	0.148**	0.089	-0.041
2017	0.151	0.095	0.077	0.088	-0.070
2019	0.063	0.004	-0.005	-0.026	-0.136*
2020	0.074	0.052	0.050	0.006	-0.124**
2021	0.071	0.020	0.028	-0.033	-0.186*
2022	0.060	0.030	0.030	-0.021	-0.166***
Disease	-0.029	0.000	-0.007	0.032	0.011
2007 * Disease	-0.095	-0.099	-0.093	-0.119	-0.081
2009 * Disease	0.000	0.000	0.000	0.000	0.000
2010 * Disease	0.025	-0.040	-0.042	-0.085	-0.106
2011 * Disease	-0.105	-0.097	-0.080	-0.085	-0.065
2012 * Disease	0.000	0.000	0.000	0.000	0.000
2013 * Disease	-0.112	-0.137	-0.117	-0.121	-0.065
2015 * Disease	-0.171	-0.171	-0.154	-0.154	-0.116
2017 * Disease	0.421***	0.470***	0.375**	0.252	0.158
2019 * Disease	0.222	0.146	0.131	0.047	0.156
2020 * Disease	0.069	-0.047	-0.051	-0.052	-0.068
2021 * Disease	-0.500***	-0.631***	-0.462***	-0.067	0.251*
2022 * Disease	0.211	0.124	0.140	0.133	0.155
Demographic Controls	N	Y	Y	Y	Y
Health Controls	N	N	Y	Y	Y
Socioeconomic Controls	N	N	N	Y	Y
Past Returns Controls	N	N	N	N	Y
Expectations Controls	N	N	N	N	Y
Country-Specific Controls	N	N	N	N	Y
Number of Observations	16,602	16,602	16,602	16,602	16,602
R-squared	0.0149	0.0594	0.0769	0.1438	0.1865

Table 3: Difference-in-Differences Analysis. The statistically significant p-values are shown as: *** p<0.01, ** p<0.05, * p<0.1. The independent variable is financial risk tolerance. To avoid omitted variable bias, five types of control variables are added. The demographic controls include age, gender, and marital status. The health controls include health status, unhealthy habits, health limitations, and depression. The socioeconomic controls include diploma, yearly household income, and cash holdings. The expectations controls include life expectancy and hopes for the future. The country-specific controls account for country-specific factors. The standard errors are clustered at the country level. The interaction terms with the disease group indicate whether there is a correlation between financial risk tolerance and being in the disease group. Model I includes no controls, Model II includes demographic controls, Model III includes demographic, and health controls, Model IV includes demographic, health and socioeconomic controls, and Model V includes demographic, health, socioeconomic, past returns, expectations and country-specific controls.

Table 4: Difference-in-Differences Analysis Socioeconomic Controls

	(I)	(II)	(III)	(IV)
	Coefficient	**Coefficient**	**Coefficient**	**Coefficient**
2019 * Disease	0.046	0.046	0.026	0.168
2020 * Disease	-0.051	-0.053	-0.070	-0.018
2021 * Disease	-0.067	-0.069	-0.063	-0.446***
2022 * Disease	0.211	0.132	0.111	0.203
Demographic Controls	Y	Y	Y	Y
Health Controls	Y	Y	Y	Y
Total yearly income household	N	Y	Y	Y
Cash holdings household	Y	N	Y	Y
Bond market participation	Y	Y	N	Y
Stock market participation	Y	Y	Y	N
Number of Observations	16,602	16,602	16,602	16,602
R-squared	0.1438	0.1438	0.1419	0.1438

Table 4: Difference-in-Differences Analysis Socioeconomic Controls. The statistically significant p-values are shown as: *** p<0.01, ** p<0.05, * p<0.1. The independent variable is financial risk tolerance. The Demographic Controls include age, gender, and marital status. The health controls include health status, unhealthy habits, health limitations, and depression. The Socioeconomic controls include diploma, yearly household income, and cash holdings. The socioeconomic controls are removed one at a time to dissect which control variable instigated the change in significance and magnitude of the effect in Model IV of Table 3. The interaction terms with the disease group indicate whether there is a correlation between financial risk tolerance and being in the disease group for the given years. Model I includes demographic, health and socioeconomic Controls excluding total yearly income household, Model II includes demographic, health and socioeconomic controls excluding cash holdings household, Model III includes demographic, health and socioeconomic controls excluding bond market participation, Model IV includes demographic, health and socioeconomic controls excluding stock market participation.

6. Extension

In this extension of the research, we look further into what variables are formational for financial risk tolerance before and after the COVID-19 pandemic. Furthermore, we investigated whether COVID-19 pandemic policy strictness impacted financial risk tolerance.

