Article

Confucian culture and household financial asset allocation: Based on a biomechanical mechanism perspective

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Abstract: In the context of household financial decisions, the biomechanical mechanism mainly refers to a series of principles in which the internal physiological processes of the body are interrelated with psychological cognition and influence the decision-making results when individuals make financial decisions. From the perspective of neurobiology, Confucian culture can influence the allocation behavior of household financial assets through the neural mechanisms in multiple regions of the brain, mainly including the prefrontal cortex, amygdala, and cingulate gyrus. From the perspective of the neuroendocrine system, the secretion levels of stress hormones such as cortisol are also closely related to household financial decisions. Stress responses, by influencing psychological cognition and neural mechanisms, have become one of the important biomechanical factors affecting financial decision-making behaviors. Confucian culture has profoundly influenced individuals' choices in the allocation of household financial assets by affecting the triggering and cognitive assessment of stress responses, the neuroendocrine regulation related to stress responses, and exerting long-term impacts and intergenerational inheritance on stress responses, resulting in characteristics such as high savings and low participation in risky assets in the allocation of household financial assets. To verify the impact of Confucian culture on the allocation of household financial assets, this study constructs the Confucian culture variable by using the iterative principal factor method, constructs Probit and Tobit models, and conducts empirical analysis using the China Household Finance Survey data (CHFS). The study finds that Confucian culture can significantly promote savings, suppress the breadth and depth of households' participation in the financial market, and lead to a more simplified allocation of financial assets. Heterogeneity analysis shows that its impact on elderly and low-income households is more significant. This study provides insights into the cultural and biological roots behind household financial asset allocation, offering new perspectives to explain how Confucian culture shapes financial behavior through biomechanical pathways. Future research can utilize neuroscience and genetic technologies to analyze the micro-genetic, neural regulation, and molecular connections between culture and biology in the influence of Confucian culture on financial decisions from the dimensions such as the integration of molecular genetics and cultural neuroscience, the exploration of gene-culture co-evolution, and the construction of gene expression network models, so as to contribute to the research in cultural economics.

Keywords: Confucian culture; financial asset allocation; biomechanics; neural mechanisms; stress response; cultural neuroscience

1. Introduction

With the rapid growth of China's economy, the living standards of residents have improved significantly, disposable income has increased substantially, and total household wealth has continued to rise. The proportion of funds used for basic living consumption gradually decreases, and the surplus funds available for investment gradually increase, bringing possibilities and potential for residents to engage in diversified investments. However, the reality is that China's household asset allocation is singular, manifesting a phenomenon of 'high savings' and 'limited participation'. According to the 'China Household Finance Survey Report 2019', the proportion of savings in household financial assets is as high as 88%, while the proportion of households participating in stock, fund, and bond investments is only 8.84%, 4.24%, and 0.77%, respectively. In contrast, according to data released by the Federal Reserve, in 2020, the proportion of financial assets in the wealth of residents in North America, Western Europe, and Asia was 72%, 45%, and 36%, respectively, which is much higher than that in China. An overly homogeneous financial asset structure has prevented Chinese households from sharing the dividends of national economic growth, greatly reduced the growth potential of Chinese household wealth, and seriously affected the realization of China's financial power.

Since Campbell [1] proposed the concept of family finance from the perspective of behavioral finance, the issue of family financial asset allocation has gradually become the focus of scholars' research [2]. Existing research on the factors influencing the distribution of household financial assets focuses on: gender [3], age [4], education level [5], risk preference [6], household income [7], wealth level [8], health conditions [9] and financial literacy [10]. Studies found that these factors are relatively stable in the short term. Following the financial crisis of 2008, culture as an informal institution becoming a focal point of scholarly interest. In addition to economic factors, non-economic factors such as culture can significantly influence household financial behavior [11]. Culture is the soul of a nation, and Confucianism, as a pillar of China's exceptional traditional culture, has shaped widely accepted moral norms and guidelines for action over centuries. Consequently, household financial behavior in China is inevitably influenced by it [12]. Confucian culture is not a unified and fixed concept, and its manifestations and influences vary in different historical stages, regions and schools, among which Yangming is an important part of Chinese Confucian culture [13]. Confucian culture has not only influenced China, but also East Asian countries such as Japan [14]. The Confucian culture covered in this paper is not the Confucianism of a specific historical period, but a cultural tradition that has widely influenced the financial decisions of Chinese families. This study focuses on the influence of modern Confucianism on the financial decision-making behaviors of Chinese households, which still play an important role in contemporary Chinese society, especially in terms of cultural influences on family ethics, social responsibility, and risk aversion. Therefore, studying household financial asset allocation in China from the perspective of Confucian culture has significant practical relevance.

With the continuous development of neuroscience, psychology, sociology, and economics, an increasing number of interdisciplinary studies have emerged [15].

However, whether there are biological neural mechanisms and biomechanical factors, especially the potential impact of stress responses on the financial decision-making process, behind the behavior of household financial asset allocation driven by Confucian culture has rarely been deeply explored. Modern neuroscience research indicates that the decision-making process is not only influenced by an individual's experience and knowledge but also regulated by specific regions of the brain [16]. The prefrontal cortex (PFC) plays a crucial role in processing risks and rewards, and the cingulate gyrus (ACC) related to emotions and social identity also functions in the influence of culture on financial decisions. Cultural neuroscience shows that many cultural and economic phenomena can be explained from the perspective of neural mechanisms. Cultural factors can affect the decision-making process by altering the neural activity patterns of the brain. Individuals from different cultural backgrounds exhibit different brain activity patterns when handling financial decisions and risk assessments [17]. Western cultures that emphasize individualism tend to activate the prefrontal cortex (PFC) during decision-making, while Confucian cultures that emphasize collectivism are more likely to activate the cingulate gyrus (ACC) related to emotional control and social identity [18].

The interaction between Confucian culture and neural and biomechanical mechanisms can affect the decision-making process, thereby influencing the allocation of household financial assets. This study aims to explore these complex relationships and, from the perspective of the internal biological logic, explain how Confucian culture affects human psychological and physiological processes through neural mechanisms and stress responses, leading households to choose more conservative household financial asset allocations. By constructing Probit and Tobit models, using the iterative principal factor method to build a Confucian culture variable, and conducting an empirical analysis of the China Household Finance Survey (CHFS) data, this study examines the impact of Confucian culture on the allocation of household financial assets. This study explains the phenomena of 'limited participation' and 'high savings' in the financial market from the perspectives of biological mechanisms and cultural internal causes, deeply reveals the cultural and biological roots behind financial decisions, and provides a new theoretical perspective and research approach for explaining how cultural factors and biological mechanisms shape household financial behaviors.

The rest of the paper is as follows: section 2 introduces the intrinsic biological mechanism of Confucian culture affecting household financial asset allocation, section 3 presents the economic hypotheses of Confucian culture affecting household financial asset allocation, section 4 describes the data, variables, and model construction for the empirical analysis, section 5 presents the results of the empirical analysis, section 6 presents the heterogeneity analysis, section 7 presents the robustness test, and section 8 summarizes the paper's findings and suggests directions for future research.

