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Original Paper

How Financial Capability Protects Financial Well-Being during COVID-19: A Pre- and Post-Pandemic Analysis

Ziang Wang[1] & Mingyang Song[2]

[1,2] School of Finance, Harbin University of Commerce, Harbin, 150028, Heilongjiang, China

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Abstract

Financial well-being represents both the material foundation and an essential component of overall household well-being. The outbreak of the COVID-19 pandemic at the end of 2019 significantly impacted a wide range of small and large business owners as well as wage earners across the United States, subsequently affecting the financial well-being of many households. In order to mitigate such adverse effects, this study aims to explore whether higher financial capability positively influences financial well-being. Consistent with findings from prior research on financial behavior, which suggest that stronger financial capability leads to improved financial well-being, this study further investigates the mediating effect of financial behavior. The analysis reveals that financial capability affects financial well-being indirectly through its influence on financial behavior. Moreover, a heterogeneity analysis shows that individuals with higher levels of education tend to possess stronger financial capability, which in turn leads to differences in financial well-being. Additional analyses suggest that financial capability serves as a necessary condition for achieving financial well-being.

Keywords

Financial capability, Financial well-being, Financial behaviour, Mediation, Necessary condition analysis, COVID-19

1. Introduction

As the global economy gradually recovers from the recent pandemic, financial well-being has emerged as an increasingly prominent topic in academic discourse (Cui, 2019). The crisis not only exposed the systemic vulnerabilities of the global financial system but also fundamentally reshaped individuals' perceptions of economic security and their behavioral patterns. Against this backdrop, understanding the determinants of financial well-being has become especially critical. According to an official WTO report, approximately 7 million people worldwide died from the pandemic, and Internationaler

Währungsfonds noted that in 2020, the annual GDP growth rate in the United States dropped to -2.8%. In the face of such a "black swan" event as COVID-19, protecting personal financial well-being amid turbulence has become a central concern.

From an individual perspective, personal wealth level is considered a primary indicator of financial well-being (Heckman & Mosso, 2014), yet the pandemic has adversely impacted individual wealth to varying degrees. The Dept. report shows that nearly 70% of global economies have yet to return to pre-pandemic output levels. Additionally, another key metric related to financial well-being is debt burden. According to OECD, household debt-to-income ratios increased significantly by 15 basis points after the pandemic. Furthermore, Hojman (2016) found that individuals with excessive debt are more likely to suffer from depression. Inappropriate saving behavior not only affects an individual's well-being but also has implications for the family unit (Prawitz, 2006).

In summary, the above findings consistently reflect the multifaceted impact of the pandemic on financial well-being. This study, in light of the coexistence of macroeconomic recovery and micro-level vulnerability, investigates the protective role of individual financial capability on financial well-being, drawing on panel data collected before and after the onset of the pandemic.

Current research has largely focused on the impact of financial literacy (Adam, 2017; Allgood & Walstad, 2016; Hastings, 2013; Zhang & Chatterjee, 2023) and financial attitude (Talwar, 2021; Saurabh & Nandan, 2018) on financial well-being. However, whether improvements in financial capability directly translate into greater financial well-being, or whether financial capability influences well-being indirectly through mediating variables such as financial behavior, remains an underexplored area. Some scholars, for instance, drawing on the scarcity mindset framework, argue that the benefits of financial capability may only materialize once a critical threshold is surpassed (Johnson & Sherraden, 2007).

Against this backdrop, this paper offers three main marginal contributions. First and foremost, it investigates the protective effect of financial capability on individual financial well-being in the context of a severe pandemic shock. While existing studies have examined the effect of financial attitudes on retail investors' behavior during the pandemic using cross-sectional data (Talwar, 2021.), this study employs panel data, which allows for the removal of unobserved individual heterogeneity over time. It further incorporates sociodemographic characteristics, financial knowledge, financial confidence, and financial attitudes as control variables, thereby constructing a more comprehensive theoretical model. Furthermore, given the complexity of the model, this study employs multiple methodological approaches to address the challenges posed by high-dimensional estimation. Specifically, it adopts machine learning techniques to support high-dimensional causal inference and mitigate the curse of dimensionality, using a large sample size and implementing the orthogonal score function to enhance robustness. This ensures that the causal estimates remain consistent even in the presence of mild model misspecification in the first-stage estimation (e.g., Lasso). Additionally, the study adopts a mixed-methods approach. Using Necessary Condition Analysis (NCA), it further explores whether

financial capability (FC) serves as a necessary condition for achieving high levels of financial well-being (FWB), and if so, at what threshold level this necessity holds.

2. Theory and Hypotheses Development

From a behavioural perspective, attitude is an emotional or affective evaluation of a person, object, or event (Barki & Hartwick, 1994), which may result in either positive or negative actions toward it . Accordingly, FA is the individual's perspective against financial matters, giving a positive or negative influence on financial matters. Specifically, asserted by Abdullah (2019). that the attitude toward money, specifically, the dimension of ability/effort, uniquely contributes to FWB. Similarly, Sabri and Zakaria (2015) found out that both retention-money attitude and effort-money attitude had a significant impact on FWB amid young workers; Vlaev and Elliott (2014) show that FA is one of the key determinants of FWB; evidence from Saurabh and Nandan (2018) show that FA positively influenced financial satisfaction. Also, drawing from theory of Planned behaviour (Ajzen, 1991), attitude is of the driving factors of one's behaviour, In summary, the mixed evidences suggest that a higher FA would leads to higher FWB. Thus, we formulate the hypothesis:

H1: Financial capability is positively related to financial well-being.