6.1 Ordered Logistic Regression

In the main analysis, we found that socioeconomic factors significantly changed our findings. Specifically when adding socioeconomic factors, the effect of the disease group in 2021 became smaller and was no longer statistically significant. Additionally, when we added the past return, expectation and country-specific controls we saw that the direction of the change in financial risk tolerance changed to positive for the disease group in 2021 and 2022, although both were not statistically significant. This raises the question of which variables are influential in the formation of financial risk tolerance in our dataset.

Furthermore, Pandey et al. (2023) indicated that individuals have started to favour a healthier lifestyle, in addition to a link between mental health issues and decision-making processes (Nelson, 2020; Romero-Rivas, 2021). Hence, we would expect an increase in the importance of (mental) health factors post-covid in the formation of financial risk tolerance. To see whether (mental) health factors increased in importance in the formation of financial risk tolerance we will perform an ordered logistic model.

Order Logistic Regression Model

In the model, financial risk tolerance Y_i is the dependent variable. The ordered logit model is fitting as the financial risk tolerance is ranked but the distances between ranks are unknown (J. Bruin, 2011). The ordered logit will predict the probability that the ordinal dependent variable falls within or below a particular category, based on the independent variables.

The independent variables are grouped into categories for simplicity, these categories are $Demographics_i$ (age, gender, marital status etc.); $SocioEcon_i$ (yearly household income and diploma); $Health_i$ (health, unhealthy habits, limited due to health and depression); $Country_i$ (country of residence); $MovingAvgReturn_i$ (A 10-year moving average of stock returns); $FutureExpect_i$ (life expectancy and hopes).

In the first model, all the independent variables are interacted with $Covid_{i,}$ which is a dummy variable for whether the COVID-19 pandemic has started. This dummy equals 1 if the year is 2020 or later. This model will give us insight into the formation of financial risk tolerance and more specifically how these formational variables changed due to the general effects of the COVID-19 pandemic.

(1) $$\left[\log\left(\frac{P(y_i \leq j)}{P(y_i > j)}\right) = \alpha_j - \left(\beta_1 \text{Demographics}_i + \beta_2 \text{SocioEcon}_i + \beta_3 \text{Health}_i + \beta_4 \text{MentalHealth}_i + \beta_5 \text{Country}_i + \beta_6 \text{MovingAvgReturn}_i + \beta_7 \text{FutureExpect}_i\right)\right]\left[-\left(\gamma_1 \text{Demographics}_i \times \text{Covid}_i + \gamma_2 \text{SocioEcon}_i \times \text{Covid}_i + \gamma_3 \text{Health}_i \times \text{Covid}_i + \gamma_4 \text{MentalHealth}_i \times \text{Covid}_i + \gamma_5 \text{Country}_i \times \text{Covid}_i + \gamma_6 \text{MovingAvgReturn}_i \times \text{Covid}_i + \gamma_7 \text{FutureExpect}_i \times \text{Covid}_i\right)\right]$$

Ordered Logistic Regression Results

Table 5 presents the results of the ordered logistic regression model used to examine whether the COVID-19 pandemic has made health-related factors more influential in forming financial risk tolerance post-COVID-19. The model includes interaction terms to capture the differential impacts of health-related variables before and after the pandemic.

We found that health significantly influences the formation of financial risk tolerance, with a coefficient of 0.181 ($P < 0.01$). However, there is no significant change in the importance of health post-COVID-19. None of the mental health factors showed statistically significant coefficients for the interaction terms with post-COVID-19.

After the pandemic, the effect of having a diploma on financial risk tolerance shifted from negative to significantly positive, with a coefficient of 4.620 ($P < 0.05$). The negative relationship between moving average returns and financial risk tolerance became more pronounced, with a coefficient of -8.951 ($P < 0.01$)

Further changes were observed in the importance of cash holdings, which became associated with a significantly lower financial risk tolerance post-COVID-19, with a coefficient of 0.002 ($P < 0.01$). The positive relationship between age and financial risk tolerance became slightly less pronounced post-COVID-19, with a statistically significant coefficient of 0.013 ($P < 0.1$). The effect of moving average returns shifted significantly, which became more negative in their relationship to financial risk tolerance, with a statistically significant coefficient of -8.951 ($P < 0.01$).

These findings indicate that the pandemic changed the risk tolerance of individuals with a diploma, as their risk tolerance increased significantly after the start of the pandemic. Past returns in the stock market already had a negative relationship with financial risk tolerance pre-COVID, however, after the pandemic this relationship became much more negative. This could be due to the quick recovery of the markets following the COVID-19 pandemic, with people seeing this as a potential bubble. The switched sign of the relationship between education and financial risk tolerance could be due to educated people trusting financial institutions more, thus, seeing the COVID-19 pandemic as a financial opportunity or not seeing the bounce back of the markets as financial uncertainty.

