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Financial Stress and COVID-19: A Comprehensive Analysis of the Factors Associated with the Pandemic

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Abstract: The COVID-19 pandemic introduced unprecedented challenges for households globally, serving as a precursor to and trigger for financial stress. This study examined the associations across various factors thought to be associated with financial stress (a psychological syndrome) resulting from the COVID-19 pandemic. Using survey data collected in 2019 (n = 997) and 2021 (n = 988), propensity score matching and hierarchical linear modeling were employed to identify the association between financial stress and the pandemic. Results indicated that financial stress increased during the COVID-19 pandemic. Three covariate groups, including financial characteristics, health status, and socio-demographic characteristics, were found to be associated with financial stress levels. The primary contribution of this paper lies in offering a comprehensive understanding of how the dynamics of financial stress evolve with shifting macroeconomic events. This paper serves as a framework to employ a comprehensive financial stress measure and matched samples at various data points. Findings from this study contribute to the existing literature on financial well-being, financial stress, and societal outcomes associated with global health events while providing implications for policy and practice.

Keywords: financial stress; COVID-19; propensity score matching; hierarchical linear modeling; financial behavior

JEL Classification: D10; D12; D14; D90

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1. Introduction

The COVID-19 pandemic presented a unique set of challenges for individuals, households, and policymakers, leaving people to grapple with a multitude of health-related concerns, reduced social interactions, drastic disruptions to daily routines, and looming financial uncertainties (Akhtaruzzaman et al. 2021; Yazdanparast and Alhenawi 2022). It is now known that the unprecedented circumstances associated with the COVID-19 pandemic triggered a cascade of psychological effects, including a surge in financial stress (Rodrigues et al. 2023) which has prompted notable shifts in consumer behavior patterns (Galoni et al. 2020), including changes in perceptions, expectations, and behaviors (Ashraf 2020; Haroon and Rizvi 2020).

An important outcome associated with the pandemic was a marked increase in financial stress at the household level. Financial stress describes a state of emotional or physiological distress caused by financial issues or challenges (Britt et al. 2015; Friedline et al. 2021; Lee et al. 2023). Financial stress is distinct from a state of money shortage or financial instability, as it centers on individuals' emotional and physiological reactions to financial stressors (Ensel and Lin 1991; Heo et al. 2020) and their subjective perceptions

and experiences related to holding inadequate financial resources to meet needs (Pearlin et al. 1981; Simonse et al. 2022). Households across the economic spectrum experienced some degree of financial stress, which altered the way money was (and continues to be) managed. The pandemic also altered the way household financial decisions are made (Heo et al. 2021; Thayer and Gildner 2021).

Research interest in the association between the pandemic and financial stress has increased over the past five years (Simonse et al. 2022). Although limited, the extant literature suggests that rather than being primarily a functional health issue, the COVID-19 pandemic can be seen as a precursor to and trigger for financial stress, which can also relate to family well-being. For example, Rodrigues et al. (2023) noted that the COVID-19 pandemic caused financial stress in families, also affecting their perception of well-being. Kelly et al. (2022) examined how financial stress relates to family relationships (e.g., relational conflict, emotional closeness, couple relationship happiness), measured at three phases (before, at the height of the pandemic, and at the time the survey was taken during the summer of 2020). What these and other studies indicate is that it is important to consider financial stress and well-being in a macroeconomic context (Friedline et al. 2021). By comparing different time frames, an analysis of financial stress can more effectively account for shifting macroeconomic conditions that were evident during the COVID-19 pandemic.

It is important to note that the COVID-19 pandemic affected households in heterogeneous ways. For instance, studies have shown that individual characteristics such as age, education, gender, income, and other socioeconomic status variables are associated with perceptions and reactions to the pandemic (Atchison et al. 2020; Cutler 2020; Lund 2020; Park et al. 2020). Thus, it is reasonable to hypothesize that these perceptions and behaviors have an association with the degree of financial stress exhibited at the household level. Furthermore, it is worth considering the possibility that factors related to financial stress at different points in time (e.g., before and after the onset of the pandemic) may provide more nuanced insights into the association between financial stress and future global health crises.

The current study fills a needed gap in the existing literature by examining the associations among various factors theoretically associated with the psychological syndrome of financial stress as these factors relate to the COVID-19 pandemic. The study aims to describe the financial stress levels of households prior to and concurrent with the COVID-19 pandemic and to determine whether household financial capacity, financial risk tolerance, having insurance, health status, and demographic factors are associated with the financial stress exhibited by households at the height of the pandemic. In a distinctive departure from previous studies about financial stress in the context of COVID-19, this study utilized a more comprehensive measure of financial stress, encompassing logical, situational, and relational responses to external financial stimuli following Heo et al. (2020). Findings from this study show that the financial stress level of individuals increased during the pandemic. Three covariate groups, including financial characteristics, health status, and socio-demographic characteristics, were shown to be associated with financial stress levels. This study is among the first to examine the association between financial stress and the COVID-19 pandemic with an exhaustive household variable list framed within a changing macroeconomic context.

To address the macroeconomic context, stress level comparisons pre-pandemic (i.e., 2019) and concurrent with the pandemic (i.e., 2021) were made using a multi-step analytic process. First, a χ^2 test and a t test were used to determine whether the two samples were comparable. It was hypothesized that if the covariates from two samples showed a similar distribution, the surveys could be combined without further adjustment. However, an additional balancing adjustment would be needed if the sample covariates were statistically different. At the second step, propensity score matching (PSM) was employed to balance distributions of the covariates by matching samples. Finally, the adjusted covariates were utilized in a hierarchical linear model (HLM). The HLM model was used to check

whether financial stress differed between periods and how the effects of the covariates (i.e., financial capacity, financial risk tolerance, insurance, health status, and demographic factors) were associated with financial stress between the periods. This approach allowed for a comparison of samples from two timeframes. The methodology also provides a framework that can be applied to other studies with different data points and samples.

The remainder of this paper is organized as follows: Section 2 provides a brief literature review, Section 3 presents the research hypotheses, Section 4 outlines the methodology, Section 5 presents the results, Section 6 presents a discussion of the findings, and Section 7 provides a discussion of the implications and limitations.

2. Literature Review

2.1. The COVID-19 Pandemic and Household Psychological Responses

By their very nature, pandemics are known by scholars to cause emotional distress. Pandemics create uncertainty, ambiguity, feelings of loss of control, and internal (i.e., psychophysiological) symptoms, such as anger, anxiety, and depression (Ensel and Lin 1991; Pearlin et al. 1981). The COVID-19 pandemic outbreak that began in late 2019 and accelerated into early 2020 (World Health Organization 2020) led policymakers worldwide to respond by implementing policies such as social distancing, the closing of schools, family gathering restrictions, work-at-home mandates, and travel restrictions. Although unknown at the time, these policies resulted in an increase in negative psychological outcomes, including psychological distress (Shanahan et al. 2020; Van Rheenen et al. 2020).

Social distancing requirements implemented in 2020 led to widespread psychological distress that resulted in generalized stress and anger. The Office for National Statistics (2020) in the United Kingdom reported that about 72% of the UK's population was concerned about the impact COVID-19 would have on their lives, with many reporting high levels of anxiety (32%), diminished well-being (43%), and loneliness (23%). In addition, countries such as Italy and Spain that were deeply affected by COVID-19 observed societal impacts that went beyond physical symptomologies (e.g., González-Sanguino et al. 2020; Odriozola-Gonzalez et al. 2020; Orgilés et al. 2020).

2.2. Economic Influence of the Pandemic

It is now clear that there was comorbidity between the physiological and mental effects of COVID-19 and economic stress. Many households experienced unemployment, economic disruptions, and investment asset price volatility at the height of the pandemic (Akhtaruzzaman et al. 2021). In one study that used a nationally representative sample of U.S. adults, researchers found that the increase in psychological distress associated with COVID-19 was caused more by economic stressors than by fear of contagion among those aged 60 years or younger (Breslau et al. 2021). The work of Breslau et al. (2021) hints at the strong likelihood that some of the psychological syndromes associated with COVID-19 were related, in part, to financial stress.

Private employers reacted to the pandemic in a variety of ways. Some employers responded to decreased consumer demand for products and services by furloughing employees. This had a significant effect on the labor market, as it adversely impacted consumption patterns, the allocation of financial resources, and economic activity, leading to more significant financial stress for a majority of the population. Thayer and Gildner (2021) found that 43% of those living in the United States during the pandemic were worried about their financial situation.