Furthermore, confirmed by Faique et al. that FA does affect FB among individual Malaysian workers; Chen et al. discovered no significant correlation amid financial/money attitude and gambling behaviour. Accordingly, a positive effect of FB on financial satisfaction was found by Saurabh and Nandanin (2018) the Indian context; Sabri (2023). indicated that FB is positively associated with FWB. Therefore, a mediating role of FB in the relationship of FA and FWB was presumed. Additionally, Tokar Asaad (2015); Wagner and Walstad (2019) categorised LT_FB, ST_FB and Risky_FB as the three primary components of FB. Whereby, we believe that the three different layers of FW would have different effects when mediating the relationship of FA and FWB. Thus, we formulate the hypotheses:

H2: FC is a necessary condition for FWB.

H3: Financial behaviour mediates the relationship between financial capability and financial well-being.

Some researchers point out that 1) income has a significant but small effect on individuals' well-being, 2) the impact of income on well-being is not linear: the impact of income on well-being is more pronounced if the individual's income is relatively lower, and 3) individuals report greater happiness when their income exceeds that of their reference group. Kahneman and Deaton (2010) concluded that while high income contributes to life satisfaction, it does not necessarily enhance happiness, whereas both low emotional well-being and low life evaluation is linked with low income. These literature suggest that income would have an impact on (financial) well-being. However, several other literature demonstrates that income would have an impact on attitude (Nano, 2015.; Doherty, 2006.; Gasiorowska, 2015). Hence, we believe that the impact of FA on FWB is moderated by income. Thus, we formulate the hypothesis:

H4: Individuals with different levels of education have varying financial well-being, and the higher the level of education, the higher the financial well-being.

H5: financial capability still has a positive impact on financial well-being in the NCA.

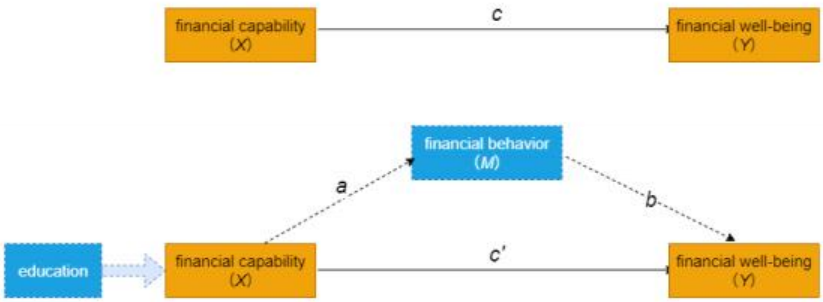

Figure 1. Conceptual Framework

3. Methodology

3.1 Data and Procedure

3.1.1 Data Sources

This study utilizes data from the National Financial Capability Study (NFCS), conducted by the FINRA Investor Education Foundation. The NFCS examines a diverse and extensive sample of the U.S. population, capturing interrelated perceptions, attitudes, experiences, and behaviors regarding financial capability. Conducted every three years, each wave of the study incorporates topical and timely issues relevant to the current economic and financial landscape. The fifth wave (2021) provides insights into financial capability during the COVID-19 pandemic, revealing that while the pandemic did not negatively impact the overall financial capability of U.S. adults, it indirectly led to job losses for some individuals, consequently affecting their financial well-being. The NFCS aims to systematically assess the financial literacy levels and household financial management capabilities of the U.S. adult population. Given its strong external validity and generalizability, the dataset enables the construction of individual-level dynamic behavioral models, supporting the objectives of this study.

This study applies machine learning techniques and utilizes data designed for high-dimensional causal inference to address the curse of dimensionality. A large sample is employed, and estimation robustness is achieved using orthogonal score functions, which allow for consistent causal effect estimates even under mild misspecification of first-stage models (e.g., Lasso). This study utilizes sample data from the two most recent waves (2018–2021) for two key reasons. First, the 2018 survey introduced two new sets of questions, allowing for a more comprehensive measurement of Financial Well-Being. Second, the core variable of this study, financial capability (FC), is measured primarily through debt-related indicators, and responses from 2018 to 2021 may capture shifts in financial behavior before and after the COVID- 19 pandemic. After merging the two datasets, the initial sample consisted of 54,209 observations. Responses of “Prefer not to say” and “Don’t know” are replaced as missing values, which

are then imputed using linear interpolation. Subsequently, dimensionless normalization is applied, followed by the entropy weight method to determine the weight of each item and construct the composite variable, resulting in a final sample of 24,151 observations. Given this sample size, we assume that the estimator converges in probability to the population parameter. Even in the presence of minor model misspecification, the results remain interpretable and meaningful.

3.1.2 Measures

Financial Well-Being (FWB) is the dependent variable in this study. The definition of FWB remains widely debated. From an objective perspective, FWB is measured by factors such as income, savings, investments, credit scores, and debt status (Browning & Lusardi, 1996; Soman, 2002; Schmeiser, 2013). From a subjective perspective, it emphasizes consumer confidence, attitudes, capabilities, behaviors, and financial knowledge (Brüggen, 2017; Netemeyer, 2018.; Mahendru, 2022). This study focuses on the subjective dimension of FWB. Integrating insights from existing literature, we define FWB as an individual's ability to maintain a stable financial condition with ease or achieve a desired standard of living. The measurement of FWB includes items such as "money situation," "I am just getting by financially," "concerned about money," "whether money is left over at the end of the month," and "finances control life". Additionally, the NFCS incorporates the Consumer Financial Protection Bureau (CFPB)'s abbreviated financial well-being scale (Roll, 2022). In this study, FWB is measured using the aforementioned set of items.

The core explanatory variable of this paper, financial capability (FC), which has been widely discussed in recent years, does not have a unified definition. Some researchers argue that FC in a narrow sense refers to individuals' financial literacy and decision-making competence (Lusardi & Mitchell, 2014), while others define it as the behavioral capacity to utilize appropriate financial knowledge and actions to achieve healthy financial conditions. Drawing on the FINRA Foundation's study on the pandemic's impact on FC, this paper operationalizes FC as "the ability to maintain sufficiently low debt levels to attain an unburdened or ideal financial status", incorporating the following measurement items: "Was financial education offered by a school or college or workplace you attended," "Have any unpaid bills," "Have you been contacted by a debt collection agency," "Whether have too much debt," "Thinking of your assets, debts, and savings, how satisfied are you with your current financial condition," and "How confident are you in your ability to raise $2,000 in the event of an emergency?"