Table 5: Ordered Logistic Regression Model

Variables	Coefficient	Standard Error
Post Covid	6.376	3.939
Health	0.181***	0.023
Post Covid * Health	0.003	0.050
Depression	-0.044	0.043
Post Covid * Depression	-0.093	0.092
Unhealthy habit(s)	-0.038	0.040
Post Covid * Unhealthy habit(s)	0.068	0.086
Limited due to health	-0.001	0.038
Post Covid * Limited due to health	-0.036	0.079
Life expectancy	0.003**	0.002
Post Covid * Life expectancy	0.003	0.004
Age	0.037***	0.003
Post Covid * Age	-0.013*	0.007
Gender	0.650***	0.041
Post Covid * Gender	-0.025	0.088
Married	-0.036	0.044
Post Covid * Married	-0.131	0.090
Diploma dummy	-0.700**	0.336
Post Covid * Diploma dummy	4.620**	1.811
Yearly income household	-0.000*	0.000
Post Covid * yearly income household	-0.000	0.000
Cash	-0.000	0.000
Post Covid * Cash	-0.002***	0.000
Bond dummy	-0.597***	0.078
Post Covid * Bond dummy	-0.334	0.300
Stock dummy	-1.213***	0.053
Post Covid * Stock dummy	-0.161	0.129
Any hopes mentioned	-0.276***	0.075
Post Covid * Any hopes mentioned	0.185	0.157
Moving average return	-1.478*	0.888
Post Covid * Moving average return	-8.951***	2.997
Country-Specific Fixed Effects	Y	
#Obs.	16,602	

Table 5: Ordered Logistic Regression Model. The statistically significant p-values are shown as: *** p<0.01, ** p<0.05, * p<0.1. The independent variable is financial risk tolerance. The empty values were removed from the table for readability. Robust standard errors were clustered by country. The cash and the yearly income household variables were divided by 1000 to see the effects per 1000 euros over 1 making interpretation easier. The gender equal to 1 in the case of males and 0 in the case of females.

6.2 Impact Government Policy

In Table 3 we see a change in sign and significance between Model IV and Model V when we look at the 2021 * disease, many of the other coefficients also change. For this reason, we continue by looking into how country-specific policy responses to the COVID-19 pandemic impacted financial risk tolerance.

Table 6 ranks countries based on their COVID-19 policy strictness, assigning 20 points for vaccination mandates and travel restrictions. Then, mask mandates and lockdown measures were categorized into severity levels, ranging from 0 to 3. The mask mandates are categorized as: (3) mandatory masks in all contact situations, (2) mandatory masks in all for enclosed spaces, (1) mandatory masks for public transport and health institutions, (0) no mandate. For lockdown measures are categorized as: (3) exemptions were required for going outside or fines were imposed for non-essential travel, (2) all non-essential services were closed, (1) that staying home was strongly encouraged but not enforced, (0) no lockdown measures were in place. The last column includes the country-specific interaction term with “Post Covid” from Table 5, which indicates a country’s unique factors affected elicited risk tolerance differently when the pandemic started.

However, there seems to be no clear effect of groups, using certain policies and strictness of measures, as both groups show significant divergences amongst similar countries. For example, for not a single level of policy strictness we see the coefficients for the countries are all positive or negative. We also do not see a steady decrease or increase as policy strictness increases.

Table 6: COVID-19 Policies by Country

Variables	Mask Mandates	Lockdown Measures	Travel Restrictions	Vaccination Mandates	Overall Policy Strictness (0-100)	Coefficient and Significance
Sweden	1	1	Y	N	40	-1.176*** (0.109)
Switzerland	2	2	Y	N	60	-0.21515
Bulgaria	2	2	Y	Y	80	0.288 (0.654)
Croatia	2	2	Y	Y	80	-0.384 (0.243)
Cyprus	2	2	Y	Y	80	-13.327 (1195.403)
Denmark	2	2	Y	Y	80	-1.018*** (0.247)
Estonia	2	2	Y	Y	80	-1.192*** (0.252)
Finland	2	2	Y	Y	80	0.144 (0.289)
Latvia	2	2	Y	Y	80	-0.128 (0.611)
Lithuania	2	2	Y	Y	80	-0.424 (0.457)
Luxembourg	2	2	Y	Y	80	0.000 (.)
Malta	2	2	Y	Y	80	2.892** (1.121)
Netherlands	2	2	Y	Y	80	0.351 (0.724)
Poland	2	2	Y	Y	80	0.236 (0.314)
Slovenia	2	2	Y	Y	80	-1.013*** (0.229)
Austria	3	3	Y	Y	100	0.000 (.)
Belgium	3	3	Y	Y	100	-0.1045
Czech Republic	3	3	Y	Y	100	-0.266 (0.239)