2. Intrinsic biological mechanisms of Confucian culture influencing household financial asset allocation

2.1. The neural mechanism by which Confucian culture influences household financial decision-making behavior

Research in the field of cultural neuroscience has shown that cultural backgrounds not only influence people's behaviors but also regulate the activities of brain regions through neural mechanisms, thereby affecting the decision-making process [16]. The main brain region divisions are shown in **Figure 1**. The prefrontal cortex (PFC) and the anterior cingulate gyrus (ACG) are regions in the brain that are closely related to decision-making, emotion regulation, and behavior control. The prefrontal cortex is mainly responsible for advanced cognitive functions such as decision-making, planning, risk assessment, and self-control, and it plays a crucial role in the decision-making process [19]. The anterior cingulate gyrus, on the other hand, is closely related to emotion regulation and self-awareness, and its role is mainly reflected in the control of an individual's emotional responses [20]. It can help individuals suppress impulses and enhance compliance with social and cultural norms when facing complex situations.
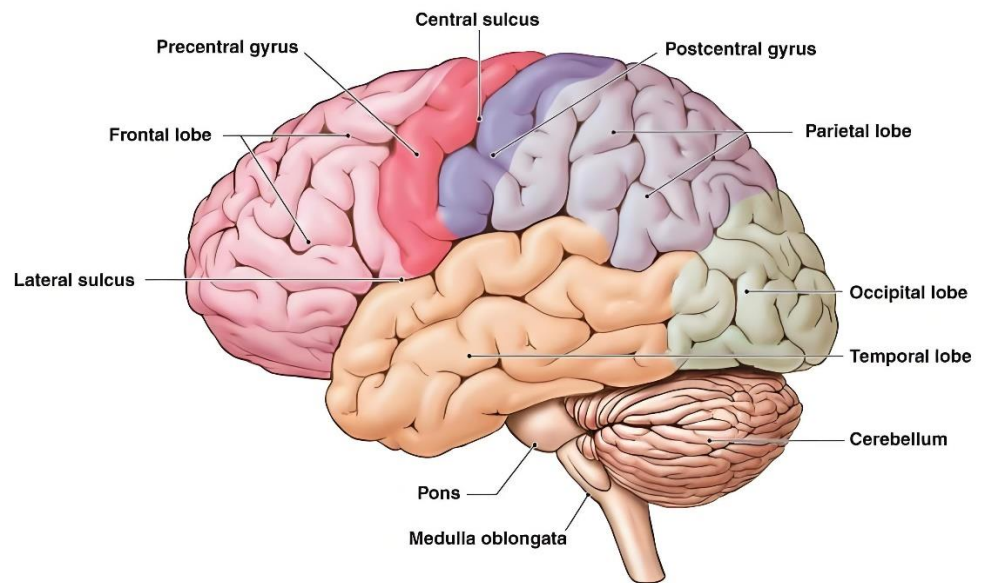
Figure 1. Division of brain regions.

Neuroeconomics points out that financial decision-making is not a purely cognitive behavior but is influenced by underlying biological factors that affect individual behaviors [21]. Confucian culture influences financial behaviors by emphasizing values such as familism, social order, and risk aversion and functions through specific neural mechanisms. The role of neural mechanisms in household financial decision-making is multifaceted and involves multiple brain regions that handle decisions regarding risk, return, and uncertainty [22]. The activities of these neural regions can affect an individual's risk preferences and financial behaviors. As shown in **Figure 2**, the prefrontal cortex is associated with executive functions such

as planning and decision-making, participates in regulating risk perception and decision control, and plays a crucial role in guiding prudent financial management behaviors in line with Confucian values. In the context of Confucian culture's emphasis on careful financial management and risk aversion, the prefrontal cortex may be activated due to the importance placed on future stability and family welfare in Confucian culture, leading to more cautious and deliberate choices. In situations involving financial risks, the amygdala, which is related to emotional responses, can trigger reactions related to financial risks and uncertainties, especially fear and anxiety. The nucleus accumbens is related to reward processing and is activated when an individual experiences financial gains or losses, further shaping their financial decisions [23]. The cingulate gyrus is associated with social emotions and a sense of responsibility, which coincides with the emphasis on the concept of family responsibility in Confucian culture. When individuals in Confucian culture face high-risk financial choices, the cingulate gyrus, which is involved in conflict monitoring, may be more active because they may be more sensitive to the social and family impacts that financial failure may bring. This high sensitivity to the social consequences of risks and financial decisions may lead individuals to adopt more conservative financial strategies, such as giving priority to savings rather than speculative investments. Through structural magnetic resonance imaging (sMRI) techniques to observe changes in structural indicators such as gray matter density and white matter fiber integrity, as well as using resting-state functional magnetic resonance imaging (rs-fMRI) to analyze changes in brain functional connectivity [24]. The study indicated that long-term learning and practice of Confucian culture may lead to structural and functional remodeling of brain regions related to social cognition, emotion regulation, and moral judgment, including the medial prefrontal cortex, amygdala, and cingulate gyrus. The plastic changes in these brain regions may make individuals more inclined to consider social relations, family values, and other factors when making financial decisions, exhibiting decision-making behaviors consistent with Confucian culture, such as attaching importance to family wealth inheritance, avoiding excessive risks, and thus tending to hold savings and reducing the proportion of risky asset holdings.
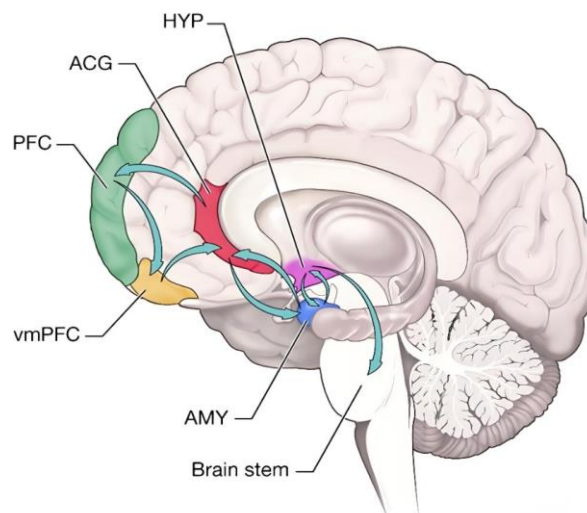

Figure 2. Brain regions.

Confucian culture has an impact on neural regions of the brain, and these neural regions work together to process financial information, evaluate risks and rewards, regulate emotional responses, and ultimately guide the decision-making process of household financial asset allocation. Under the influence of neural mechanisms, families with a stronger Confucian cultural influence tend to adopt more conservative financial asset allocation behaviors, emphasizing savings rather than making risky investments.

2.2. Mechanisms of the impact of stress on financial decision-making

When individuals face financial decisions, they may experience physical stress responses, such as accelerated heartbeats and increased blood pressure, which are related to the biomechanics during decision-making [19]. Confucian culture may influence individuals' perception of stress and coping styles in financial decision-making, and further affect their decision-making processes. Stress hormones like cortisol can influence the aforementioned neural pathways and usually lead to more conservative or risk-averse financial decisions under financial stress. Stress responses, by influencing psychological cognition and neural mechanisms, have become one of the important biomechanical factors affecting financial decision-making behaviors. Financial decisions regarding household financial asset allocation are a type of ambiguous decision. Ambiguous decision-making refers to decision-making in which decision-makers cannot know the probabilities of outcomes in advance and can only rely on subjective judgments. Stress is a series of physiological and psychological responses generated by individuals to restore homeostatic balance when their bodies and minds are threatened, involving complex changes in the neuroendocrine system [17]. As shown in **Figure 3**, stress responses not only affect the cognition of financial decisions in terms of three cognitive components, namely learning feedback, reward sensitivity, and risk preference, but also have an impact on the physiological neural mechanisms. Psychological cognitive changes are closely linked to the functions of neural mechanisms, and they jointly act on the overall state of individuals. Some studies have shown that individuals usually tend to make unfavorable decisions because of blocked learning feedback, changes in reward sensitivity, and risk attitudes, which may be related to the impairment of the functions of the prefrontal lobe caused by stress [25].
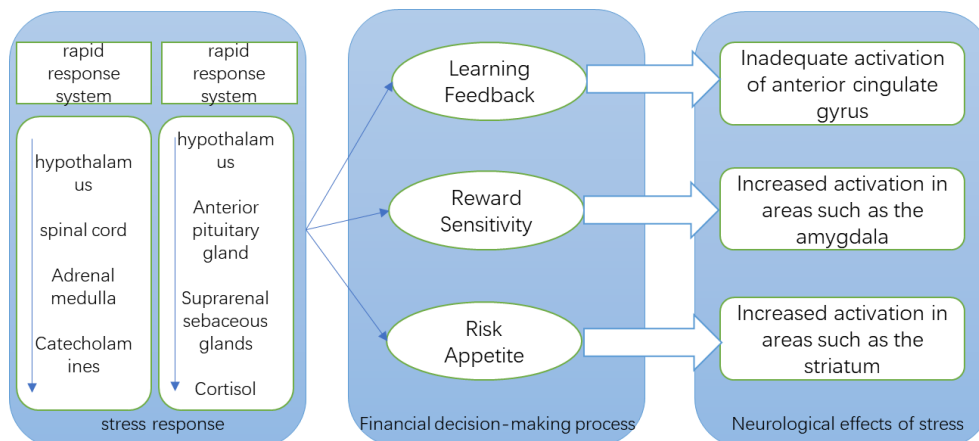
Figure 3. Financial decision-making processes and neural mechanisms influencing them in response to stress.