The linkages between disease (both functional and psychological) and financial stress, while very apparent during the pandemic, were not unique to the period ranging from 2019 to 2022. Negative outcomes associated with global health crises have been observed at other times as well. Haacker (2004) studied how the economic costs of the HIV/AIDS pandemic affected human life. Haacker pointed out that permanent changes in consumer behavior due to the HIV/AIDS pandemic created a tremendous challenge to the global economy, resulting in a decline in consumption and domestic demand worldwide. Similarly,

Santaeulalia-Llopis (2008) investigated the impact of the HIV/AIDS epidemic on economic growth, finding that AIDS delayed industrialization for nearly a century and reduced income per capita by 12% in countries where the prevalence of the disease was at its highest. These studies suggest that pandemics bring changes to the global economy by triggering problematic financial behavior that is linked to financial stress (e.g., a pandemic can shift the risk preference of a society, which can reduce human economic activity (Heo et al. 2021; The American Institute of Stress 2020)).

2.3. Personal Finance and the Pandemic

To date, there have been just a handful of empirical investigations into the association between the COVID-19 pandemic and personal financial behavior (Heo et al. 2021; Yazdanparast and Alhenawi 2022). Given the lack of research, it is difficult to clearly define how the pandemic was or continues to be associated with individual and household financial behavior. However, studies that have examined other global financial crises provide some clues to better understand the association. For instance, Leoni (2013) found that the spread of HIV in developing countries was related to a significant increase in bank deposit turnover because of the need to pay for medical treatments. Lagoade-Segot and Leoni (2013) developed a theoretical model showing that the prevalence of large-scale pandemics increases in alignment with the likelihood of a banking industry collapse in developing countries. Similarly, Skoufias (2003) noted that a significant portion of collective loans from micro-financial institutions and banks come under pressure during pandemics due to the systematic negative effect of the health crisis on all group members. The societal impact of a pandemic can reduce the ability of households to make loan repayments.

A pandemic can also affect the use of other household financial products. Insurance ownership, for example, needs to be in place to deal with financial emergencies, especially crises resulting from health problems (Gangopadhyaya and Garrett 2020). Most workers in the United States receive health insurance benefits through their employer or their spouse's employer. If they (or their spouse) lose their job, they are likely to lose job-based insurance, although they can retain insurance coverage over a temporary period through the Consolidated Omnibus Budget Reconciliation Act (COBRA). Gangopadhyaya and Garrett (2020) noted that the COVID-19 crisis highlights the possibility that millions of people might not only lose their livelihoods but also their ability to pay for medical bills. As the insurance literature suggests, the knock-on effects of economic crises that emerge after a pandemic are closely linked to health issues beyond end-of-life concerns. For this reason, this study was designed to determine whether health status and insurance status are associated with differences in financial stress and financial behavior.

This study was also designed to determine if financial stress observed during the pandemic, between 2019 and 2021, correlates with household financial capacity. This is important because of the large variance in financial capacity observed at the household level. For instance, high-income households have a higher degree of immunity from supply and demand shocks, while low-wage workers are much more economically vulnerable (Cutler 2020). When viewed this way, the COVID-19 pandemic can be seen as a mechanism that accelerated and worsened measures of income inequality. That is, the gap between the rich and the poor widened during and immediately after the pandemic (Heo et al. 2021). Heo et al. (2021) found that COVID-19 shifted downward the financial risk tolerance of households, especially for low-income financial decision-makers. Heo et al. argued that, over time, this shift may increase the income and wealth gap between high-income and low-income households.

2.4. Other Factors Associated with a Pandemic

In the context of pandemics, researchers have taken an interest in gaining a better understanding of the potential associations between demographic characteristics and financial stress experienced at different points in time. Of particular interest is the relationship between demographic attributes, such as gender, age, marital status, income level, educational

attainment, number of dependents, employment status, and the experience of financial stress. Notably, gender, despite being acknowledged as a multidimensional construct, occupies a fundamental role in influencing an individual's ability to cope with stressors and their ensuing responses (Geary 2010; Matsuno and Budge 2017). A significant portion of the existing literature on pandemics, with a particular focus on the COVID-19 pandemic, has concentrated on discerning behavioral distinctions between males and females, building upon prior studies that explored gender-based variations during disease outbreaks. For instance, during the Ebola outbreak in Africa, women faced disproportionately heightened responsibilities in caregiving, partly due to their increased roles as primary caregivers (Androsik 2020; Park et al. 2020).

Age is another salient factor in predicting individuals' reactions to stressors and their perception of health threats amidst a pandemic. Age is a useful descriptor because of the capacity of older individuals to contextualize novel stressors and exhibit heightened resilience towards disease and mortality concerns (Bacon and Corr 2020; Cicirelli 1999). This was evidenced by an inverse correlation between age and COVID-19-related stress in a sample of American adults, with younger individuals reporting higher stress levels (Park et al. 2020). Park et al.'s (2020) findings imply that adolescents may adopt less adaptive coping strategies, potentially leading to adverse consequences (Atchison et al. 2020).

Moreover, some researchers have identified other demographic factors, including race/ethnicity, socioeconomic status, and parental status, as potential risk indicators when adopting inappropriate responses during a pandemic (e.g., Park et al. 2020). However, these studies have not thoroughly explored the correlation between demographic factors and how individuals' coping responses to COVID-19 may be linked to their financial behavior or stress level. Extensive research, however, has shown that the relationship between demographic characteristics and health-related behaviors can be mediated (Cheng and Furnham 2003; Nabi et al. 2008), implying that demographic attributes are intertwined with individuals' health-related behaviors during national health crises, ultimately manifesting as financial stress.

In summation, demographic factors exhibit a discernible connection with the psychological responses to financial challenges exhibited by households. This is true historically and during the COVID-19 pandemic.

2.5. Factors Related to Financial Stress

As described above, the COVID-19 pandemic created a substantial negative impact on society and households, both in the short term and the long term. This impact has manifested in various ways, including heightened anxiety related to health issues, job insecurity, financial instability, elevated stress levels, and increased conflicts within couples due to self-quarantine and telecommuting measures. Additionally, individuals have encountered challenges related to credit card payments, escalating debts, and a global economy that has experienced an unprecedented slowdown (Mastropietro et al. 2020; Phan and Narayan 2020; Remuzzi and Remuzzi 2020). Consequently, the amplification of financial stress resulting from the COVID-19 pandemic can be expected to have a substantial impact on individuals' financial well-being today and into the future (Brewer and Gardiner 2020; Brodeur et al. 2021).

The issue of financial stress is not unique to the COVID-19 pandemic. Financial stress is known to have arisen during previous economic and global health crises. For instance, researchers who studied the 2008 global financial crisis observed an increase in biased financial decision making at the household level, which likely resulted in and from increased stress levels (Apostolakis and Van Dijk 2018). Apostolakis and Van Dijk (2018) found that sociological factors such as one's living situation, care provisions, health conditions, and loneliness are linked to feelings of financial stress, impaired financial decision making, and other problematic household financial outcomes. It has been well established in the literature that global health crises, such as the COVID-19 pandemic, cause people to experience emotional distress, encompassing symptoms such as anxiety,

depression, and anger (Ensel and Lin 1991). Thus, it can be postulated that the outbreak of the COVID-19 pandemic induced stress, which was accompanied by a spectrum of negative emotions as well as concerns regarding personal and familial health and economic losses (Forbes et al. 2016).

However, even though researchers and policymakers acknowledge the relationship between health crises and stress reactions, comprehensive descriptions of the association are lacking in the current body of literature. For example, there are only a handful of studies that have reported on the socioeconomic or socio-demographic factors associated with financial stress. Nearly all of these studies suggest that stress is felt more acutely by lower-income households and individuals with a lower net wealth (Guan et al. 2022). In addition to income and wealth, other researchers have documented a link between financial worries and psychological distress and other socio-demographic factors, including gender, marital status, employment, and education (e.g., Ryu and Fan 2023). Based on the extant literature, this study controlled for these and other socioeconomic or sociodemographic factors.