The mediating variable in this study, financial behavior (FB), is defined based on the research of Xiao (2014). as "individual financial behaviors related to consumption, saving, and investment." Considering that under the uncertainty of the pandemic shock, people may experience financial anxiety and financial stress, which in turn affect financial behavior Lin et al., this study incorporates FB to examine whether there is an indirect effect from FC to FWB. This variable consists of a total of 14 questions related to consumption, saving, and investment (Wagner & Walstad, 2019) (see Appendix), covering financial behaviors directly related to household expenditures (e.g., consumption and loan repayment), financial planning aimed at increasing liquidity and ensuring future cash flow (e.g.,

retirement planning and emergency funds), and relatively riskier investment activities undertaken for wealth accumulation (e.g., receiving a tax advance on a refund, taking out an auto title loan, and obtaining a payday loan) (Tokar Asaad, 2015; Henager & Cude, 2016), in order to obtain more convincing results.

The control variables in this study include financial literacy (FL), financial confidence (FCONF), and financial attitude (FA). FL is defined as "a combination of awareness, knowledge, attitude, and behavior necessary to achieve sound personal financial well-being". FCONF is defined as "confidence in handling a range of financial issues" (Atkinson & Messy, 2011), while FA is defined as "an individual's understanding of fundamental financial knowledge and their ability to manage and make financial decisions" (the specific items of the constructs are included in the appendix). Following the research of Finney, Riitsalu (2019). Vlaev and Elliott (2014), demographic characteristics may influence our hypotheses. Therefore, this study incorporates race, gender, age, education level, marital status, personal income level, and occupation as control variables. In light of the pandemic's impact, we incorporate variables such as health shock, income shock, bank account ownership, and homeownership, thereby enhancing the reliability of the research findings.

3.2 Empirical Models

The empirical model used in this study is Ordinary Least Squares (OLS), which is employed to examine the direct effect of the explanatory variable FC on FWB and to test whether a positive impact exists (H1). The model is specified as a two-way fixed effects (TWFE) model, controlling for both year and region, as follows:

$$FWB_i = \alpha_0 + \alpha_1 FC_i + \alpha_j \sum X_{ji} + \theta_{State} + \delta_{Year} + \mu_i \quad (1)$$

$$FWB_i = \alpha_0 + \alpha_1 FC_i + \alpha_j \Sigma X_{ji} + \theta_{State} + \delta_{Year} + \eta_{State\#Year} + \mu_i \quad (2)$$

Where FWB_i (financial well-being) is the dependent variable for the i^{th} individual; α_0 stand for the intercept term; α_1 represents the estimated coefficient of our core explanatory variable, (FC_i); FC_i represents financial capability scores for the i^{th} individual; α_j is a j × 1 vector of coefficient; X_{ji} is a vector ofj covariates of individual i; μ_i is the residual for the i_{th} individual. In Equation (2), we introduce year-region interaction terms to account for heterogeneous time-varying shocks, recognizing that individuals in different regions may respond differently to the same shock (e.g., a pandemic). These interaction terms also relax the assumption of homogeneous time trends by allowing for region-specific temporal dynamics. Additionally, they help mitigate omitted variable bias by capturing unobserved factors that vary both over time and across regions.

To examine the mediating effect of FB on the relationship between FC and FWB (H3), this study first applies the causal steps approach to preliminarily test whether a mediation effect exists in the model. Next, the product of coefficients method is used to directly estimate the mediation effect size. Finally, the bootstrap confidence interval method is employed to estimate the confidence interval of the mediation effect using a nonparametric resampling approach, which does not rely on the normality assumption. Accordingly, the following model is constructed:

$$M = aFC_i + \alpha_j \Sigma X_{ji} + \theta_{State} + \delta_{Year} + \eta_{State\#Year} + \mu_i \quad (3)$$

$$FWB_i = \alpha_0 + cFC_i + \alpha_j \sum X_{ji} + \theta_{State} + \delta_{Year} + \eta_{State\#Year} + \mu_i \quad (4)$$

$$FWB_i = \alpha_0 + bM + c'FC_i + \alpha_j \Sigma X_{ji} + \theta_{State} + \delta_{Year} + \eta_{State\#Year} + \mu_i \quad (5)$$

Where M represents mediator; a represents the coefficient of the effect of FC on M; b represents the coefficient of the effect of M on FWB; a × b shows the indirect effects; c′ shows the direct effects; c shows the total effects.

4. Results

4.1 Univariate Analysis

Table 1 presents the descriptive statistics of the key variables. Panel A reports the frequency distributions and percentage compositions of the sample. As shown in the table, the sample is predominantly composed of non-Hispanic White individuals, accounting for 78.91% of the total sample. A slightly higher proportion of males, constituting 56.49% of the respondents. In terms of age distribution, older individuals account for a larger proportion of the sample. with 65% of participants aged 44 or above. It is worth noting that given that older age corresponds to longer- term wealth accumulation, this characteristic enhances the measurement accuracy of financial well-being (FWB), thereby underscoring the dataset's representativeness. Considering the impact of educational attainment on personal financial status, nearly half of the sample (49.23%) holds a bachelor's degree or higher. Notably, income categorization differs between survey waves: in 2018, households earning over 150,000 were grouped into a single category, where as the 2021 survey refined this classification by further segmenting the 150,000+ bracket. Additionally, the analysis reports health and Income shocks, with 17.5% of respondents experiencing health related adversities and 19.10% facing income disruptions. Furthermore, the set of control variables includes bank account and own a home, revealing near-universal bank account ownership (99.96%) and a homeownership rate of 77.16%.