Under stress, financial decision-makers are unable to conduct effective learning feedback and information judgment, thus making unfavorable financial decision-making behaviors [19]. A research result of the Iowa gambling task (IGT) using eye-tracking technology found that the impact of stress on decision-making is mainly through impeding the brain's processing of information about unfavorable decks, preventing decision-makers from effective learning and ultimately leading to unfavorable decisions [25]. Stress can interfere with the information processing and judgment ability of households in the process of financial asset allocation decisions. Under normal circumstances, when making investment decisions, households will comprehensively consider various factors, such as family economic situations, macroeconomic trends, and industry development prospects. However, under stress, individuals often have difficulty concentrating on comprehensively analyzing this information and may selectively focus on certain negative information or overly rely on past experiences. For example, when a short-term market fluctuation acts as a stressor, investors may ignore the long-term investment value and sell stocks only because of a short-term price drop, without fully considering that the fundamentals of the enterprise have not fundamentally changed.

The principle that rational financial decision-makers always follow is to seek the optimal decision to maximize returns [2]. They pursue rewards while trying their best to avoid losses. However, under the influence of stress, decision-makers will change their sensitivity to rewards and punishments, overly pursue rewards while ignoring the avoidance of losses. In economic decision-making, the anxiety caused by stress makes individuals overly focus on potential losses and neglect potential gains, thus leading to conservative decisions. An fMRI study has confirmed this phenomenon. The research results found that in the stressed state, the reward circuit of the healthy group showed an increased response to positive task feedback, while the sensitivity to negative feedback decreased at the same time [26]. Stress causes families to become more short-sighted in decision-making, pursue short-term gains to avoid losses, and abandon investment strategies that may be more beneficial in the long term.

An individual's risk attitude can have a significant impact on ambiguous decisions, including financial decisions. Most ambiguous decision-making tasks (such as the Ellsberg urn task, the Occlude task, the Iowa Gambling Task, and household financial asset allocation) generally use the decision outcomes of "conservative is beneficial" and "risk-taking is unfavorable" as evaluation criteria. A study that induced stress through a hypoxia paradigm found that people are more likely to take risks in a mildly hypoxic environment than in a normoxic environment [27]. A study that introduced personality traits as an influencing factor found that individuals with a low risk-taking tendency overestimate risks under acute stress and thus make more conservative decisions [17].

The impact of stress responses on financial decision-making in terms of the physiological neural mechanism mainly works by activating the rapidly responding sympathetic nervous system (SNS) and the slower hypothalamic-pituitary-adrenal (HPA) axis (as shown in **Figure 4**). It releases stress hormones and binds to the receptors in the brain regions related to decision-making to have an effect. Besides the difference in response time, these two systems also secrete different hormones.

The SNS releases catecholamines, resulting in various responses of the peripheral nerves, such as increases in heart rate, pulse, blood pressure, and skin electrical activity. After these activities are fed back to the brain regions related to cognitive control, a "fight-or-flight" response will be triggered. The activation of the slower HPA axis causes the paraventricular nucleus of the hypothalamus and the anterior pituitary to secrete adrenocorticotropic hormone (ACTH), which leads to the release of a large amount of glucocorticoids (GC), mainly cortisol by the adrenal cortex [28]. Changes in cortisol levels will directly affect the functions of various organs and systems in the body. For example, it can regulate the cardiovascular system to increase blood pressure and heart rate, affect the metabolic system to raise blood glucose levels, etc., enabling the body to be physiologically prepared to cope with stressors. Meanwhile, cortisol crosses the blood-brain barrier and enters the brain to affect the brain regions with mineralocorticoid receptors and glucocorticoid receptors in the cerebral cortex, and ultimately influences the anterior cingulate gyrus, amygdala, and striatum in the brain.
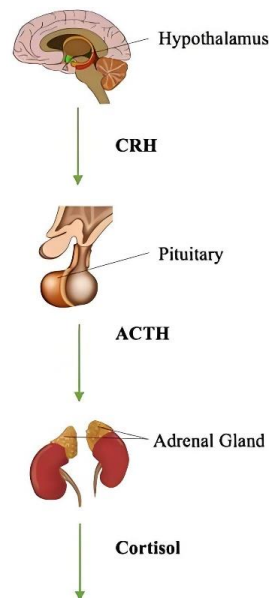
Figure 4. HPA axis.

When families engage in specific financial asset allocation behaviors, the biomechanical influence of stress responses becomes more evident. When families face stressors such as economic pressures (such as a family member losing their job or suffering from a sudden serious illness) or investment risks, investors may become more worried about fluctuations in the financial market. They may overestimate risks even during normal market adjustments. Stress responses lead to changes in their perception and attitude towards risks [25]. The stress hormones secreted by individuals under stress can affect the neural activities of the brain, especially the functions of the prefrontal cortex and the amygdala. During stress, the decision-making function of the prefrontal cortex may be inhibited to some extent, making it difficult for individuals to rationally weigh risks and returns. Under the influence of stress hormones, the amygdala becomes more active, which makes individuals more sensitive to risks and regard potential investment losses as more

serious threats, thereby strengthening risk aversion [28]. Families that might originally be willing to take certain risks to pursue higher returns may change their risk preferences under the influence of stress and tend to adopt more conservative investment strategies, increasing the proportion of savings and reducing investments in risky assets to cope with possible economic crises and ensure the stability of family finances. Such changes in decision-making behaviors are specific manifestations of the role played by stress responses in family financial decision-making through biomechanical mechanisms, further indicating that stress responses are a biomechanical factor that cannot be ignored in the process of family financial decision-making.