3. Hypotheses

Based on the aims of this study, and the relevant literature, the following research hypotheses were tested:

H_1. *A significant difference in financial stress was observable before and during the COVID-19 pandemic between 2019 and 2021.*

H_2. *Financial capacity, measured with net worth and income, y, was associated with financial stress exhibited during the COVID-19 pandemic.*

H_3. *Financial risk tolerance was associated with the level of financial stress exhibited during the COVID-19 pandemic.*

H_4. *Health insurance and life insurance ownership was associated with the level of financial stress exhibited during the COVID-19 pandemic.*

H_5. *Health status was associated with the level of financial stress exhibited during the COVID-19 pandemic.*

H_6. *Demographic characteristics (i.e., female, age, marital status, education level, number of children, and working status) were associated with the financial stress exhibited during the COVID-19 pandemic.*

4. Data, Measurement, and Analytic Procedure

4.1. Data

This study used data from two online surveys collected in 2019 and 2021. Data were collected using a random sampling method in the United States. The final sample size for the study was 997 for 2019 and 988 for 2021. The two surveys were reviewed and approved as exempt by the lead researcher's university Internal Review Board (IRB) in 2018 (Approval#: IRB-1807003-EXM). The surveys contained the same survey items. However, respondents differed between surveys. As such, the sample covariates (i.e., demographics and finance-related factors) were slightly different. To handle potential differences between the two surveys, a Propensity Score Matching (PSM) technique was used to balance the covariates through sample matching (Austin 2011).

4.2. Measurements

Financial stress was the dependent variable in the main analysis.

In this study, the outcome variable of primary interest was financial stress. The dependent variables for the PSM analytic process (i.e., selection and weights) were the survey years (i.e., prior to and concurrent with the COVID-19 pandemic). The explanatory factors included finance-related variables, health status, and demographic factors. No variables were winsorized. As described in the results section, the majority of factors,

including income and net worth, were measured as ordinary or categorial factors. In addition, continuous variables were based on scale measurements that normally did not have threshold issues.

As noted above, financial stress was measured with a summed 24-item scale (see Heo et al. 2020). Respondents answered the items using a 5-point Likert-style scale. The minimum score on the scale was 24 (i.e., low stress), whereas the maximum score was 120 (i.e., high stress).

The binary survey year code was utilized as (a) the dependent variable in the PSM procedure and (b) an independent variable (i.e., treatment factor) for the main HLM analysis. As it will be explained below, PSM produces coefficients by treatment. In this study, the treatment was the occurrence of the pandemic. The sample from 2019 was considered to be the control group, whereas the sample from 2021 was considered to be the treatment group.

This study used four vectors of independent variables in the main HLM analysis: (a) COVID-19, (b) finance-related factors, (c) health status, and (d) demographic factors. COVID-19 was the treatment factor (pre- and during COVID-19 pandemic) and coded dichotomously as 2019 survey year (coded 0) and 2021 survey year (coded 1). Finance-related factors included financial capacity (i.e., net worth, income), insurance ownership (i.e., health insurance, life insurance), and financial risk tolerance. Net worth was measured with three categories: positive, negative, and zero net worth. Income was measured using six categories: (a) less than $15,000, (b) $25,000–35,000, (c) $35,000–50,000, (d) $50,000–75,000, (e) $75,000–100,000, and (f) over $150,000). Holding a health insurance policy was coded 1, otherwise it was coded as 0. Similar coding was used to account for life insurance ownership. Financial risk tolerance was assessed with the 13-item Grable and Lytton (1999) scale. Scores ranged from 13 to 47, with higher scores representing an increased willingness to take financial risk. Health status was measured as (a) excellent (coded 1), (b) good (coded 2), (c) fair (coded 3), and (d) poor (coded 4). Demographic factors included gender (coded male = 0 and female = 1), marital status as categorical dummies (i.e., married, living with a partner, single, separated/divorced), education as categorical dummies (i.e., high school or less, some college, college, graduate or higher), and work status as categorical dummies (i.e., full-time workers, self-employed, homemakers, full-time students, not working respondents). Age and the number of children in the household were coded as continuous variables. The detail of the measurement and correlations among variables were shown in Appendices A and B.

4.3. Analytic Procedure

A multi-step analytical approach was used in this study. At the first step, a descriptive sample comparison was conducted before propensity score matching (PSM). At the second step, variable weights were calculated using PSM. Finally, a Hierarchical Linear Model (HLM) was used to describe the association between financial stress and the COVID-19 pandemic.

At the first step on the analysis, descriptive characteristics of the two survey samples were examined using a χ^2 test and a t test. These tests were used to determine whether PSM should be conducted before the main analysis. Based on the descriptive results, the second step in the analysis was conducted.

At the second step of the process, the weights of variables, using PSM, were estimated. This was followed by the general procedure of PSM, as outlined by Boubaker et al. (2016). The first stage of the PSM focused on estimating the coefficients of the explanatory variables by setting the survey year as the dependent variable. At the second stage of the PSM, a logistic regression was utilized to identify the interval region of propensity scores by extending by 0.25 times per each coefficient from the logistic regression (i.e., caliper = 0.25). At the third stage, financial stress scores were used as the criterion. The weights of explanatory variables were then estimated using the second step's interval range extension. Finally, the weights of the explanatory variables were utilized as matching tools

between the two survey years. The following model was utilized as the selection equation in the logistic regression:

$$Y(COVID,\ 1,\ 0) = a + b_{fs}\sum x_{fs} + b_{ins}\sum x_{ins} + b_{frt}x_{frt} + b_{demo}\sum x_{demo} + e \quad (1)$$

where a is constant, b_{fs} denotes coefficients of financial capacity (i.e., net worth and income level), b_{ins} denotes coefficients associated with holding insurance (i.e., health insurance and life insurance), b_{frt} denotes the financial risk tolerance coefficient, and b_{demo} denotes the vector of demographic factor coefficients (i.e., female, age, marital status, education level, number of children, health status, and work status). As explained above, the coefficients from the logit were then used to estimate weights for the PSM. The weights estimated by the PSM procedure balanced the two survey samples, making a comparison possible. Finally, the resulting matched samples allowed for further comparisons.

The matched samples from the PSM procedure were then used in an HLM that examined how the COVID-19 pandemic, financial capacity, insurance, financial risk tolerance, and demographic factors are associated with levels of financial stress. The baseline HLM was a model with one predictor (i.e., COVID-19 pandemic), whereas the full HLM included all predictors (i.e., COVID-19 pandemic, financial capacity, holding insurance, financial risk tolerance, and demographic factors). The equation for the HLM is shown in Equations (2) and (3). The nested regression was employed to execute the HLM appropriately (StataCorp 2023).

$$Y(Financial\ Stress) = a + b_{covid}x_{covid} + e \quad (2)$$

$$Y(Financial\ Stress) = a + b_{covid}x_{covid} + b_{fs}\sum x_{fs} + b_{ins}\sum x_{ins} + b_{frt}x_{frt} + b_{demo}\sum x_{demo} + e \quad (3)$$

5. Results

5.1. Descriptive Results from the χ^2 and t Tests

Table 1 shows the descriptive characteristics of the two survey samples and the comparison results between the samples. In terms of financial capacity, more respondents in 2019 reported a positive net worth (62.19%) compared to 2021 (50.30%). The portion of those with a negative net worth was smaller in 2019 (26.38%) than in 2021 (38.06%). The difference was statistically significant (χ^2 = 33.48, $p < 0.001$). Income levels also differed between the two samples (χ^2 = 32.55, $p < 0.001$). For example, those whose income was below $15,000 accounted for 11.33% of respondents in 2019 and for 17.71% in 2021; those whose income fell between $35,000 and $50,000 accounted for 15.75% of the sample in 2019 and 12.85% in 2021; those with income between $50,000 and $75,000 accounted for 18.25% of the sample in 2019 and 14.98% in 2021; and those with income over $150,000 accounted for 4.21% of the sample in 2019 and 7.39% in 2021. The significant difference between net worth and income confirmed the need to use the PSM method to allow for inter-year comparisons. The financial capacity variables exhibited a statistical difference between the two survey samples, suggesting that these variables needed to be balanced before the main analysis was conducted.

Regarding holding insurance and financial risk tolerance, more respondents in 2019 reported having health insurance (84.65%) compared to 2021 (78.64%). In addition, more respondents in 2019 were covered by life insurance (54.56%) compared to 2021 (48.79%) at the significance level of $\alpha = 0.05$. Financial risk tolerance was lower in 2019 (M = 25.25, SD = 4.68) than in 2021 (M = 27.44, SD = 5.15). This difference was statistically significant ($t = -9.93$, $p < 0.001$). Given these differences, it was determined that these variables needed to be balanced using the PSM method before employing the HLM.