Table 1 Panel B reports the mean, standard deviation and the Cronbach's alpha values, which measures the internal consistency, for each variable, assessing whether the items consistently reflect the same latent construct. The means and SD of FWB, FC, FB, and FL are similar across the 2018 and 2021 samples, likely due to the nature of the self-reported measures. For instance, items such as "Because of my money situation, I feel like I will never have the things I want in life" (J41_1) and "I am concerned that the money I have or will save won't last" (J41_3) capture subjective perceptions that are less likely to change over time. Similarly, experiential questions like "Was financial education offered by a school or college you attended, or a workplace where you were employed?" tend to yield stable responses. The mean and variance of FCONF and FA differ significantly, indicating that attitudinal and confidence indicators were more substantially affected by the pandemic.

Table 1 Panel C reports pairwise correlation coefficients using STATA 18. The analysis reveals moderate correlations between FB, FA, FC, and FWB (coefficient range: 0.3-0.6), as well as between FL, FC, and FB with coefficients of 0.36 (FL-FB) and 0.58 (FC-FB), respectively. All remaining

coefficients were below 0.3, indicating weak associations. These results suggest the absence of severe multicollinearity among the variables of interest, fulfilling the independence assumption. Furthermore, multicollinearity diagnostics were performed for all independent variables expect for temporal and spatial factors. All variance inflation factor (VIF) values ranged from 1.28 to 2.46, substantially below the conservative threshold of 5, thereby demonstrating no significant collinearity within the model.

Table 1. Data Characteristics & Descriptive Statistics

Panel A: Demographic Characteristics							
Variables	Categories	NFCS 2021		NFCS 2018		Full Sample	
		Freq	Pct	Freq	Pct	Freq	Pct
		N = 11613		N = 12538		N = 24151	
Ethnicity							
	White	2565	77.91	2626	79.06	5191	78.51
	Non-White	9048	22.09	9912	20.94	18960	21.49
Gender							
	Female	4931	42.46	5576	44.47	10507	43.51
	Male	6682	57.54	6962	55.53	13644	56.49
Age							
	18-24	623	5.36	641	5.11	1264	5.23
	25-34	1596	13.74	1783	14.22	3379	13.99
	35-44	1827	15.73	1984	15.82	3811	15.78
	45-54	2060	17.74	2247	17.92	4307	17.83
	55-64	2354	20.27	2666	21.26	5020	20.79
	65+	3153	27.15	3217	25.66	6370	26.38
Education							
	Did not complete high school	84	0.72	78	0.62	162	0.67
	High school graduate - regular high school diploma	1188	10.23	1533	12.23	2721	11.27
	High school graduate - GED or alternative credential	468	4.03	530	4.23	998	4.13
	Some college, no degree	2659	22.90	3048	24.31	5707	23.63
	Associate’s degree	1338	11.52	1336	10.66	2674	11.07
	Bachelor’s degree	3912	33.69	3517	28.05	7429	30.76
	Postgraduate degree	1964	16.91	2496	19.91	4460	18.47
Marital Status							
	Married	7115	61.27	8028	64.03	15143	62.70

	Single	2630	22.65	2644	21.09	5274	21.84
	Separated	125	1.08	118	0.94	243	1.01
	Divorced	1245	10.72	1277	10.19	2522	10.44
	Widowed/Widower	498	4.29	471	3.76	969	4.01
Household's annual income							
	Less than $15,000	438	3.77	392	3.13	830	3.44
	$15,000-$25,000	689	5.93	690	5.50	1379	5.71
	$25,000-$35,000	890	7.66	961	7.66	1851	7.66
	$35,000-$50,000	1438	12.38	1656	13.21	3094	12.81
	$50,000-$75,000	2444	21.05	2736	21.82	5180	21.45
	$75,000-$100,000	2011	17.32	2393	19.09	4404	18.24
	$100,000-$150,000	2220	19.12	2341	18.67	4561	18.89
	$150,000-$200,000 [$150,000 or more (2018)]	864	7.44	1369	10.92	2233	9.25
	$200,000-$300,000	421	3.63	N/A	N/A	421	1.74
	$300,000 or more	198	1.70	N/A	N/A	198	0.82
Profession							
	Self-employed	940	8.09	1000	7.98	1940	8.03
	Work full-time for an employer [or the military]	5314	45.76	5859	46.73	11173	46.26
	Work part-time for an employer [or the military]	782	6.73	838	6.68	1620	6.71
	Homemaker	462	3.98	583	4.65	1045	4.33
	Full-time student	148	1.27	219	1.75	367	1.52
	Permanently sick, disabled or unable to work	304	2.62	334	2.66	638	2.64
	Unemployed or temporarily laid of	392	3.38	225	1.79	617	2.55
	Retired	3271	28.17	3480	27.76	6751	27.95
Health Shock							
	No	9594	82.61	10323	82.33	19917	82.47
	Yes	2019	17.39	2215	17.67	4234	17.53
Income Shock							
	No	9082	78.21	10455	83.39	19537	80.90
	Yes	2531	21.79	2083	16.61	4614	19.1
Bank Account							
	No	2	0.02	8	0.06	10	0.04
	Yes	11611	99.98	12530	99.94	24141	99.96
Own-a-home							
	No	2764	23.8	2752	21.95	5516	22.84
	Yes	8849	76.20	9786	78.05	18635	77.16

Panel B: Descriptive Statistics

	NFCS 2021		NFCS 2018		Full Sample		
Variables	Mean	SD	Mean	SD	Mean	SD	Alpha
FWB	0.55	0.16	0.55	0.16	0.55	0.16	0.87(5)
FC	0.67	0.22	0.66	0.21	0.67	0.22	0.68(6)
FB	0.74	0.12	0.74	0.12	0.74	0.12	0.80(14)
FL	0.74	0.22	0.75	0.21	0.74	0.21	0.52(6)
FCONF	0.81	0.16	0.35	0.07	0.57	0.26	0.68(3)
FA	0.44	0.18	0.61	0.14	0.53	0.18	0.48(4)