2.3. Internal mechanisms of Confucianism influencing family decision-making behavior through stress response

2.3.1. Triggering and cognitive assessment of Confucian cultural influences on stress response

Under different cultural backgrounds, people's values, beliefs, and social norms vary [12]. These factors profoundly influence individuals' perception and evaluation of stressors, and further determine whether stress responses are triggered and their intensities. The values and behavioral norms advocated by Confucian culture have deeply shaped individuals' unique cognitive evaluation ways of stressors. When considering high-risk investments, the concept of 'A gentleman does not stand beside a collapsing wall' advocated by Confucian culture makes individuals regard investment losses as a serious threat to family responsibilities, thus making it easier to trigger stress responses [27]. Confucian culture emphasizes the overall interests of the family and the social order of the Three Cardinal Bonds and Five Constant Virtues. This leads individuals to evaluate potential stressors encountered in financial asset allocation decisions, such as market fluctuations and investment risks, from the perspectives of family responsibilities and social norms. This evaluation method often increases individuals' perception of the subjective severity of stressful events, and further affects the subsequent financial decision-making process. Confucian culture emphasizes values such as "the Doctrine of the Mean" and "Harmony is precious", advocating that individuals maintain a calm and moderate attitude when facing problems and avoid extremes and impulsiveness [29]. This value system will subtly influence individuals' cognitive evaluation of stressors. Individuals influenced by Confucian culture may be more inclined to focus on the risk factors in investment decisions, while their evaluation of potential gains is relatively conservative. They will place more emphasis on risk aversion and tend to choose investment options that are considered to be able to safeguard the security of family assets, such as risk-free asset savings or low-risk asset treasury bonds, and be cautious about high-risk assets such as stock funds.

2.3.2. Confucian culture influences stress-related neuroendocrine regulation

The thinking patterns and behavioral habits formed under the long-term influence of Confucian culture may create specific neural pathways and neural regulatory patterns in the brain, which in turn influence the stress-related neuroendocrine system [30]. When individuals follow the calm mindset and rational

coping methods advocated by Confucian culture, regions such as the prefrontal cortex of the brain may play a stronger regulatory role, suppressing the excessive responses of brain regions like the amygdala to stressors, thereby reducing the excessive secretion of stress hormones such as cortisol. Such changes in neuroendocrine regulation help individuals maintain a relatively stable physiological state under stress and avoid damage to the body caused by excessive stress responses. The neuroendocrine changes under stress responses affect financial decision-making preferences. Once stress responses are triggered, a series of changes will occur in the body's neuroendocrine system, and the increased secretion of stress hormones such as cortisol is a key link. Cortisol can affect the neural activities in multiple regions of the brain, especially the amygdala and the prefrontal cortex which are closely related to emotions and decision-making [31]. In the context of Confucian culture, for individuals who have been influenced by its values for a long time, the amygdala may show stronger activity during stress responses because their concerns about family economic stability are closely linked to the family responsibilities emphasized by Confucian culture. The excessive activity of the amygdala will enhance individuals' aversion to risks, making them more inclined to avoid risks. Meanwhile, the increase in cortisol may impair some functions of the prefrontal cortex, such as the abilities of decision-making, impulse inhibition, and rational thinking. Under normal circumstances, the prefrontal cortex can help individuals weigh risks and returns and formulate long-term plans. However, under stress, its functions are inhibited, leading individuals to find it more difficult to make rational financial decisions and instead prefer conservative and safe options, such as increasing the proportion of savings and reducing investments in high-risk assets like stocks.

2.3.3. Long-term effects and intergenerational transmission of Confucian culture on stress response

The influence of Confucian culture on stress responses is long-term and continuous. After experiencing similar stressful decision-making situations for multiple times, individuals will gradually form stable decision-making habits [30]. As Confucian culture prompts individuals to frequently trigger stress responses in financial decision-making and guides them to make conservative and risk-averse decisions, over time, this decision-making pattern will be strengthened into a habitual behavior and be passed down among family generations. Confucian culture attaches great importance to traditions and experiences. If a family tradition has always emphasized prudent financial management, then under the influence of stress responses, the family may be more firmly committed to maintaining a low-risk, low-return asset allocation structure, missing out on investment opportunities brought about by economic growth and finding it difficult to effectively increase family wealth. Families that have been in the Confucian cultural environment for a long time will gradually form a fixed financial decision-making pattern based on stress responses [18]. This pattern is passed down from generation to generation through family education, family cultural inheritance, and other means. The elders set good examples in daily life, passing on Confucian values and ways of coping with economic pressures, and the younger generation will subtly accept and follow these

patterns during their growth. When they face financial decisions, even if the historical background and economic environment change, they will still be influenced by the stress response patterns passed down by the family and make financial decisions that are in line with the values of Confucian culture. This inheritance enables the mechanism by which Confucian culture influences family financial decisions through stress responses to continue in the dimension of time.

3. Confucian culture influences household financial asset allocation economics hypotheses proposed

Research by Bhamra and Uppal [32] has pointed out that culture, through familiarity bias, can lead to a lack of diversification in residents' investments. Confucianism, as the backbone of China's outstanding traditional culture, is seen as the 'root' and 'source' of Chinese culture. It shapes the psychological structure of the Chinese nation, thereby subtly affecting the everyday life and economic behavior of the general public. While many scholars have examined the impact of Confucian culture on economic and financial development and corporate decision-making, a smaller group has focused on household financial asset allocation. In the area of risk-free asset savings, Zhang et al. [33] found that in regions with a strong Confucian culture, families tend to have a stronger preference for sons over daughters, resulting in relatively higher savings rates. However, Chen et al. [34] noted that the Confucian concept of 'raising children for old age security' reduces worries about retirement, leading to lower savings rates. This shows that there is a divergence in research conclusions regarding savings rates. In terms of risky assets, Du and Zhan [35] constructed a dummy variable for Confucian culture based on a question about elderly care preferences and found that in areas where Confucian culture is stronger, the likelihood of choosing to allocate risky assets is lower.

The concept of filial piety is an important aspect of Confucian culture. The notion that children should respect and support their parents is deeply ingrained. For thousands of years, 'raising children for old age security' has been the primary mode of eldercare. Zheng and Xu [36] have confirmed that the concept of filial piety strengthens the internal market economy function within families and discourages residents from relying on commercial endowment insurance as their primary means of eldercare. According to the theory of rational reciprocity, parents hope to receive care from their children in their later years, so they invest heavily in their children during their youth. This increased burden of child-rearing crowds out capital for risk asset investment, leading to a significant impact of the number of children on household financial asset allocation [34]. Moreover, in modern society, where the gender ratio is imbalanced, competition in the marriage market has intensified, and purchasing a marital home and providing a dowry have become essential for entering marriage. To enhance their children's competitiveness in the marriage market, families often adopt a 'competitive saving' strategy.

Confucian culture embodies a strong risk-averse ideology, which significantly influences residents' risk aversion [35]. Theoretically, according to portfolio theory, residents' risk preferences significantly affect investors' stock investment decisions. Empirically, numerous scholars have used empirical studies to demonstrate that

residents' portfolio choices differ based on their risk preferences [2]. The risk-averse ideology in Confucian culture is reflected in several key concepts: First, Confucian culture includes a sense of foreboding and precaution, such as the saying 'a gentleman does not stand under a crumbling wall.' In household financial asset allocation, this ideology leads to an increase in 'precautionary savings' to prepare for potential financial crises [35]. Second, Confucian culture emphasizes collectivism, which stresses that the interests of the collective are superior to those of the individual. Studies show that under the influence of collectivist thought, organizations and individuals exhibit lower risk preferences and are more inclined to avoid risks [34]. Third, Confucian culture advocates for the doctrine of the mean, emphasizing cautious speech and actions. This is manifested in investment decisions by a preference for savings and reduced holdings of risky assets.

Based on the above analysis, this paper proposes the following hypothesis:

H1: Confucian culture will increase savings, hinder participation in financial markets, and reduce the probability and proportion of holding risky assets.

4. Data, variables, and model

4.1. Data source

Issues related to constructing the Confucian culture variable were only addressed in the 2015 survey, so this study uses data from the China Household Finance Survey (CHFS) conducted by the Southwestern University of Finance and Economics in 2015. The survey was conducted nationwide in China, covering 29 provinces and 363 counties and involving more than 37,000 valid respondents. Stata 17 software was used to process the data, retaining only the head-of-household sample, excluding incomplete key information or extreme values, and excluding respondents under the age of 18, resulting in a final sample of 23,612 valid respondents.