The health status and demographic profile of respondents across the surveys showed significant differences. Regarding health status, a smaller portion of respondents reported excellent health status in 2019 (16.95%) compared to 2021 (28.44%). More respondents reported poor health status in 2019 (5.52%) compared to 2021 (4.96%). These differences were significant (χ^2 = 32.43, $p < 0.001$). The ratio of female respondents was higher in 2019

(77.83%) than in 2021 (50.71%). The ratio difference was statistically significant (χ^2 = 159.12, $p < 0.001$). More married respondents were present in the 2019 survey (43.63%) than in the 2021 survey (38.36%). Fewer single respondents were observed in 2019 (26.18%) than in 2021 (37.55%), while more respondents reported being separated or divorced in 2019 (19.16%) than in 2021 (11.44%). Statistically, marital status significantly differed between the two samples (χ^2 = 43.93, $p < 0.001$). Group differences were also significant between the two samples with respect to education (χ^2 = 13.85, $p < 0.01$) and work status (χ^2 = 45.00, $p < 0.001$). As with the other variables, it was determined that the variables needed to be balanced before conducting the HLM.

Table 1. Descriptive results of the two survey samples before PSM (n = 1985).

	Survey before COVID-19 (n = 997)		**Survey during COVID-19 (n = 988)**		**Standardized Bias**	**Difference**
Categorical Factors	**Freq.**	**Per.**	**Freq.**	**Per.**	**%**	χ^2
Financial capacity						
Net Worth						33.48 ***
Positive	620	62.19%	497	50.30%		
Zero	114	11.43%	115	11.64%	0.6	
Negative	263	26.38%	376	38.06%	25.2	
Income Level						32.55 ***
Lower than $15k	113	11.33%	175	17.71%		
$15k–25k	126	12.64%	118	11.94%	−2.1	
$25k–35k	144	14.44%	138	13.97%	−1.4	
$35k–50k	157	15.75%	127	12.85%	−8.3	
$50k–75k	182	18.25%	148	14.98%	−8.8	
$75k–100k	128	12.84%	99	10.02%	−8.9	
$100k–150k	105	10.53%	110	11.13%	1.9	
Over $150k	142	4.21%	73	7.39%	13.6	
Having Insurance						
Health Ins. (=1)	844	84.65%	777	78.64%	−15.6	11.97 **
Life Ins. (=1)	544	54.56%	482	48.79%	−11.6	6.64 *
Socio-Demographics						
Female	776	77.83%	501	50.71%	−59.0	159.12 ***
Marital Status						43.93 ***
Married	435	43.63%	379	38.36%		
Living with partner	110	11.03%	125	12.65%	5.0	
Single	261	26.18%	371	37.55%	24.6	
Separate/Divorced	191	19.16%	113	11.44%	−21.6	
Education						13.85 **
High School or Lower	235	23.57%	279	28.24%		
Some College (Associate)	303	30.39%	269	27.23%	−7.0	
College (Bachelor)	321	32.20%	269	27.23%	−10.9	
Graduate or higher	138	13.84%	171	17.31%	9.6	
Health Status						32.43 ***
Excellent	169	16.95%	281	28.44%		
Good	551	55.27%	468	47.37%	−15.8	
Fair	222	22.27%	190	19.23%	−7.5	
Poor	55	5.52%	49	4.96%	−0.25	
Work Status						45.00 ***
Full-Time Working	372	37.31%	397	40.18%		
Part-Time Working	106	10.63%	93	9.41%	−4.1	
Self-Employed	70	7.02%	80	8.10%	4.1	
Homemaker	109	10.93%	59	5.97%	−17.9	
Full-Time Student	26	2.61%	78	7.89%	23.9	
Not Working	314	31.49%	281	28.44%	−6.7	

Table 1. *Cont.*

	Survey before COVID-19 (n = 997)		**Survey during COVID-19 (n = 988)**		**Standardized Bias**	**Difference**
Categorical Factors	**Freq.**	**Per.**	**Freq.**	**Per.**	**%**	**χ^2**
	Survey before COVID-19		Survey during COVID-19			Difference
Continuous Factors	Mean or Values	Standard Deviation	Mean or Values	Standard Deviation		*t*
Financial Stress	59.19	24.24	67	27.74		−6.68 ***
Minimum	24		24			
First Quartile	40		46			
Median	58		66			
Third Quartile	77		87			
Maximum	120		120			
Financial Risk Tolerance	25.25	4.68	27.44	5.15	44.5	−9.93 ***
Minimum	16		16			
First Quartile	22		24			
Median	25		27			
Third Quartile	28		31			
Maximum	47		47			
Socio-Demographics						
Age	47.02	15.90	38.85	15.28	−52.4	11.68 ***
Minimum	17		18			
First Quartile	33		27			
Median	46		37			
Third Quartile	60		49			
Maximum	85		87			
Number of Children	0.71	1.15	0.75	1.12	3.8	−0.84
Minimum	0		0			
First Quartile	0		0			
Median	0		0			
Third Quartile	1		1			
Maximum	8		10			

Note. This table shows the pre-PSM descriptive information for the explanatory variables, including financial capacity (i.e., net worth and income level), insurance (i.e., health insurance and life insurance), financial risk tolerance coefficient, and the vector of demographic factor coefficients (i.e., female, age, marital status, education level, number of children, health status, and work status); * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Freq. denotes frequency; per. means percentage; standardized bias (%) for reference group in each variable was omitted.

5.2. Propensity Score Matching

A logit model was estimated to determine the probability of being in the treatment sample (i.e., concurrent with the COVID-19 pandemic) compared to the control sample (i.e., pre-COVID-19 pandemic). The value for the treatment (COVID-19) was coded as 1, whereas the value of the control (pre-COVID-19) was coded as 0. Based on the descriptive results, all independent variables (i.e., financial capacity, insurance ownership, financial risk tolerance, and demographic factors) were included in the logistic model. Table 2 shows the coefficients used for sample matching. The pseudo-R^2 of the logistic model was 0.16, and χ^2 was 426.15 ($p < 0.001$). The probability of being in the treatment sample was utilized for sample matching.

As shown in Table 2, the following factors were negatively associated with the likelihood of being in the treatment sample: higher income levels ($b = -0.49$, $p < 0.05$; $b = -0.40$, $p < 0.05$; $b = -0.53$, $p < 0.05$ for \$35,000–50,000, \$50,000–75,000, and \$75,000–100,000, respectively) compared to the lowest income level; being female ($b = -1.24$, $p < 0.001$); age ($b = -0.03$, $p < 0.001$); and good health status compared to the excellent health status ($b = -0.38$, $p < 0.01$). On the other hand, the following factors were positively associated with being in the treatment sample: negative net worth ($b = 0.54$, $p < 0.001$) compared to

positive net worth; financial risk tolerance ($b = 0.06$, $p < 0.001$); and working status ($b = 0.99$, $p < 0.001$; $b = 0.67$, $p < 0.001$, for full-time student and for not working, respectively, compared to full-time workers).

Table 2. Logit model results used to estimate coefficients for PSM ($n = 1985$).