Panel C: Pairwise Correlations

Variables	FWB	FB	FL	FCONF	FA	FC	VIF
FWB	1						N/A
FB	0.39***	1					N/A
FC	0.6***	0.58***	1				1.99
FA	0.30***	0.17***	0.22***	1			1.63
FCONF	0.14***	0.09***	0.16***	-0.29***	1		5.32
FL	0.19***	0.36***	0.29***	0.07***	0.03***	1	2.46

4.2 Multivariate Analysis

4.2.1 Baseline Results

Table 2 reports the baseline regression results using the fixed-effects model. Column 1 presents the baseline regression with fixed effects for both year and state. Column 2 reports the results of the high-dimensional regression, which introduces state and year fixed effects as well as state-year interaction terms. This approach aims to address potential high-dimensional issues arising from a large number of variables and to capture more complex heterogeneity effects, thereby improving the accuracy of the estimates. The results indicate that, whether in the baseline regression or the high-dimensional regression, FC has a significantly positive impact on FWB at the 1% level. Moreover, these results remain robust after controlling for the potential influence of state-year interactions. Columns 3 and 4 report the baseline regression results for the years 2021 and 2018, respectively. The results show that the core explanatory variable FC has a positive effect on FWB, and The effect is economically significant at the 1% level in both years. The control variable FCONF exhibits significant changes between 2021 and 2018, which may be attributed to the impact of the pandemic. For example, it could have led to a substantial decline in the scores for the question M1_1 (“I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses”), thereby increasing the marginal effect of FCONF on FWB in 2021.

Furthermore, among the control variables, individual characteristics and income status both have a significantly positive impact on FWB. Specifically, in terms of individual characteristics, age has a positive and significant effect, suggesting that as individuals grow older, they accumulate more experience in their careers and daily lives. This experience enables older individuals to make better economic decisions, manage household finances more effectively, and avoid risks, thereby increasing the likelihood of higher household annual income. In terms of income status, household annual income has a significantly positive impact on FWB. From the perspective of the Matthew Effect, where the strong get stronger and the weak get weaker. similarly, higher incomes have access to better resources and choices, therefore facilitates better financial behaviors and, utimately, higher levels of FWB.

4.2.2 Identification Strategies

To address potential issue of model specification, to enumerate, reverse causality (where higher FWB may conversely lead to higher FC) and self-selection bias (as survey participants may have systematically higher FC than the general population), the study employs an instrumental variable (IV) approach. Columns 1-2 of Table 3 present the first-stage and second-stage results under the IV framework. Considering that endogeneity may stem from sample self-selection or bidirectional causality for instance, individuals with higher FC might be more inclined to participate in surveys, while higher FWB could conversely enhance FC - this paper adopts Muhammad's (2024) methodology to construct a dummy variable FC_STATE as the instrumental variable. Specifically, FC_STATE equals the original FC value when an individual's FC exceeds the state-level average, and is set to 0 otherwise.

Table 2. Main Regression Analysis

VARIABLES	(1)	(2)	(3)	(4)
FC	0.3834***	0.3833***	0.3835***	0.3764***
	(0.0060)	(0.0056)	(0.0089)	(0.0082)
FA	0.179***	0.1794***	0.1533***	0.2999***
	(0.0057)	(0.0055)	(0.0069)	(0.0122)
FCONF	0.0734***	0.0728***	0.0867***	-0.1431***
	(0.0078)	(0.0070)	(0.0084)	(0.025)
FL	-0.003	-0.0035	-0.0080	0.0023
	(0.0044)	(0.0042)	(0.006)	(0.0061)
Gender	-0.003*	-0.0028*	-0.0017	-0.0054**
	(0.002)	(0.002)	(0.0024)	(0.0022)
Age	0.0035***	0.0035***	0.0035***	0.0035***
	(0.0007)	(0.0007)	(0.0010)	(0.0010)
Ethnicity	-0.0170***	-0.0171***	-0.0197***	-0.0136***
	(0.0022)	(0.0021)	(0.0032)	(0.0030)

Marital__Status	0.0009	0.0009	0.0011	0.0004
Education	(0.0007)	(0.0007)	(0.0011)	(0.001)
	-0.0041***	-0.0040***	-0.0025***	-0.005***
	(0.0005)	(0.0005)	(0.0008)	(0.0007)
Profession	0.0048***	0.0048***	0.0054***	0.0041***
	(0.0004)	(0.0004)	(0.0005)	(0.0005)
Households__Annul__Income	0.0088***	0.0087***	0.0085***	0.0084***
Income__Shock	(0.0005)	(0.0005)	(0.0008)	(0.0008)
	-0.0633***	-0.0607***	-0.0604***	-0.0661***
Health__Shock	(0.0024)	(0.0022)	(0.003)	(0.0035)
	0.0461***	-0.0463***	0.0441***	0.0457***
Own__a__Home	(0.0031)	(0.0029)	(0.0046)	(0.0043)
	-0.0016	-0.0017	0.0018	-0.0058*
Bank__Account	(0.0022)	(0.0021)	(0.0032)	(0.003)
	0.0703***	0.0703*	0.0613	0.0825***
Constant	(0.0272)	(0.0382)	(0.0714)	(0.0284)
	0.0461	0.0524	0.0452	0.0544*
	(0.0284)	(0.0386)	(0.0723)	(0.0305)
Observations	24,151	24,151	11,613	12,538
R-squared	0.446	0.447	0.450	0.450
Controls	YES	YES	YES	YES
State fix	YES	YES	YES	YES
Year fix	YES	YES	NO	NO
State#Year fix	NO	YES	NO	NO

Note. Columns 1 and 2 use the full sample, whereas Columns 3 and 4 are based on NFCS 2021 and NFCS 2018, respectively. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, indicate significance at the 1%, 5% and 10% levels, respectively.

The Hausman test yields a p-value (Prob > chi2) of 0.000, indicating that financial capability is an endogenous variable at the 1% significance level. The first- stage results show an F-statistic of 27,997.6, significantly exceeding the critical value for weak instrument tests, thus eliminating concerns about weak instruments. The second-stage results demonstrate that the coefficient of FC remains significant at the 1% level and shows a positive effect on FWB.