4.2. Variable selection

4.2.1. Dependent variables

The dependent variables in this study include measures of risk-free asset savings and risky financial assets. For risk-free asset savings, the proportion of savings (shr) is defined as the ratio of cash, demand deposits, and time deposits to the total financial assets. For risky financial assets, the study examines both the breadth and depth of participation. The breadth of participation in financial markets (rah) is measured by whether the household holds any risky financial assets, coded as 1 if the household holds such assets and 0 otherwise. The depth of participation in financial markets (rar) is determined by the ratio of risky financial assets to the total financial assets. The total financial assets include risky financial assets, cash, demand deposits, time deposits, loans extended, government bonds, etc. Risky financial assets encompass stocks, financial products, bonds, mutual funds, derivatives, foreign currencies, and gold.

4.2.2. Explanatory variable

The explanatory variable is a composite indicator that quantifies the influence of Confucian culture. To comprehensively measure Confucian culture, this study selected nine survey questions that effectively reflect Confucian cultural values. An iterative principal factor method was used to construct a composite indicator. As shown in **Table 1**, the KMO value for the full sample is 0.610, which is greater than 0.6, and the Bartlett's test of sphericity yields a value of 13,436.8 with a corresponding *p*-value of 0.000, indicating that the data are suitable for factor analysis. Following the principle of retaining factors with eigenvalues greater than 1 and a cumulative variance contribution rate exceeding 80%, the first two factors were retained. The weights of the two factors obtained from the analysis were used to calculate a weighted average of the variables, and the result was normalized to obtain the composite indicator of Confucian culture (coc).

Table 1. Results of KMO test and rotated factor loadings of Confucian culture indicators.

entry	KMO	factor1	factor 2
Whether the main purpose of marriage is to support parents and raise children	0.7211	0.0487	0.0935
Whether the main reason for raising children is to carry on the family line and to provide for the elderly	0.7208	0.2195	0.1652
Is it better to have a boy or a girl?	0.7742	0.0871	0.0417
Acceptability of children being single	0.5529	0.7180	0.0195
Whether it is acceptable for children not to have children	0.5577	0.7546	0.0351
Would you rather have children who are obedient to their parents or independent thinkers?	0.6862	0.1171	0.4384
Agree that parents should have the final say in important family matters, regardless of the age of the children.	0.6308	0.0101	0.4608
Do you agree that children should honor their parents no matter what kind of person they are?	0.6657	0.0363	0.1590
Considering that the old age of elderly people with children should be mainly the responsibility of their children	0.7259	0.0994	0.1934
full sample	0.6100		

Data source: CHFS 2015.

4.2.3. Control variables

Control variables were selected from three levels: individual, family, and regional characteristics. Individual characteristics include: household head's gender (gen), age (age), marital status (mar), years of education (edu), health status (hea), party membership (ppm), and risk preference (pre). Family characteristics include: whether the household is engaged in self-employment or business (seb), whether anyone in the household works in the financial sector (job), family size (fam), and logarithm of household disposable income (inc). Regional characteristics include: household registration type (rur) and region of residence (reg).

4.3. Descriptive statistics of variables

Variable definitions and descriptive statistics are presented in **Table 2**.

Table 2. Variable definitions and descriptive statistics.

Variable type	Variable	Description of variables	*N*	Mean	Std.dev	Min	Max
dependent Variable	rah	Whether risky assets are held (yes = 1)	23,612	0.303	0.459	0	1
	rar	Risky assets as a proportion of financial assets	23,612	0.072	0.198	0	1
	shr	Savings as a share of financial assets	23,612	0.837	0.315	0	1
explanatory variable	coc	Confucianism constructed by iterative principal factor approach	23,612	0.585	0.225	0	1
control variable	gen	Sex of head of household (*M* = 1, *F* = 0)	23,612	0.697	0.459	0	1
	age	age	23,612	52.80	14.64	18	101
	mar	Marital status (married = 1, other = 0)	23,612	0.840	0.367	0	1
	edu	Years of schooling (no schooling = 0, primary school = 6, junior high school = 9, senior high school = 12, secondary/vocational high school = 13, college/higher vocational = 15, B.A. = 16, M.A./Ph.D. = 19)	23,612	10.13	3.158	0	19
	hea	Health status (values 1 to 5 indicate very bad, bad, fair, good, very good, respectively)	23,612	3.389	0.933	1	5
	ppm	Whether party member (yes = 1, no = 0)	23,612	0.192	0.394	0	1
	pre	Risk appetite, with values from 1 to 5 indicating increasing risk aversion	23,612	4.060	1.186	1	5
	seb	Whether engaged in self-employed business (yes = 1)	23,612	0.162	0.368	0	1
	job	Does anyone in the family work in the financial sector (Yes = 1, No = 0)	23,612	0.014	0.118	0	1
	fam	Household size	23,612	3.404	1.683	1	20
	inc	Logarithm of disposable income	23,612	10.18	2.407	0	15.42
	rur	Type of household (rural = 0, urban = 1)	23,612	0.294	0.455	0	1
	reg	Region (East = 1, Middle = 2, West = 3)	23,612	1.733	0.820	1	3

4.4. Model specification

To examine the impact of Confucian culture on risk-free asset savings, the following model is constructed:

$$shr_i = \alpha_0 + \alpha_1 coc_i + \alpha_2 fif_i + \sum \alpha_{3,k} controls_i + \mu_i \tag{1}$$

shr_i is the proportion of savings in financial assets; coc_i is the composite indicator of Confucian culture; fif_i is the composite indicator of financial literacy; $controls_i$ are the control variables, including individual, family, and regional characteristics. Considering the distribution characteristics of the savings variable, Equation (1) is estimated using a Tobit model.

To examine the impact of Confucian culture on the allocation of risky assets, the following models are constructed:

$$rah_i = \beta_0 + \beta_1 coc_i + \beta_2 fif_i + \sum \beta_{3,k} controls_i + \mu_i \tag{2}$$

$$rar_i = \gamma_0 + \gamma_1 coc_i + \gamma_2 fif_i + \sum \gamma_{3,k} controls_i + \mu_i \tag{3}$$

rah_i represents the breadth of participation in risky assets, i.e., whether the household holds risky assets; rar_i represents the depth of participation in risky assets, i.e., the proportion of risky assets held. Other symbols are defined as in Equation (1). Since whether a household holds risky assets is a binary variable, it is appropriate to use a discrete model, and thus Equation (2) is estimated using a Probit

model. Considering that the proportion of risky assets held ranges from 0 to 1 and there are many cases where this proportion is 0, Equation (3) is estimated using a Tobit model. To address potential autocorrelation issues among individuals, robust standard errors clustered at the provincial level are used in all regressions.

5. Empirical test of the impact of Confucian culture on household financial asset allocation

The estimated results of Confucianism on household financial asset allocation are shown in **Table 3**. Column (1) presents the results of the Probit model estimating the likelihood of holding risky assets, while columns (2) and (3) present the results of the Tobit model estimating the proportion of risky assets held and the proportion of savings, respectively. In columns (1) and (2), the effect of Confucian culture on the breadth and depth of involvement in risky assets is significantly negative at the 1% level; in column (3), the effect of Confucian culture on the proportion of savings is significantly positive at the 1% level. These results indicate that households with stronger Confucian cultural values tend to hold more safe assets and are less likely to hold risky financial assets, with a lower proportion of risky financial assets held. Thus, Confucian culture significantly promotes savings and inhibits the breadth and depth of household participation in financial markets, leading to a more concentrated financial asset allocation. H1 is supported by these findings.

Table 3. Influence of Confucianism on household financial asset allocation.