			95% C.I.	
	b	***S.E.***	**Lower**	**Upper**
Financial capacity				
Net Worth				
Zero	0.28	0.17	−0.04	0.60
Negative	0.54 ***	0.12	0.31	0.77
Income Level				
$15k–25k	−0.30	0.20	−0.69	0.08
$25k–35k	−0.28	0.20	−0.66	0.10
$35k–50k	−0.49 *	0.20	−0.87	−0.10
$50k–75k	−0.40 *	0.20	−0.80	−0.01
$75k–100k	−0.53 *	0.23	−0.98	−0.09
$100k–150k	−0.41	0.24	−0.88	0.06
Over $150k	−0.06	0.29	−0.63	0.51
Having Insurance				
Health Ins. (=1)	−0.04	0.14	−0.32	0.24
Life Ins. (=1)	−0.21	0.11	−0.44	0.01
Financial Risk Tolerance	0.06 ***	0.01	0.04	0.08
Socio-Demographics				
Female	−1.24 ***	0.12	−1.47	−1.01
Age	−0.03 ***	0.00	−0.04	−0.02
Marital Status				
Living with partner	−0.07	0.18	−0.42	0.28
Single	−0.09	0.15	−0.38	0.20
Separate/Divorced	−0.06	0.17	−0.40	0.27
Education				
Some College (Associate)	−0.17	0.14	−0.44	0.10
College (Bachelor)	−0.24	0.14	−0.52	0.05
Graduate or higher	−0.08	0.19	−0.45	0.28
Number of Children	0.03	0.05	−0.07	0.12
Health Status				
Good	−0.38 **	0.13	−0.65	−0.12
Fair	−0.45	0.17	−0.78	−0.12
Poor	−0.52	0.25	−1.02	−0.02
Work Status				
Part-Time Working	0.11	0.18	−0.25	0.47
Self-Employed	0.16	0.20	−0.24	0.56
Homemaker	0.00	0.21	−0.40	0.41
Full-Time Student	0.99 ***	0.27	0.47	1.52
Not Working	0.67 ***	0.16	0.36	0.97
Constant	1.15 *	0.46	0.25	2.05
Pseudo-R^2	0.16			
χ^2	426.15 ***			

Note. This table shows the logistic regression result for PSM procedure using the dependent variable (survey year before and concurrent with the COVID−19 pandemic) and explanatory variables including financial capacity (i.e., net worth and income level), holding insurance (i.e., health insurance and life insurance), financial risk tolerance coefficient, and the vector of demographic factor coefficients (i.e., female, age, marital status, education level, number of children, health status, and work status); * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Ins. denotes insurance; FRT means financial risk tolerance; the reference group for net worth was positive net worth; the reference group for income level was lower than $15k; the reference group for marital status was married; the reference group for education was high school or lower; the reference group for health status was excellent health status; the reference group for work status was full-time worker.

PSM weights were calculated from 1 to 20 (average = 1.39, SD = 1.40) using the coefficients from Table 2. Descriptive data were adjusted to balance the covariates, as shown in Table 3. After the adjustments, the descriptive variables were determined to be well-balanced. Significant differences were reduced, except for net worth, marital status, and education. Even so, the difference between the pre-COVID-19 and concurrent with COVID-19 samples for these variables was significantly reduced.

While the difference in net worth remained significant ($\chi^2 = 8.86$, $p < 0.05$), compared to Table 1 (before score matching) the distributions were more balanced. The net worth distributions in the 2019 survey were 62.19% (positive), 11.43% (zero), and 26.38% (negative). Distributions in 2021 were 50.30%, 11.64%, and 38.06% for positive, zero, and negative net worth, respectively. However, the adjusted distributions were 51.62% (positive), 15.38% (zero), and 33.00% (negative), which aligned closely with the net worth distributions in the 2021 survey. A similar situation was observed in relation to marital status. Marital status in the 2019 survey was 43.63% (married), 11.03% (living with a partner), 26.18% (single), and 19.16% (separated/divorced). In 2021, the distribution was 38.36%, 12.65%, 37.55%, and 11.44% for married, living with a partner, single, and separated/divorced, respectively. The adjusted distribution of marital status after score matching was 31.98% (married), 13.16% (living with a partner), 39.27% (single), and 15.59% (separated/divorced), which was closer to the marital status distribution recorded in the 2021 survey. A parallel pattern was observed with education. The education distribution in the 2019 survey was 23.57% (high school or lower), 30.39% (some college), 32.20% (college), and 13.84% (graduate or higher). In 2021, the distribution was 28.24%, 27.23%, 27.23%, and 17.31% for high school or lower, some college, college, and graduate or higher, respectively. After the analysis, the adjusted distribution of education was 33.10% (high school or lower), 23.38% (some college), 29.55% (college), and 13.97% (graduate or higher), which was closer to the education distribution recorded as part of the 2021 survey. Given the alignment of distributions across variables, the matching samples from the two surveys were considered comparable (i.e., any differences across the samples was reduced using the PSM procedure).

Table 3. Propensity score matched sample (n = 1976).

	Survey before COVID-19 (n = 988)		**Survey during COVID-19 (n = 988)**		**Standardized Bias**	**Reduction of Bias**	**Difference**
Categorical Factors	**Freq.**	**Per.**	**Freq.**	**Per.**	**%**	**%**	**χ^2**
Financial capacity							
Net Worth							8.86 *
Positive	510	51.62%	497	50.30%			
Zero	152	15.38%	115	11.64%	−11.7	−1723.5	
Negative	326	33.00%	376	38.06%	10.9	56.7	
Income Level							6.49
Lower than $15k	196	19.84%	175	17.71%			
$15k–25k	128	12.96%	118	11.94%	−3.1	−45.7	
$25k–35k	134	13.56%	138	13.97%	1.2	14.9	
$35k–50k	146	14.78%	127	12.85%	−5.5	33.5	
$50k–75k	121	12.25%	148	14.98%	7.3	16.6	
$75k–100k	96	9.74%	99	10.02%	1.0	89.2	
$100k–150k	99	10.02%	110	11.13%	3.6	−84.9	
Over $150k	68	6.88%	73	7.39%	2.2	84.1	
Having Insurance							
Health Ins. (=1)	769	77.83%	777	78.64%	2.1	86.5	0.19
Life Ins. (=1)	458	46.36%	482	48.79%	4.9	58.0	1.17
Socio-Demographics							
Female	511	51.72%	501	50.71%	−2.2	96.3	0.20

Table 3. *Cont.*

	Survey before COVID-19 (n = 988)		Survey during COVID-19 (n = 988)		Standardized Bias	Reduction of Bias	Difference
Categorical Factors	**Freq.**	**Per.**	**Freq.**	**Per.**	**%**	**%**	χ^2
Marital Status							12.49 **
Married	316	31.98%	379	38.36%			
Living with partner	130	13.16%	125	12.65%	−1.6	68.7	
Single	388	39.27%	371	37.55%	−3.7	84.9	
Separate/Divorced	154	15.59%	113	11.44%	−11.6	46.2	
Education							11.16 *
High School or Lower	327	33.10%	279	28.24%			
Some College (Associate)	231	23.38%	269	27.23%	8.5	−21.5	
College (Bachelor)	292	29.55%	269	27.23%	−5.1	53.2	
Graduate or higher	138	13.97%	171	17.31%	9.2	3.6	
Health Status							6.23
Excellent	264	26.72%	281	28.44%			
Good	447	45.24%	468	47.37%	4.3	73.1	
Fair	204	20.65%	190	19.23%	−3.5	53.3	
Poor	73	7.39%	49	4.96%	−10.9	−336.1	
Work Status							7.92
Full-Time Working	349	35.32%	397	40.18%			
Part-Time Working	95	9.62%	93	9.41%	−0.7	83.4	
Self-Employed	75	7.59%	80	8.10%	1.9	53.0	
Homemaker	61	6.17%	59	5.97%	−0.7	95.9	
Full-Time Student	104	10.53%	78	7.89%	−11.9	50.2	
Not Working	304	30.77%	281	28.44%	−5.1	23.8	
	Survey before COVID-19		Survey during COVID-19				Difference
Continuous Factors	Mean	SD	Mean	SD			t
Financial Risk Tolerance	27.50	5.25	27.44	5.15	−1.2	97.3	−0.26
Socio-Demographics							
Age	39.36	14.55	38.85	15.28	−3.3	93.7	−0.77
Number of Children	0.72	1.13	0.75	1.12	2.7	29.2	0.60

Note. This table shows the post-PSM descriptive information of explanatory variables including financial capacity (i.e., net worth and income level), insurance (i.e., health insurance and life insurance), financial risk tolerance coefficient, and the vector of demographic factor coefficients (i.e., female, age, marital status, education level, number of children, health status, and work status); * $p < 0.05$; ** $p < 0.01$; Freq. denotes frequency; per. means percentage; standardized bias (%) and reduction of bias (%) for the reference group in each variable were omitted.