Additionally, given the large number of variables, this paper employs IVLasso regression for variable selection. By applying coefficient penalties, this method shrinks coefficients of insignificant variables to zero, thereby achieving variable selection while simultaneously addressing endogeneity issues. Columns 3-5 respectively report the results using three methods: CHS lasso-orthogonalized, CHS

post-lasso- orthogonalized, and PDS-selected variables with the full regressor set. The regression results show that the financial capability coefficients in IVLasso are highly consistent with those in IV-2SLS, indicating the robustness of the baseline regression results.

The regression results indicate that across all four methods, the coefficient of FC on FWB is statistically significant at the 1% level. After addressing endogeneity problem, each unit increase in FC is associated with an increase of 0.3764 to 0.3835 units in FWB, providing empirical support for H1.

Table 3. Identification Strategies

Variable	(1)	(2)	(3)	(4)	(5)
FC__STATE	0.329247***	-	-	-	-
	(0.0019699)	-	-	-	-
FC	-	0.4358758***	0.4364828***	0.4351321***	0.4359446***
FA	-	(0.0081132)	(0.0081178)	(0.0081022)	(0.0081051)
	0.0463361	0.1693044***	0.1695963***	0.1700557***	0.1688852***
FCONF	(0.0043219)	(0.0057988)	(0.0057832)	(.0057932)	(0.0057947)
	0.1069678	0.0613241***	0.0621312***	0.0621631***	0.0621447***
FL	(0.0063834)	(-0.0038256)	(0.0078357)	(0.0078469)	(0.0078534)
	-0.0173526***	-0.0038256	-0.0053167	-0.0048138	-0.0040176
	(0.0034483)	(0.0043845)	(0.0043723)	(0.0043724)	(0.0043836)
State fix	YES	YES	YES	YES	YES
Year fix	YES	YES	YES	YES	YES
State#Year fix	YES	YES	YES	YES	YES

Standard errors in parentheses

4.2.3 Mediation Analysis

The primary regression confirms the significant direct effect of FC on FWB. To take a step further, we examine the indirect effect of FC on FWB through FB using three distinct methodologies: the causal steps approach, the coefficient product method, and the bootstrap confidence interval method. This multi-method approach enhances the robustness of the results, addresses issues related to non-asymptotically normal distribution of estimates, and ensures a more comprehensive and reliable analysis.

The mediation analysis results are presented in Table 4, revealing a modest mediation effect of only 1.56%, accounting for 5% of the total effect. The stepwise analysis shows that the coefficient for the effect of FC on FB is 0.259, whereas the coefficient for the effect of FB on FWB is merely 0.083. This discrepancy may stem from the fact that specific FB behaviors might require individual-level "adaptation" to achieve better FWB outcomes. However, our study lacks the capability to tailor FB

strategies to each individual, which could explain the small effect size observed. In conclusion, H3 is not supported.

Table 4. Mediation Analysis

	est	std. err.	z/Bias(Bootstrap)	value	Bootstrap Confident Interval	
FB						
a__coefficient	0.259	0.006	41.131	0.000	N/A	N/A
b__coefficient	0.083	0.009	9.015	0.000	N/A	N/A
Indirect__efect__a× b	0.022	0.002	8.806	0.000	N/A	N/A
Direct__efect__c’	0.414	0.009	47.817	0.000	N/A	N/A
Total__efect__c	0.436	0.008	52.046	0.000	N/A	N/A
Sobel	0.022	0.002	8.806	0.000	N/A	N/A
Aroian	0.022	0.002	8.803	0.000	N/A	N/A
Goodman	0.022	0.002	8.808	0.000	N/A	N/A
Bootstrap						
Indirect effect	0.015561	0.00113021	2.56e-06	N/A	0.0133458	0.0177762 (N)
					0.0133772	0.0178127 (P)
					0.0134069	0.0178686 (BC)
					0.0134069	0.0178686 (BCa)
Direct effect	0.23742788	0.00613594	0.0000296	N/A	0.2254017	0.2494541 (N)
					0.2252479	0.2493257 (P)
					0.2244631	0.2490212 (BC)
					0.2244631	0.2490212 (BCa)
Proportion of total effect that is mediated:						0.05
Ratio of indirect to direct effect:						0.052
Ratio of total to direct effect:						1.052

N: Normal

P: Percentile

BC: Bias-corrected

BCa: Bias-corrected and accelerated

4.2.4 Heterogeneity Analysis

In this section, this essay conducted Chow tests to examine potential structural changes in the model and employed Fisher permutation tests to assess the specific heterogeneity. Table 5 reports the results using educational background as a moderating variable. The Chow tests were all statistically significant at the 5% level, indicating certain structural differences across subsamples. Educational backgrounds

were categorized into three tiers: samples without a Bachelor's degree were labeled Education 1, those with a Bachelor's degree as Education 2, and those with education beyond a Bachelor's degree (graduate or doctoral degrees) as Education 3. Columns 1–3 report the coefficient differences between Education 1 and Education 2, Education 2 and Education 3, and Education 1 and Education 3, respectively.

Column 1 shows that FC is statistically significant at the 5% level between samples with a Bachelor's degree and those without. Column 2 demonstrates that FC is significant at the 10% level between samples with a Bachelor's degree and those with higher educational background (postgraduate/doctoral). Column 3 reveals that FC is significant at the 1% level when comparing individuals with education above and below the Bachelor's degree threshold.

These results suggest that educational attainment moderates the effect of FC on FWB, respondents, those with lower education levels show higher levels of vulnerability across multiple measures of financial capability. Notably, the significance level in Column 1 (5%) exceeds that in Column 2 (10%), implying diminishing marginal contributions of education as attainment increases. Collectively, these findings validate H4.