France	3	3	Y	Y	100	-0.112774
Germany	3	3	Y	Y	100	-0.649*** (0.188)
Greece	3	3	Y	Y	100	15.366 (2082.505)
Hungary	3	3	Y	Y	100	-0.279 (0.404)
Ireland	3	3	Y	Y	100	0.000 (.)
Israel	3	3	Y	Y	100	-1.966 (1.039)
Italy	3	3	Y	Y	100	-1.113 (1.338)
Portugal	3	3	Y	Y	100	-0.232 (0.438)
Romania	3	3	Y	Y	100	1.239 (0.965)
Slovakia	3	3	Y	Y	100	-1.313** (0.464)
Spain	3	3	Y	Y	100	0.679 (0.356)

Table 6: COVID-19 Policies by Country. The statistically significant p-values are shown as: *** p<0.01, ** p<0.05, * p<0.1. This table ranks countries based on their COVID-19 policy strictness, assigning 20 points for vaccination mandates and travel restrictions. Then, mask mandates and lockdown measures were categorized into severity levels, ranging from 0 to 3. For mask mandates, a "3" represents mandatory masks in all contact situations, a "2" for enclosed spaces, and an "1" for public transport and health institutions, with a "0" indicating no mandate. For lockdown measures, a "3" signifies that exemptions were required for going outside or fines were imposed for non-essential travel, a "2" that all non-essential services were closed, a "1" that staying home was strongly encouraged but not enforced, and a "0" that no lockdown measures were in place. The coefficients are taken from the country-specific effects part of Table 3.

7. Conclusion

This research investigated the impact of the COVID-19 pandemic on financial risk tolerance, using a difference-in-differences methodology across two groups, the disease (individuals who had themselves, a close relative or a family member hospitalized/dying of COVID-19) and healthy group (those impacted only by the general consequences of the pandemic). The comprehensive analysis along with the incremental addition of control variables helped us understand how health crises shape financial risk-taking.

Our findings showed a significant downward shift in financial risk-taking from 2019 onwards, which intensified in 2021 and 2022 (Table 3, Model V). The initial models suggested a more pronounced decrease in financial risk tolerance for the disease group. However, the introduction of socioeconomic controls in later models indicated that these effects are considerably moderated by economic factors. Furthermore, sensitivity analysis highlighted that stock market participation is a key explanatory variable, as when omitted the observed financial risk tolerance among the disease group remained significant. This difference across groups could be due to the disease group being more risk-taking to begin with as suggested by the higher stock participation. This aligns with the findings of the final model, where we saw a significant increase in financial risk tolerance for the disease group in the short term (2021). This raises questions about the impact of government policies as country-specific controls were added to this model. However, in further analysis, we did not find any trends relating to COVID-19 policy strictness.

The ordered logistic analysis underlined the importance of several variables formational for financial risk tolerance as suggested by previous research. With analysis of different governmental responses to the COVID-19 pandemic does not yield clear differences in outcomes.

There are several limitations to this study. The first limitation of this study is that it only had data up until 2022. This means that the long-term effects of COVID on financial risk tolerance could not be investigated. Furthermore, it is difficult to say whether the medium-run effects are investigated in this study as defining a timeframe for the COVID-19 pandemic is difficult due to there is not a clear start and end date. Another limitation is that these surveys are retrospective, meaning that observations can go undetected. For example, if someone contracts COVID-19 in 2020 they do not report this in the survey until the special COVID-19 survey of 2021. Meaning participants might be unjustly grouped in the healthy group. Another limitation of the survey is that it only includes males/females, however, with the discussion around gender, and which genders there are, is becoming commonplace and the effects of gender, as mentioned in the literature review, the gender being narrowed down to two could hurt the accuracy of the analysis. The financial risk tolerance variable that is used is self-reported, which could cause bias in the responses. If the survey results could be monitored better a more direct measure of risk tolerance would be suitable.

Further research is necessary to address these limitations and build on our findings. Future studies could link the COVID measure to the relative number of cases, allowing for a more precise COVID measure, though defining the appropriate lag time would be challenging (unless data with date of infection is made available). Additionally, further research could include data from the Survey of Consumer Finances (SCF) to help increase the sample size and provide insights from the United States, although there are differences between the variables that would need to be accounted for. When more years of data are available the long-term effects of COVID-19 on financial risk tolerance can also be studied.

This research illustrates that a broad crisis like the COVID-19 pandemic elicits a different change in financial risk tolerance when compared to a financial crisis and thus requires a different governmental response. This insight could prove important for financial policy when dealing with future crises that span beyond only the economic realm. Furthermore, the results could help individual investors and financial advisors improve their financial decision-making.

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