5.3. Hierarchical Linear Modeling with Nested Regressions

HLM with nested regression algorithms was utilized to test the degree to which the selected factors were associated with levels of financial stress. As shown in Table 4, the survey date was positively related to financial stress levels. The level of financial stress was higher (b = 6.11, $p < 0.01$) in 2021 (i.e., concurrent with COVID-19) compared to the 2019 survey (i.e., pre-COVID-19). Table 4 also shows that the adjusted R^2 increased from 1% to 25% as additional covariates were included in the model, implying that various covariates are associated with financial stress. In terms of multicollinearity, the variance inflation factors (VIF) were observed to be less than the criteria of 5.00 (see Chatterjee and Simonoff 2013). As such, it was determined that the model was not subject to a multicollinear issue. The modified coefficient for financial stress level decreased to 5.85 ($p < 0.001$) when accounting for the various covariates. The following diverse set of significant covariates was found to be associated with the level of financial stress pre-COVID-19 and concurrent with COVID-19: net worth, income level, health insurance cover, financial risk tolerance, age, marital status, education, health status, and work status. Each of the significant associations is described below.

Financial capacity, health insurance cover, and financial risk tolerance were associated with financial stress. Compared to those who had a positive net worth, those with zero or negative net worth were more likely to report a higher level of financial stress ($b = 9.46$, $p < 0.001$; $b = 12.35$, $p < 0.001$, for zero net worth and negative net worth, respectively). Compared to those in the lowest income level (i.e., lower than $15,000), those in a higher income level showed a lower level of financial stress ($b = -4.20$, $p < 0.05$; $b = -5.10$, $p < 0.05$; $b = -4.98$, $p < 0.05$; $b = -6.49$, $p < 0.01$; $b = -7.54$, $p < 0.01$, for $25,000–35,000, $35,000–50,000, $50,000–75,000, $75,000–100,000, and Over $150,000, respectively). In addition, holding health insurance cover was also found to be statistically significant. Those with health insurance reported a lower level of financial stress ($b = -4.12$, $p < 0.05$); however, the relationship between owning life insurance and financial stress was not significant (b = −0.16, $p = 0.93$). Financial risk tolerance was found to be positively associated with financial stress ($b = 0.70$, $p < 0.001$).

In terms of health status, compared to excellent health status, those reporting fair and poor health status reported a significantly higher level of financial stress ($b = 12.32$, $p < 0.001$; $b = 23.77$, $p < 0.001$ for fair health status and poor health status, respectively). The main difference between the two survey samples was whether or not a respondent was in the concurrent-with-COVID-19 period, which likely led to increased concerns about health.

Older respondents were observed to report lower financial stress ($b = -0.32$, $p < 0.001$), even though older respondents were more likely to have experienced various crises over their lives. Compared to married respondents, all the other categories of marital status were found to have lower levels of financial stress. Specifically, those who lived with a partner ($b = -6.07$, $p < 0.01$), those who were single ($b = -6.59$, $p < 0.001$), and those who were separated or divorced ($b = -4.71$, $p < 0.05$) exhibited a lower level of financial stress. The more children in a household, the higher the level of financial stress ($b = 1.96$, $p < 0.001$). Couples with children may report high levels of financial stress because they have greater financial responsibilities (i.e., taking care of dependents). In the case of work status, the results were somewhat surprising. Compared to full-time workers, the self-employed ($b = -6.62$, $p < 0.01$), homemakers ($b = -7.11$, $p < 0.01$), full-time students ($b = -12.89$, $p < 0.001$), and non-working respondents were observed to have a lower level of financial stress ($b = -7.60$, $p < 0.001$).

Table 4. Multivariable regression results ($n = 1976$).

	Model 1		**Model 2**		**VIFs**
	b	***S.E.***	***b***	***S.E.***	
Before/During	6.11 **	1.24	5.85 ***	1.09	1.25
Financial capacity					
Net Worth					
Zero			9.46 ***	1.73	1.11
Negative			12.35 ***	1.29	1.22
Income Level					
$15k–25k			−0.97	2.05	1.72
$25k–35k			−4.20 *	2.05	1.85
$35k–50k			−5.10 *	2.04	1.93
$50k–75k			−4.98 *	2.16	2.21
$75k–100k			−6.49 **	2.42	2.05
$100k–150k			−4.01	2.45	2.17
Over $150k			−7.54 **	2.87	1.77

Table 4. *Cont.*

	Model 1		Model 2		VIFs
	b	***S.E.***	***b***	***S.E.***	
Having Insurance					
Health Ins. (=1)			−4.12 **	1.47	1.21
Life Ins. (=1)			−0.16	1.26	1.28
Financial Risk Tolerance			0.70 ***	0.12	1.27
Socio-Demographics					
Female			0.01	1.22	1.32
Age			−0.32 ***	0.05	2.07
Marital Status					
Living with partner			−6.07 **	1.95	1.35
Single			−6.59 ***	1.65	1.92
Separate/Divorced			−4.71 *	2.00	1.48
Education					
Some College (Associate)			−3.17 *	1.52	1.57
College (Bachelor)			−2.38	1.57	1.74
Graduate or higher			−0.36	2.10	1.84
Number of Children			1.96 ***	0.54	1.25
Health Status					
Good			−0.87	1.42	1.80
Fair			12.32 ***	1.84	1.84
Poor			23.77 ***	2.68	1.34
Work Status					
Part-Time Working			−1.96	2.08	1.24
Self-Employed			−6.62 **	2.22	1.18
Homemaker			−7.11 **	2.55	1.32
Full-Time Student			−12.89 ***	2.21	1.26
Not Working			−7.60 ***	1.74	2.00
Constant	60.89 ***	0.87	60.83 ***	4.84	
Mean of VIF					1.59
R^2	0.01		0.25		
ΔR^2	0.01		0.24		
F	24.42 ***		22.53 ***		
Block F	24.42 ***		22.21 ***		

Note. This table shows the HLM results for the model with the dependent variable being financial stress. The model included explanatory variables including financial capacity (i.e., net worth and income level), holding insurance cover (i.e., health insurance and life insurance), financial risk tolerance coefficient, and the vector of demographic factor coefficients (i.e., female, age, marital status, education level, number of children, health status, and work status); * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Ins. Denotes insurance; FRT means financial risk tolerance; the reference group for net worth was positive net worth; the reference group for income level was lower than \$15k; the reference group for marital status was married; the reference group for education was high school or lower; the reference group for health status was excellent health status; the reference group for work status was full-time worker.

6. Discussion

This study was undertaken to investigate whether the COVID-19 pandemic was associated with household financial stress levels and whether covariates such as financial capacity, financial risk tolerance, insurance ownership, health status, and demographic factors related to levels of financial stress during periods of a national health crisis. Using survey samples collected in 2019 and 2021, the study compared the two samples as a control group (i.e., pre-COVID-19 pandemic) and a treatment group (i.e., during the COVID-19 pandemic). Both χ^2 tests and *t* tests were used to determine the comparability of the samples. It was determined that the covariates needed to be balanced before the two samples could be compared. Propensity score matching (PSM) was used to balance the distributions of the covariates. A hierarchical linear modeling (HLM) technique, utilizing the matched samples, was then used to examine how levels of financial stress differed

between periods and how the covariates (i.e., financial capacity, financial risk tolerance, insurance, health status, and demographic factors) were associated with financial stress.

The HLM results showed an increase in financial stress during the pandemic. Three types of covariates were found to be significant descriptors of financial stress: financial characteristics, health status, and demographic factors. Those with better financial profiles tended to exhibit lower levels of financial stress. For example, respondents with a positive net worth reported lower levels of financial stress than those with zero or negative net worth. Similarly, those with a higher income were observed to have a lower level of financial stress than those with a lower income. One explanation for these findings is that households with higher incomes and net worth have more resources to meet their basic living expenses and weather unexpected financial setbacks. This can help reduce financial stress, as those in the household are less likely to worry about making ends meet. Those with greater financial capacity are more likely to have peace of mind knowing they have a financial safety net. They may also have more financial flexibility, which implies they have more options when making financial decisions, such as paying off debt faster or saving more for retirement. This can further reduce stress, as they have more control over their financial situation. It is important to note that even those with higher incomes and net worth can experience financial stress. However, they are generally less likely to experience financial stress than those living in lower income and net worth households.

Respondents with health insurance and those in excellent health reported lower levels of financial stress. As illustrated in this study, financial stress is not solely a product of financial instability. Seemingly unrelated social factors, such as health status, can manifest through financial strain (Butterworth and Crosier 2005). This is likely because health insurance can help to offset the costs of medical care, while unexpected medical expenses can be financially devastating. Additionally, individuals in good health are less likely to experience unexpected medical expenses. For those not in good health, financial stress can be exacerbated by lost income if they are unable to work due to health issues (e.g., illness, injury). Even if they are able to work, poor health can reduce productivity and earning potential. System-wide health crises, such as the COVID-19 pandemic, can also have a significant impact on financial stress, as people experience job losses, reduced income, and increased medical expenses.