Table 5. Heterogeneity Analysis

Variable	(1)	(2)	(3)
FC	0.025**	0.025*	0.050***
	(0.029)	(0.081)	(0.001)
FA	-0.007	-0.029**	-0.037**
	(0.286)	(0.042)	(0.011)
FCONF	-0.032**	0.030*	-0.002
	(0.033)	(0.099)	(0.466)
FL	0.020**	-0.021**	-0.001
	(0.023)	(0.050)	(0.485)
Gender	0.005*	0.006*	0.011***
	(0.078)	(0.095)	(0.007)
Age	0.002*	-0.007***	-0.004**
	(0.070)	(0.000)	(0.008)
Ethnicity	-0.008*	0.006	-0.002
	(0.069)	(0.173)	(0.388)
Marital Status	-0.001	0.001	0.000
	(0.311)	(0.267)	(0.411)
Households Annul Income	0.000	-0.001	-0.001
	(0.385)	(0.278)	(0.359)

Profession	-0.004***	0.003***	-0.000
	(0.000)	(0.000)	(0.329)
Income shock	-0.002	0.003	0.001
	(0.371)	(0.357)	(0.422)
Health shock	0.002	0.012	0.014*
	(0.376)	(0.102)	(0.051)
Bank Account	0.021	0.127	0.148**
	(0.379)	(0.108)	(0.029)
Own__a__home	-0.002	0.002	0.001
Chow test	(0.367)	(0.358)	(0.452)
	2.08***	1.32**	2.04***
	(0.000)	(0.045)	(0.000)
State fix	YES	YES	YES
Year fix	YES	YES	YES

Note. P-values in parentheses

4.2.5 Robustness Tests

In the regression results above, we have demonstrated the positive effect of FC on FWB. In this section, we first apply Winsorization to mitigate the influence of outliers on the analysis and then introduce state-year interaction terms to enhance the robustness of the findings. Column 1 of Table 6 presents regression results controlling for state and year fixed effects separately. Column 2 reports results with controls for state, year, and their interaction terms. Columns 3–4 narrow the sample by conducting separate regressions for pre- and post-COVID-19 pandemic years. The results consistently show a positive impact of FC on FWB, with coefficients ranging between 0.371 and 0.376, all statistically significant at the 1% level. These findings confirm that the baseline regression results remain robust.

Table 6. Robustness Tests

VARIABLES	(1)	(2)	(3)	(4)
FC	0.3755***	0.3755***	0.3731***	0.3710***
	(0.0055)	(0.0058)	(0.0085)	(0.0080)
FA	0.1783***	0.1773***	0.1523***	0.2967***
	(0.0053)	(0.0049)	(0.0067)	(0.0119)
FCONF	0.0689***	0.0712***	0.0834***	-0.1433***
	(0.0069)	(0.0033)	(0.0080)	(0.0242)
FL	-0.0020	-0.0020	-0.0058	0.0030
	(0.0040)	(0.0043)	(0.0061)	(0.0059)

Gender	-0.0025	-0.0028*	-0.0015	-0.0051**
	(0.0016)	(0.0016)	(0.0023)	(0.0022)
Age	0.0036***	0.0036***	0.0036***	0.0036***
	(0.0007)	(0.0007)	(0.0010)	(0.0009)
Ethnicity	-0.0169***	-0.0168***	-0.0196***	-0.0133***
	(0.0020)	(0.0021)	(0.0031)	(0.0029)
Marital__Status	0.0008	0.0008	0.0011	0.0004
Education	(0.0007)	(0.0007)	(0.0010)	(0.0010)
	-0.0040***	-0.0040***	-0.0025***	-0.0053***
	(0.0005)	(0.0005)	(0.0008)	(0.0007)
Profession	0.0048***	0.0048***	0.0055***	0.0041***
	(0.0004)	(0.0003)	(0.0005)	(0.0005)
Households__Annul__Income	0.0087***	0.0087***	0.0085***	0.0083***
Income__Shock	(0.0005)	(0.0005)	(0.0007)	(0.0008)
	-0.0618***	-0.0618***	-0.0591***	-0.0645***
Health__Shock	(0.0022)	(0.0023)	(0.0032)	(0.0034)
	0.0450***	0.0449***	0.0431***	0.0444***
Bank__Account	(0.0028)	(0.0030)	(0.0044)	(0.0041)
	0.0711*	0.0708***	0.0633	0.0828***
Own__a__Home	(0.0372)	(0.0269)	(0.0696)	(0.0282)
	-0.0022	-0.0021	0.0009	-0.0058*
Constant	(0.0020)	(0.0022)	(0.0031)	(0.0030)
	0.0581	0.0496*	0.0507	0.0561*
	(0.0376)	(0.0280)	(0.0705)	(0.0302)
Observations	24,151	24,151	11,613	12,538
Adjusted R-squared	0.448	0.448	0.452	0.450
Controls	YES	YES	YES	YES
State fix	YES	YES	YES	YES
Year fix	YES	YES	NO	NO
State#Year fix	NO	YES	NO	NO

Note. Columns 1 and 2 use the full sample, whereas Columns 3 and 4 are based on NFCS 2021 and NFCS 2018, respectively. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, indicate significance at the 1%, 5% and 10% levels, respectively.

4.3 Additional Analyses: NCA

In addition, this study adopts a Mixed Methods Research (MMR) framework, integrating quantitative analysis with qualitative exploration to overcome the limitations of relying on a single methodological

approach. The quantitative analysis employs econometric models to identify statistical relationships between variables, while the qualitative component reveals underlying mechanisms and sources of heterogeneity. These two approaches are mutually complementary in validating H1.