	(1) rah	(2) rar	(3) shr
coc	−0.345***	−0.295***	0.223***
	(0.066)	(0.041)	(0.046)
gen	0.001	−0.089***	0.063***
	(0.022)	(0.015)	(0.017)
age	−0.009***	−0.002***	0.001
	(0.001)	(0.001)	(0.001)
mar	0.110***	0.085***	−0.045**
	(0.028)	(0.024)	(0.020)
edu	0.063***	0.050***	−0.058***
	(0.005)	(0.003)	(0.004)
hea	0.054***	0.002	0.009
	(0.013)	(0.009)	(0.012)
ppm	0.154***	0.064***	−0.044**
	(0.028)	(0.015)	(0.021)
pre	−0.166***	−0.114***	0.139***
	(0.009)	(0.006)	(0.009)
seb	0.284***	0.039**	−0.123***
	(0.024)	(0.018)	(0.024)
job	0.205**	0.063**	−0.165***
	(0.087)	(0.029)	(0.043)

Table 3. (*Continued*).

	(1) rah	(2) rar	(3) shr
fam	−0.018**	−0.026***	0.016**
	(0.009)	(0.008)	(0.008)
inc	0.077***	0.054***	−0.018***
	(0.007)	(0.004)	(0.005)
rur	−0.236***	−0.361***	0.019
	(0.029)	(0.039)	(0.029)
reg	−0.080***	−0.084***	0.055**
	(0.030)	(0.024)	(0.024)
cons	−1.163***	−1.222***	1.614***
	(0.115)	(0.116)	(0.110)
N	23612	23612	23612
Pseudo R^2	0.222	0.298	0.088

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively; regression coefficients, not marginal effects, are reported in the table; cons is a constant term; and standard errors of robust estimation of clustering to the provincial level are shown in parentheses, below.

6. Heterogeneity analysis

6.1. Different age groups

The neural mechanisms behind household economic decision-making differ across age, and studies using functional magnetic resonance imaging (fMRI) in younger and older adults have found higher activation in the left dorsolateral prefrontal cortex (dlpfc) in older adults [37]. Aging may be associated with a stronger reliance on computational areas that support goal maintenance and rule-switching during interactive economic decision-making. The extent to which individuals are influenced by Confucian cultural values varies across age groups. Modernization and globalization have exposed younger generations to diverse cultures and education, particularly through the internet and social media, fostering pluralistic values and weakening ties to traditional Confucian culture. Additionally, due to differences in wealth goals across age groups, their financial asset allocation strategies also vary. Therefore, this study divides the sample into three age groups to examine the heterogeneity of the impact of Confucian culture on risky assets and savings: the young group (18 to 35 years old), the middle-aged group (36 to 60 years old), and the elderly group (over 60 years old). The regression results are presented in **Table 4**.

According to Columns (1) and (2), the absolute values of the coefficients for Confucian culture increase with age, suggesting that the inhibiting effect of Confucian culture on the breadth and depth of participation in risky assets becomes stronger with increasing age, and is most pronounced in the elderly group. The results in Column (3) show that the coefficients for Confucian culture also increase with age, indicating that the promoting effect of Confucian culture on savings becomes more significant as individuals grow older. This may be because middle-aged and older adults tend to adopt more conservative investment strategies to avoid

potential financial risks and place greater importance on savings to prepare for future uncertainties and provide economic support for their children. The financial asset allocation of middle-aged and elderly households exhibits stronger Confucian cultural characteristics.

Table 4. Heterogeneity analysis by age group.

variable	(1) rah	(2) rar	(3) shr
the young group			
coc	−0.371*** (0.143)	−0.278*** (0.077)	0.161** (0.068)
cons	−1.554*** (0.229)	−1.074*** (0.119)	1.810*** (0.115)
control	Yes	Yes	Yes
N	3222	3222	3222
Pseudo R^2	0.110	0.173	0.068
the middle-aged group			
coc	−0.470*** (0.086)	−0.345*** (0.041)	0.318*** (0.050)
cons	−2.395*** (0.142)	−1.831*** (0.137)	2.413*** (0.144)
control	Yes	Yes	Yes
N	12755	12755	12755
Pseudo R^2	0.133	0.236	0.062
the elderly group			
coc	−0.624*** (0.096)	−0.576*** (0.062)	0.614*** (0.118)
cons	−3.503*** (0.214)	−3.034*** (0.331)	2.863*** (0.291)
control	Yes	Yes	Yes
N	7635	7635	7635
Pseudo R^2	0.172	0.260	0.041
Chow test	79.90*** (0.000)	1.07*** (0.000)	4.37*** (0.000)

6.2. Household income level

Higher-income households usually have more disposable resources and greater access to financial advisory services, and thus higher risk tolerance in financial decision-making. From the perspective of neural mechanisms, their brain's assessment of risk during the decision-making process may be more complex and flexible. When high-income families face investment risks, their prefrontal cortex and other areas responsible for rational decision-making may be more active and able to weigh risks and returns more comprehensively. The amygdala in the brains of low-income families may be more sensitive to potential risks, as investment failure may have a serious impact on the family's basic livelihood. To investigate whether the impact of Confucian culture on household financial asset allocation differs across income levels, this study divides the sample into two groups based on disposable

income: the bottom 50% are classified as the low- to middle-income group, and the top 25% are classified as the high-income group. The regression results are presented in **Table 5**.

The *p*-values of the Chow tests are all significant at the 1% level, indicating that the differences in coefficients between the groups are statistically significant. The impact of Confucian culture on household financial asset allocation is significant at the 1% level for both income groups. Comparing the coefficients of the two groups, the influence of Confucian culture is greater in the low- to middle-income group, regardless of whether it pertains to the likelihood of holding risky assets, the proportion of risky assets held, or the proportion of savings. The results suggest that high-income households have weaker motives for saving and are more likely to break free from the conservative mindset of Confucian culture. After meeting certain savings needs, they tend to invest in risky assets to seek maximum wealth. In contrast, the low- to middle-income group has weaker resilience against uncertainty and is more reliant on and aligned with Confucian cultural values, especially in frugality, saving, and risk aversion. Their financial decisions focus more on short-term stability and security.

Table 5. Heterogeneity analysis of income levels.

	rah		rar		shr	
	lower middle income	high income	lower middle income	high income	lower middle income	high income
coc	−0.507***	−0.388***	−0.515***	−0.228***	0.407***	0.210***
	(0.088)	(0.085)	(0.075)	(0.046)	(0.138)	(0.035)
control	Yes	Yes	Yes	Yes	Yes	Yes
N	11806	5903	11806	5903	11806	5903
Pseudo R^2	0.127	0.120	0.213	0.163	0.026	0.083
Chow test	691.64*** (0.000)		456.48*** (0.000)		238.35*** (0.000)	

7. Robustness tests

7.1. Endogeneity issues

Although control variables have been included, the regression results for Confucian culture may still suffer from endogeneity problems. On one hand, regression analysis may not capture all possible influencing factors, potentially omitting important variables. On the other hand, measurement errors may occur during the survey process. To address these endogeneity issues, we adopt an instrumental variable (IV) approach based on the methodology used by Ge et al. [29] We use the average level of Confucian culture among other households in the same community within the same survey area as the instrument variable (sqc). As an informal institution, Confucian culture spreads within a certain range, and households within the same community often exchange and integrate culturally. The stronger the Confucian cultural values in a community, the more likely it is that the sample household will have a deeper degree of Confucian cultural influence, satisfying the relevance assumption. The average level of Confucian culture among

other households in the community is not directly related to the asset allocation decisions of the sample household, thus satisfying the exogeneity assumption.