In this study, financial risk tolerance was positively associated with increased financial stress. Household portfolio holdings differ by a financial decision-maker's willingness to take financial risks. Heo et al. (2021) demonstrated that investors with higher financial risk tolerance were more likely to be less apprehensive about their financial knowledge, leading them to allocate a larger portion of their household wealth to riskier (i.e., greater volatility) assets, including equities, real estate, and commodities. These types of assets, while potentially generating greater returns, carry a greater risk of loss. Given the heightened volatility experienced by stock market investors due to the COVID-19 pandemic (Uddin et al. 2021), the value of risk investments fluctuated more significantly than the value of lower-risk assets. Households who held a greater proportion of their wealth (i.e., those with more risk tolerance) in risky equity assets were more likely to experience losses in their portfolios, potentially exacerbating feelings of financial stress. Relatedly, individuals with high financial risk tolerance tend to be more likely to overestimate their ability to deal, both fiscally and emotionally, with financial risks. During the pandemic, this tendency may have led some to make biased investment decisions, further contributing to financial stress. Moreover, individuals with high financial risk tolerance may also be more likely to take on debt. This can increase their overall debt burden and make them more vulnerable to financial hardship if they are unable to meet their repayment obligations, potentially leading to financial stress.

Some notable demographic characteristics were also associated with financial stress in this study. Older respondents reported a lower financial stress level, while married couples with a child reported the highest levels of financial stress. This may be due to older individuals having more resources (e.g., accumulated retirement savings, fixed, steady

stream of income), which can provide a financial cushion when a household is faced with financial uncertainty. Also, older people typically have more experience managing resources during crises. This can help them make better financial decisions and reduce the prevalence of factors that might increase their financial stress. Married couples with children living in the home may have more financial responsibilities, which can contribute to financial stress. Studies have shown that the costs of raising children (e.g., the economic and time burdens of parenthood) can reduce life satisfaction, although the effects vary depending on family contexts (Pollmann-Schult 2014; Stutzer and Frey 2006). Childcare expenses can add up quickly and strain a couple's budget. This may have been especially true during the pandemic, when many parents faced increased obligations due to remote work and childcare duties at home (Bayham and Fenichel 2020). Cluver et al. (2020) showed that parents were more likely to experience distress during the pandemic, which can increase the financial strain experienced by households with more than two people.

In this study, full-time workers reported a higher level of financial stress compared to the self-employed, homemakers, students, and other non-working respondents. These findings align with reports from previous studies. Lee et al. (2023), for example, found that employed (full time/part time) individuals are more likely to report higher levels of financial stress than those who are not working. Similarly, Lee et al. (2023) reported that the self-employed, those who are retired, and those who are not working exhibit lower levels of financial anxiety compared to salaried workers. One explanation for these associations is that full-time employment encompasses a wide range of occupations, encompassing both fixed salaries and hourly wages, spanning from high-earning to low-earning roles. While a steady paycheck offers a sense of stability, it may not always be sufficient to cover unexpected expenses or achieve long-term financial goals. Moreover, full-time workers often find themselves at a life stage or family situational role that entails significant financial responsibilities, such as supporting dependents, paying mortgages, or financing education. These financial commitments can intensify feelings of financial stress during periods of economic uncertainty.

Full-time workers also face heightened vulnerability to economic downturns, layoffs, and industry-specific changes compared to self-employed individuals, homemakers, students, and other non-working adults. The COVID-19 pandemic heightened labor market insecurity, fostering an atmosphere of uncertainty. This uncertainty led some individuals to question their employment status, raising concerns about redeploying in the event of displacement, loss of social connections, income loss, and disruptions to their professional and personal development (Parolin et al. 2020). Khudaykulov et al. (2022) indicated that the shifting dynamics of the labor market instilled concerns among employers regarding liquidity and the sustainability of their operations. Concurrent with financial concerns, employees face uncertainties about their roles and responsibilities within the workplace. This pervasive sense of insecurity extends beyond the threat of immediate financial repercussions, impacting individuals' moods, relationships, and overall psychological and emotional well-being (Khudaykulov et al. 2022), all of which can heighten feelings of financial stress.

7. Implications and Limitations

The causes of financial stress are not easily identified or described. As shown in the study, financial stress is associated with a variety of factors including financial and demographic household characteristics. People can take steps to manage and reduce their financial stress, such as engaging in behavioral change activities (e.g., setting a budget, building an emergency fund) and increasing their financial knowledge and money management skills (Lee et al. 2023). However, this study also recognizes that financial stress can be a systemic issue that cannot be solved solely through individual tasks, especially during a pandemic.

The economy and policy decisions made in response to changes in the economy can affect individual and household financial stress and well-being (Friedline et al. 2021). The compounding effects of the worldwide health crisis resulting from the COVID-19

pandemic triggered deep national economic and social crises, significantly impacting household incomes, unemployment rates, and overall well-being (Brewer and Gardiner 2020; Daks et al. 2020). Public policy plays a key role in mitigating the adverse effects of a global health crisis. Financial assistance programs were shown, for example, to boost family financial well-being during the COVID-19 pandemic. Baker et al. (2020) documented how quickly households responded to stimulus checks issued under the 2020 CARES Act in the United States. This response was particularly pronounced among households with lower incomes, steeper income declines, and limited liquidity reserves. Their analysis of spending patterns revealed a modest increase in durables spending, a more substantial rise in food expenditures, and a notable surge in short-term debt repayments, including money set aside to pay rent, mortgages, and credit card balances. Liu et al. (2023) found that stimulus checks provided by the government during the COVID-19 pandemic were negatively associated with experiencing financial hardship, measured as payment obligations in five areas including credit cards, rent/mortgages, utilities, medical bills, and other payments, among pre-retirees. By implementing policies that promote economic stability and resilience, policymakers can help reduce the negative antecedents and consequences of financial stress and improve the overall well-being of individuals and households. Access to affordable essential services, including healthcare, housing, education, and childcare, is also crucial for families to thrive during times of a global or national health crisis. This recognition underscores the need for comprehensive policy interventions and systemic changes to effectively mitigate financial stress during extreme health crises.

There are also opportunities for financial service practitioners, researchers, and educators to play an important role in helping individuals manage and improve their financial stress. Financial advisors can use the findings from this study to tailor their advice to clients in light of the impact of government policies designed to bolster family financial well-being. For example, financial advisors can emphasize the importance of emergency savings and debt reduction strategies before, during, and after times of economic uncertainty, and they can help clients develop strategies to benefit from government assistance programs. By understanding the broader context of family financial stress, financial service practitioners can provide more comprehensive and tailored interventions through techniques embedded in financial therapy, financial counseling, and financial planning models to help individuals and households better manage their finances, reduce stress, and improve their overall well-being. Financial service practitioners can also partner with community organizations to provide financial education and counseling services to individuals and families in need. These partnerships can assist families in the development of financial skills and knowledge necessary for the management of their finances effectively and cope with financial stress.

When conceptualizing the policy implications from this study, it is important to note that the COVID-19 pandemic did not affect households equally. Future research should disaggregate the impact of pandemic-related financial stress to understand how different demographic groups have been disproportionately affected. This nuanced understanding is crucial for the development of equitable policies and interventions that address the specific needs of vulnerable populations. Conducting similar studies in different countries or cultural contexts can provide insights into how different societal structures and policies impact financial stress, enhancing the global understanding of this issue. Additionally, future research should consider intervention factors (e.g., financial assistance programs, financial counseling, and financial planning) as a way of evaluating their effectiveness in alleviating financial stress and promoting well-being. This approach can guide the development of targeted interventions tailored to the specific needs of different populations, thereby enhancing the effectiveness of financial counseling, financial literacy education, and other support programs. Of particular importance in this regard is the usage of diverse research designs and data, with an emphasis on longitudinal approaches (e.g., before, during, and after a national health crisis) to examine the long-term effects of macroeconomic changes, assist in the development of more effective stress reduction interventions, and

inform future policy decisions aimed at promoting financial resilience and stability in the face of crises. Integrating qualitative research methods, such as interviews or focus groups, could also provide deeper insights into the subjective experiences of financial stress. This can complement the quantitative data and offer a more holistic view of the issue.