4.3.1 The Result of Bottleneck

As shown in Table 7, none of the conditions are necessary when the FWB requirement is below the 70% threshold. Within the 80% to 90% range, FC and FB begin to exhibit increasingly critical roles, indicating their growing necessity for achieving higher levels of FWB. When the FWB requirement reaches the 100% level, FC must cover at least 64.5% of the potential scope (CR-vrs = 64.5%); falling below this threshold would result in failure to obtain the targeted FWB. Meanwhile, achieving the highest level of FWB necessitates all variables. In summary, these quality factors are irrelevant for attaining low-level FWB; FC becomes necessary for intermediate- to-high levels of FWB, albeit with relatively weak constraints on FWB outcomes; and all antecedent variables are indispensable for achieving high-level FWB. Based on the above analysis, we conclude that FC is a fundamental factor influencing FWB.

Table 7. Results of Bottleneck

FWB	FA	FL	FC	FCONF	FB
00	NN	NN	NN	NN	NN
10	NN	NN	NN	NN	NN
20	NN	NN	NN	NN	NN
30	NN	NN	NN	NN	NN
40	NN	NN	NN	NN	NN
50	NN	NN	NN	NN	NN
60	NN	NN	NN	NN	NN
70	NN	NN	NN	NN	15.3
80	NN	NN	20.1	NN	30.9
90	10.3	NN	42.3	9.3	46.4
100	50.2	40.3	64.5	36.1	62.0

Note. CR method, NN = not necessary.

4.3.2 The Result of NCA

Table 8 reports the results of the NCA (necessary condition analysis), including effect sizes derived from two estimation methods: CR (ceiling regression) and CE (ceiling envelopment). Following Dul, a effect size(d) within 0–0.1 indicates a “small effect,” 0.1–0.3 a “medium effect,” 0.3–0.5 a “large effect,” and above 0.5 a “very large effect.” Consequently, we identify a variable as a necessary condition for the outcome variable only if it meets both of the following criteria: 1) its d value exceeds

0.1, and 2) the effect size is statistically significant. Shown in Table 8, FA meets all the above criteria, suggesting its necessary for the outcome FWB. Additionally, despite that FC does not fulling meets the above criteria, it's closed enough, therefore we believe that FC still have certain constrain on FWB. Based on the above analysis, H2 is accepted.

Table 8. The Results of The NCA Methodology

Variables	Method	c-accuracy	Effect size(d)	Ceiling zone	Scope	p-value
FA	CR	99.9%	0.32	1	0.32	0.086
	CE	100%	0.12	1	0.12	0.344
FL	CR	100%	0.018	1	0.018	0.790
	CE	100%	0.017	1	0.017	0.696
FC	CR	100%	0.094	1	0.094	0.00
	CE	100%	0.06	1	0.06	0.00
FCONF	CR	100%	0.024	1	0.024	0.661
	CE	100%	0.012	1	0.012	0.843
FB	CR	99.9%	0.099	0.804	0.124	0.022
	CE	100%	0.042	0.804	0.053	0.055

Note. Small level: $0 < d < 0.1$; medium level: $0.1 \leq d < 0.3$; large level: $0.3 < d < 0.5$; very large level: $d \geq 0.5$ Permutation Test, rep = 10000

5. Conclusions

5.1 Theoretical and Managerial Implications

This essay seeks to elucidate U.S. household FA's effects on FWB. Specifically, this study intended to 1) identify the relationship between FA and FWB, 2) examine the mediating roles of the three component of FB and FB itself, and 3) ascertain the heterogeneity effect of FA towards FWB. To achieve our goals, a representative sample of U.S. population, the two most recent NFCS data, was used. Results from multiple regression indicate the impact of FA on FWB is solid, which is consistent with the findings of Abdullah, 2019.; Vlaev and Elliott (2014); Saurabh and Nandan. This study contributes to the FWB literature by 1) employed a larger and relatively new sample to assess the effects of FA on FWB, 2) we factor in the common contributing factors FL, FCONF, and FC as control variables to better identify the effects of FA on FWB, and 3) Lasso was employed while conducting IV, this act is to screen out the factors that are really have an impact on FWB, namely to enhance the model's estimation efficiency. Furthermore, mediation analysis conforms that the effect of FA on FWB partially mediated by LT_FB, and doesn't seem to have a solid mediation effect through the agency of FB, ST_FB and Risky_FB. Our findings verify the hypotheses H2 is false and H3 is true, and provide a unique contribution by 1) verifying the mechanism of FA towards FWB, 2) exploring the different layers of FB's role to further

delve into this mechanism, and 3)employing both traditional (i.e., Casual Steps Approach and Coefficient product Method) and modern method (i.e. Bootstrap) to better identify the mechanism. Additionally, the heterogeneity effects were exploded as well, this research enrich the previous literature by concentrating specifically on FA's effect towards FWB as opposed to investigate the all sorts of independent variables effects on overall well-being. In a nutshell, to some extent, we can draw the conclusion that this study makes theoretical contribution by exploring how FA shapes FWB.

The findings of this study posed crucial implications for various stakeholders, including policymakers, financial managers, and even the general public, provided the individuals are able to adjust their actions base on what they had learnt. These findings indicate that all stakeholders ought to recognise the importance of rational expectations among the individuals and cohort, which coincide with rational expectation theory (Muth, 1961). Specifically, by understanding the mechanism of FA on FWB policymakers are able to promote overall societal FWB by simply shifting the common people, which according to our findings, can be done by targeting specific cohorts with tailored policies; financial managers would be able to assist their client better by pay attention to the client's FA, as the proper FA can lead to a better FB, therefore alternately improving FWB; providing the individuals are rationally enough, they can apply similar principles to improve their FWB, as financial managers do for their clients.

5.2 Limitations and Future Research Directions

While offering new insights, this study still has some limitations. To begin with, as our data come straight from NFCS database, we were unable to introduce additional dimensions to the study as covariates to control the other driving forces of FWB. Second, the database is constrain to U.S. adults, therefore, we suggest that the similar research ought to be carried out under other circumstances to make amend to the lack of generalisability. Furthermore, we also believe that we might not be able to capture some specific effects by using merely two waves of the data from the NFCS database. Nevertheless, beside the limitations mentioned above, we deem that this study has provided valuable insights based on our rich empirical model.

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