We use the IV-Probit model to estimate the impact of Confucian culture on the likelihood of holding risky assets and the IV-Tobit model to estimate the impact on the proportion of risky assets held and the proportion of savings. The estimation results are presented in **Table 6**. According to the first-stage regression results, the instrument variable is positively correlated with Confucian culture at the 1% level, with an *F*-statistic of 477.51, exceeding 10, indicating that there is no weak instrument variable issue. The *p*-values of the Wald test are all significant at the 1% level, confirming the presence of endogeneity in the model. The second-stage regression results show that after addressing the endogeneity issue, Confucian culture still significantly inhibits the likelihood and proportion of holding risky assets while promoting the proportion of savings, consistent with the original findings.

Table 6. Regression results of the instrumental variables approach.

variable	First-stage regression	Second-stage regression		
	(1) coc	**(2) IV-Probit rah**	**(3) IV-Tobit rar**	**(4) IV-Tobit shr**
sqc	0.582*** (0.015)			
coc		−3.312*** (0.202)	−2.869*** (0.143)	2.449*** (0.167)
control	Yes	Yes	Yes	Yes
F-Value	477.51			
Wald test		238.85*** (0.000)	403.95*** (0.000)	214.56*** (0.000)
N	23,611	23,611	23,611	23,611

7.2. Controlling for provincial fixed effects

Table 7. Control province fixed effects.

	(1) rah	**(2) rar**	**(3) shr**
coc	−0.358***	−0.298***	0.235***
	(0.052)	(0.035)	(0.039)
fif	0.928***	0.610***	−0.439***
	(0.034)	(0.026)	(0.037)
cons	−0.852***	−1.845***	2.545***
	(0.121)	(0.085)	(0.097)
control	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
N	23,612	23,612	23,612
Pseudo R^2	0.217	0.292	0.083

Households in different provinces exhibit significant differences in cultural background and behavioral habits, which may affect the estimation results. To

address this issue, this study construct province dummy variables and include them in the benchmark model. The results presented in **Table 7** show that the conclusions remain valid even after controlling for provincial fixed effects.

8. Conclusion

Based on the framework of cultural neuroscience and biomechanics, this study examines the impact of Confucian culture on household financial asset allocation behaviors from the perspectives of neural mechanisms and stress responses, presenting new possibilities for explaining the phenomena of high savings and limited participation in the financial market from an interdisciplinary perspective.

From the perspective of neurobiology, multiple regions in the brain are involved in household financial decisions and constitute the core part of the biomechanical mechanism. Confucian culture influences financial asset allocation behaviors by emphasizing values such as familism, filial piety, and risk aversion, and functions through specific neural mechanisms. In the context of Confucian culture's emphasis on careful financial management and risk aversion, the prefrontal cortex may be activated due to the importance placed on future stability and family welfare in Confucian culture, leading to more cautious and deliberate choices. In situations involving financial risks, the amygdala related to emotional responses can trigger reactions related to financial risks and uncertainties, especially fear and anxiety. When individuals in Confucian culture face high-risk financial choices, the cingulate gyrus involved in conflict monitoring may be more active because they may be more sensitive to the social and family impacts that financial failure may bring. Therefore, under the influence of neural mechanisms, families with a stronger Confucian cultural influence tend to adopt more conservative financial asset allocation behaviors, emphasizing savings rather than making risky investments.

From the perspective of the neuroendocrine system, the secretion levels of stress hormones such as cortisol are also closely related to household economic decisions. Stress responses, by influencing psychological cognition and neural mechanisms, have become one of the important biomechanical factors affecting financial decision-making behaviors. Stress responses not only affect the cognition of financial decisions in terms of three cognitive components, namely learning feedback, reward sensitivity, and risk preference, but also have an impact on the physiological neural mechanisms. Confucian culture profoundly influences individuals' choices in household financial asset allocation by affecting the triggering and cognitive assessment of stress responses, influencing the neuroendocrine regulation related to stress responses, and having long-term impacts and intergenerational inheritance on stress responses, resulting in characteristics such as high savings and low participation in risky assets in household financial asset allocation.

From the perspective of empirical research, this study analyzes the China Household Finance Survey data. It constructs the Confucian culture variable by using the iterative principal factor method and builds Probit and Tobit models to study the impact of Confucian culture on household financial asset allocation. The study finds that Confucian culture can significantly promote savings, suppress the

breadth and depth of households' participation in the financial market, and lead to a more simplified financial asset allocation. Heterogeneity analysis shows that the inhibitory effect of Confucian culture on the breadth and depth of participation in risky assets increases with age and is most pronounced among the elderly. High-income families have a weaker savings motive and are more likely to break away from the conservative ideas of Confucian culture. After using instrumental variables to address the endogeneity issue and controlling for provincial fixed effects, the conclusion remains valid.

Research on the impact of Confucian culture on financial decision-making behaviors from the aspects of biomechanical factors and neural mechanisms belongs to an emerging field. Future research can draw on the research techniques and methods of neuroscience and genetics to carry out studies from the following perspectives:

Combining molecular genetics techniques with cultural neuroscience: When studying the impact of culture on risk preferences, electroencephalogram (EEG), functional magnetic resonance imaging (fMRI), or other neuroimaging techniques can be used as aids to record the brain activities of subjects when they are performing risky investment decision-making tasks. By analyzing the activation status of brain regions related to risk assessment (such as the insular cortex), reward anticipation (such as the ventral tegmental area and the nucleus accumbens), etc., it is possible to accurately understand how culture changes individuals' risk attitudes through neural mechanisms, providing new, micro-level empirical evidence for cultural economics research. During this process, gene data can also be collected simultaneously to analyze the associations between specific gene variations and the neural activity patterns of the brain when processing culture-related information or making financial decisions.

Conducting gene-culture co-evolution studies: Utilize techniques such as genome-wide association analysis (GWAS) to search for gene loci that are significantly associated with behaviors or psychological characteristics related to Confucian culture. Combine family pedigree studies and cultural inheritance surveys to analyze the transmission patterns of gene variations within families and their correlations with the inheritance of Confucian cultural values. Look for gene sets that are differentially expressed under the influence of Confucian culture. These genes may be involved in processes such as neural plasticity regulation, neurotransmitter synthesis and metabolism, and synaptic transmission. Through this gene-culture-neural interaction research, the micro-genetic basis and the neural regulatory mechanism by which Confucian culture influences financial decision-making can be revealed, further deepening the understanding of this complex relationship.

Establishing gene expression network models: Employ gene chip technology or RNA sequencing technology to analyze the changes in the gene expression profiles of specific brain regions (such as the prefrontal cortex and the amygdala) under different Confucian cultural environments or before and after individuals receive Confucian cultural education. Integrate and analyze the differentially expressed genes with known biological pathways and functional modules to establish gene expression network models, revealing the dynamic changes in the gene regulatory

network under the influence of Confucian culture. Explore how the changes in the gene expression network mediate the shaping effect of Confucian culture on individual behavioral characteristics at the neurobiological level, providing a basis for an in-depth understanding of the molecular mechanism connections between culture and biology.

Author contributions: Conceptualization, YL and LY; methodology, YL and LY; software, YL; validation, YL, LY and AX; formal analysis, YL; investigation, LY; resources, NZ; data curation, AX; writing—original draft preparation, YL; writing—review and editing, LY; visualization, AX; supervision, NZ; project administration, NZ. All authors have read and agreed to the published version of the manuscript.

Ethical approval: Not applicable.

Conflict of interest: The authors declare no conflict of interest.