Although this study provides insights into the factors associated with household financial stress during moments of extreme health crises, there are certain limitations to note. First, this study employed the PSM method to balance the sample between two periods. The weakness associated with this approach is that it is possible some data points did not match in the same way as data that might have been obtained from a panel study. Thus, the study's findings might not fully capture the dynamic nature of financial stress across time. Future research could benefit from usage of longitudinal and panel surveys to address this limitation and provide a more nuanced understanding of changes in financial stress over time. This approach would allow researchers to track the same individuals over time, providing a clearer picture of how financial stress evolves in response to changing circumstances, such as a pandemic. Second, although the study included a comprehensive list of factors related to financial stress, there might be other relevant variables that were not considered. Future research should expand the range of variables examined to provide a more detailed picture of the factors contributing to financial stress. This could include factors such as social support networks, mental health status, employment stability, access to financial education, and regional economic conditions, which might influence financial stress levels. A causal inference approach would be desirable to account for potential confounders and colliders when including new variables. Implementing an experimental design, such as randomized controlled trials, could offer more direct evidence of the causal relationships between identified factors and financial stress. This could be particularly useful in testing the effectiveness of specific interventions or policies aimed at reducing financial stress. Third, the study's findings are specific to the context of the COVID-19 pandemic and may not be generalizable to other situations or types of financial crises. This specificity limits the applicability of the results to other contexts or times. Thus, future studies should ensure that any sample used is diverse and representative of various demographic groups, which can improve the generalizability of the findings. Fourth, the study acknowledges that financial stress is a complex, systemic issue, particularly during a pandemic, and cannot be fully addressed through individual actions alone. Recognizing this systemic nature, future studies should delve into policy implications and generalized solutions. This could involve examining the impact of government relief programs, healthcare policies, insurance coverage, and broader economic policies on financial stress. Incorporating a broader socioeconomic analysis into the study could help our understanding of the wider context of financial stress, including factors such as market trends, government policies, and global economic conditions.

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Institutional Review Board Statement: All study respondents provided informed consent, and the study design was approved by the appropriate ethics review board (IRB approved data). Data collection was approved by IRB in 2018 (Approval#: IRB-1804003-EXM) and the two surveys were allowed under the same approval.

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Data Availability Statement: Data are not available by the data publisher.

Conflicts of Interest: The authors declare that there is no conflict of interest.

Appendix A. Variable List and Description

Variables	Definition/Description
Dependent Variable	
Financial stress scale	Financial stress is an individual's emotional and physiological reactions to financial stressors. Financial stress scales with 24 items were utilized by using a five points Likert-style questionnaire, ranging from 24 to 120.
Explanatory Variables	
Before/During COVID-19	Survey year before COVID-19.The sample from 2019 is before COVID-19 (=0); the sample from 2021 is during COVID-19 (=1).
Net worth	The current assets of an individual used toward paying off mortgages, loans, debts, and credit cards. After paying all debts, the net worth was categorized as negative, zero, or positive. Three categories were coded as dummies. Positive net worth is utilized as reference in the analytic procedures.
Income level	A respondent's income level: lower than $15k, $15k–25k, $25k–35k, $35k–50k, $50k–75k, $75k–100k, $100k–150k, and over $150k. Each category was coded as dummy. The lowest income level was utilized as reference.
Having health insurance	A respondent has health insurance (=1; otherwise = 0).
Having life insurance	A respondent has life insurance (=1; otherwise = 0).
Female	A respondent is female (=1; otherwise = 0).
Marital status	A respondent has one of these marital statuses: married, living with a partner, single, separated/divorced. Each category was coded as dummy. The married status was utilized as reference.
Education	A respondent has one of these educational completions: high school graduate or lower, some college with associate degree, college with bachelor's degree, and graduate or higher degree. Each category was coded as dummy. The high school or lower status was utilized as reference.
Health status	A respondent has one of these health statuses: excellent, good, fair, poor. Each category was coded as dummy. The excellent status was utilized as reference.
Work status	A respondent has one of these work statuses: full-time working, part-time working, self-employed, homemaker, full-time student, not working. Each category was coded as dummy. The full-time working status was utilized as reference.
Financial risk tolerance	Financial risk tolerance is a respondent's willingness to take financial risks in their financial management. A financial risk tolerance scale with 13 items was utilized, ranging from 13 to 47.
Age	A respondent's age when the survey was performed.
Number of children	Number of children in a household.

Appendix B. Correlation Table (Spearman)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	1.00																		
2	0.12 ***	1.00																	
3	0.12 ***	0.30 ***	1.00																
4	0.04	0.00	0.12 ***	1.00															
5	−0.01	−0.01	−0.11 ***	−0.31 ***	1.00														
6	0.19 ***	0.16 ***	0.09 ***	−0.17 ***	−0.03	1.00													
7	−0.03	0.07 ***	0.14 ***	0.12 ***	−0.03	−0.08 ***	1.00												
8	0.09 ***	0.18 ***	0.28 ***	0.09 ***	−0.10 ***	0.24 ***	0.35 ***	1.00											
9	−0.05 *	0.00	−0.03	0.04	0.05 *	−0.18 ***	0.00	−0.31 ***	1.00										
10	−0.07 **	−0.16 ***	−0.21 ***	−0.01	−0.04	−0.38 ***	−0.31 ***	−0.57 ***	−0.25 ***	1.00									
11	0.00	−0.03	−0.08 ***	−0.14 ***	0.13 ***	0.34 ***	−0.08 ***	−0.35 ***	−0.16 ***	−0.29 ***	1.00								
12	0.07 **	0.20 ***	0.20 ***	0.18 ***	−0.16 ***	0.11 ***	0.11 ***	0.27 ***	−0.10 ***	−0.14 ***	−0.09 ***	1.00							
13	−0.19 ***	−0.10 ***	−0.16 ***	−0.24 ***	0.19 ***	0.11 ***	−0.09 ***	−0.17 ***	0.03	0.03	0.16 ***	−0.23 ***	1.00						
14	−0.06 *	0.10 ***	0.24 ***	0.20 ***	−0.20 ***	−0.17 ***	0.22 ***	0.15 ***	0.03	−0.06 **	−0.15 ***	0.29 ***	−0.23 ***	1.00					
15	−0.02	0.01	−0.04	−0.01	0.08 ***	−0.10 ***	−0.03	−0.05 *	0.04	0.05	−0.04	−0.07 **	0.03	−0.27 ***	1.00				
16	−0.01	−0.11 ***	−0.06 **	0.07 ***	−0.07 **	−0.01	−0.03	−0.06 *	0.03	0.03	0.01	0.03	−0.03	−0.23 ***	−0.10 ***	1.00			
17	0.00	−0.05 *	−0.04	−0.09 ***	0.20 ***	−0.01	0.19 ***	0.18 ***	0.01	−0.14 ***	−0.07 ***	−0.08 ***	0.04	−0.24 ***	−0.10 ***	−0.09 ***	1.00		
18	0.01	0.00	−0.04	0.00	0.07 **	−0.31 ***	−0.13 ***	−0.16 ***	−0.00	0.23 ***	−0.07 ***	−0.10 ***	−0.04	−0.19 ***	−0.08 ***	−0.07 ***	−0.07 ***	1.00	
19	0.08 ***	−0.03	−0.15 ***	−0.20 ***	0.05 *	0.40 ***	−0.25 ***	−0.13 ***	−0.08 ***	−0.01	0.26 ***	−0.18 ***	0.23 ***	−0.52 ***	−0.22 ***	−0.19 ***	−0.20 ***	−0.15 ***	1.00

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; 1 = ordinal value of net worth (1 = negative, 2 = same, 3 = positive); 2 = having health insurance; 3 = having life insurance; 4 = financial risk tolerance; 5 = female; 6 = age; 7 = child; 8 = married; 9 = living with partner; 10 = single; 11 = separated/divorced; 12 = ordinal value of education (1 = high school or lower, 2 = associate degree, 3 = bachelor degree, 4 = graduate or higher); 13 = ordinal value of health (1 = excellent health, 2 = good health, 3 = fair health, 4 = poor); 14 = full-time working; 15 = part-time working; 16 = self-employed; 17 = homemaker; 18 = full-time student; 19 = not working.

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