References

1. Campbell JY. Household Finance. The Journal of Finance. 2006; 61(4): 1553-1604. doi: 10.1111/j.1540-6261.2006.00883.x
2. Gomes F, Haliassos M, Ramadorai T. Household Finance. Journal of Economic Literature. 2021; 59(3): 919-1000. doi: 10.1257/jel.20201461
3. Ke D. Who Wears the Pants? Gender Identity Norms and Intrahousehold Financial Decision-Making. The Journal of Finance. 2021; 76(3): 1389-1425. doi: 10.1111/jofi.13002
4. Kang C, Hu R. Age structure of the population and the choice of household financial assets. Economic Research-Ekonomska Istraživanja. 2021; 35(1): 2889-2905. doi: 10.1080/1331677x.2021.1984269
5. Xu X, Yi J. The Impact of Education Gap on Household Financial Asset Allocation. Financial Engineering and Risk Management. 2024; 7(4). doi: 10.23977/ferm.2024.070412
6. Dimmock SG, Kouwenberg R. Loss-aversion and household portfolio choice. Journal of Empirical Finance. 2010; 17(3): 441-459. doi: 10.1016/j.jempfin.2009.11.005
7. Singh A, Mohan A. An Empirical Model for the Indian Foreign Investment and Stock Market Volatility: Evidence From ARDL Bounds Testing Analysis. International Journal of Financial Research. 2020; 11(2): 154. doi: 10.5430/ijfr.v11n2p154
8. Gebeyehu MG. Household saving culture and financial literacy in case of Wolaita Zone, Ethiopia. Global Business and Economics Review. 2022; 27(2): 232. doi: 10.1504/gber.2022.125043
9. Li C, Li J, Zhai C, et al. Medical insurance, health risks, and household financial asset allocation: evidence from China household finance survey. Frontiers in Public Health. 2023; 11. doi: 10.3389/fpubh.2023.1268470
10. Yu YQ. Financial literacy and asset allocation among retired residents: evidence from China. Journal of the Asia Pacific Economy. 2020; 27(4): 660-681. doi: 10.1080/13547860.2020.1849938
11. Li K, Griffin D, Yue H, et al. How does culture influence corporate risk-taking? Journal of Corporate Finance. 2013; 23: 1-22. doi: 10.1016/j.jcorpfin.2013.07.008
12. Gong Z, Gong L. The financial geographic structure, Confucian culture, and corporate asset allocation efficiency. Finance Research Letters. 2024; 63: 105264. doi: 10.1016/j.frl.2024.105264
13. Lin X, Wu S, Wu B, et al. Quantifying the diffusion history of Yangmingism. Humanities and Social Sciences Communications. 2024; 11(1). doi: 10.1057/s41599-024-02999-2
14. Liu H. A study on the influence of the spread of Yangming Studies in Japan on the psychology of the Japanese people based on big data analysis. Applied Mathematics and Nonlinear Sciences. 2023; 9(1). doi: 10.2478/amns.2023.1.00083
15. Mirmohammadi H, D. Fahmy M, Shirani Bidabadi F, Liang H. Editorial Letter. Scientific Hypotheses. 2024; 1: 1-3. doi: 10.69530/fc49qm51
16. Bendersky M, Alba-Ferrara L. Editorial: Neuroanatomy of cognition. Frontiers in Neuroanatomy. 2024; 18. doi: 10.3389/fnana.2024.1376610
17. Wang P, Gu R, Zhang J, et al. Males with low risk-taking propensity overestimate risk under acute psychological stress. Stress. 2021; 24(6): 898-910. doi: 10.1080/10253890.2021.1957824

18. Han H, Glover GH, Jeong C. Cultural influences on the neural correlate of moral decision making processes. Behavioural Brain Research. 2014; 259: 215-228. doi: 10.1016/j.bbr.2013.11.012

19. Iigaya K, Larsen T, Fong T, et al. Computational and neural evidence for altered fast and slow learning from losses in gambling disorder. The preprint server for biology; 2024.

20. Gammon E. Affective neuroscience, emotional regulation, and international relations. International Theory. 2020; 12(2): 189-219. doi: 10.1017/s1752971919000253

21. Serra D. Decision-making: from neuroscience to neuroeconomics—an overview. Theory and Decision. 2021; 91(1): 1-80. doi: 10.1007/s11238-021-09830-3

22. Rilling JK, Sanfey AG. The Neuroscience of Social Decision-Making. Annual Review of Psychology. 2011; 62(1): 23-48. doi: 10.1146/annurev.psych.121208.131647

23. Dennison JB, Sazhin D, Smith DV. Decision neuroscience and neuroeconomics: Recent progress and ongoing challenges. WIREs Cognitive Science. 2022; 13(3). doi: 10.1002/wcs.1589

24. Li M, Schilling KG, Xu L, et al. White matter engagement in brain networks assessed by integration of functional and structural connectivity. NeuroImage. 2024; 302: 120887. doi: 10.1016/j.neuroimage.2024.120887

25. Simonovic B, Stupple EJN, Gale M, et al. Performance Under Stress: An Eye-Tracking Investigation of the Iowa Gambling Task (IGT). Frontiers in Behavioral Neuroscience. 2018; 12. doi: 10.3389/fnbeh.2018.00217

26. van Leeuwen JMC, Vink M, Joëls M, et al. Increased responses of the reward circuitry to positive task feedback following acute stress in healthy controls but not in siblings of schizophrenia patients. NeuroImage. 2019; 184: 547-554. doi: 10.1016/j.neuroimage.2018.09.051

27. Pighin S, Bonini N, Hadjichristidis C, et al. Decision making under stress: mild hypoxia leads to increased risk-taking. Stress. 2019; 23(3): 290-297. doi: 10.1080/10253890.2019.1680634

28. Sapolsky RM. Glucocorticoids, the evolution of the stress-response, and the primate predicament. Neurobiology of Stress. 2021; 14: 100320. doi: 10.1016/j.ynstr.2021.100320

29. Ge Y, Kong X, Dadilabang G, et al. The effect of Confucian culture on household risky asset holdings: Using categorical principal component analysis. International Journal of Finance & Economics. 2021; 28(1): 839-857. doi: 10.1002/ijfe.2452

30. Sasaki JY, Kim HS. Nature, Nurture, and Their Interplay. Journal of Cross-Cultural Psychology. 2016; 48(1): 4-22. doi: 10.1177/0022022116680481

31. Xiong B, Chen C, Tian Y, et al. Brain preparedness: The proactive role of the cortisol awakening response in hippocampal-prefrontal functional interactions. Progress in Neurobiology. 2021; 205: 102127. doi: 10.1016/j.pneurobio.2021.102127

32. Bhamra HS, Uppal R. Does Household Finance Matter? Small Financial Errors with Large Social Costs. American Economic Review. 2019; 109(3): 1116-1154. doi: 10.1257/aer.20161076

33. Zhang C, Liu Y, Yin ZC. The impact of Confucian culture on household savings rate. Journal of Beijing Technology and Business University (Social Sciences). 2022; 37(4): 58-71.

34. Chen L, Jin Z, Ma Y, et al. Confucianism, openness to the West, and corporate investment efficiency. European Financial Management. 2018; 25(3): 554-590. doi: 10.1111/eufm.12173

35. Du CY, Zhan YB. Confucian Culture and the Allocation of Household Risky Assets: An Empirical Study Based on CGSS Data. Journal of Jilin University (Social Sciences Edition). 2019; 59(6): 95-106 + 221.

36. Zheng L, Xu MX. Does the Traditional Family Concept Inhibit Urban Residents' Participation in Commercial Endowment Insurance? An Empirical Analysis from the Perspectives of Financial Trust and Financial Literacy. Journal of Financial Research. 2021; (6): 133-151.

37. Figueroa-Jiménez MD, Cañete-Massé C, Gudayol-Ferre E, et al. Functional brain hubs are related to age: A primer study with rs-fMRI. International Journal of Clinical and Health Psychology. 2024; 24(4): 100517. doi: 10.1016/j.ijchp.2024.100517