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Assessing Risk Perception through Socio Demographic Characteristics: A CHAID-Based Exploration

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Financial Risk-Taking Capacity, Socio-Demographic Variable, CHAID

ABSTRACT

The present study examines the relationship between gender and age; and between gender and marital status in shaping an individual's risk-taking behavior. It addresses the lack of localized research on socio-demographic factors affecting financial behavior in this region. The study employs the CHAID (Chi-square Automatic Interaction Detection) technique. The model classifies individuals' risk-bearing capacity based on socio-demographic factors i.e. gender, age and marital status. This study uniquely applies the CHAID model to analyze financial risk-taking in an emerging Indian financial hub. Unlike broad gender-based analyses, it highlights the interaction of gender with age and marital status, challenging traditional assumptions of female risk aversion.

Results indicate that females, irrespective of age, exhibit higher risk-taking tendencies, with married females being more risk-inclined than their single counterparts. Among males, married individuals and those aged 41-50 years demonstrate higher risk-taking behavior. The study is limited to Indore City, and findings may vary across different regions and cultures. Future research could explore additional psychological and behavioral factors influencing financial risk-taking. Portfolio managers can use basic demographic information to assess an individual's risk propensity, enabling them to recommend suitable investment strategies. The study also highlights the need for gender-specific financial literacy programs.The findings indicate increasing financial independence among women, reflecting a shift toward gender equality. Policymakers can leverage these insights to promote financial inclusion and joint financial planning for married individuals.

1. INTRODUCTION

Financial risk-taking, encompassing an individual's beliefs, attitudes, judgments, and feelings about risk associated with financial avenues, is a critical component of investment decision-making (Nguyen et al., 2019). It reflects how individuals interpret and respond to financial opportunities, influencing both personal financial outcomes and the broader economy (Malathy & Saranya, 2017). Central to this behavior is risk perception, which involves evaluating the source of risk, the degree of uncertainty, and the potential consequences (Brown et al., 2021). Such behaviors, whether in investments, savings, or financial planning, vary significantly among individuals, often shaped by socio-demographic factors (Saivasan & Lokhande, 2022). Among those, variables such as gender, age, and marital status play a particularly significant role in influencing an individual's capacity for risk-taking (Arora & Kumari, 2015; Chaulk, 2000).

Gender has been shown to influence risk perception, with research suggesting systematic variations in attitudes toward uncertainty and risk-taking behavior (Gustafsod, 1998). Age and marital status further complicate this relationship, as these factors often intersect to create unique patterns of financial risk perception. For example younger males tend to exhibit higher

risk-taking capacity compared to older males or females of the same age group (Rolison et al., 2014). In the same way married individuals may have different financial priorities and risk tolerances compared to their single counterparts.

The ways in which gender, age, and marital status variables interact to shape financial risk-taking remain underexplored, especially in the Indian context. The present study focuses on examining how socio-demographic variables specifically gender, age, and marital status influence financial risk-taking behavior. Using Indore, a rapidly growing financial hub in central India (Puranik, 2020), as the study context, it seeks to address the lack of localized research on these variables. The CHAID (Chi-square Automatic Interaction Detection) technique is employed to uncover complex interactions between these factors and segment the data into meaningful subgroups. By analyzing these relationships, the study aims to provide a clearer understanding of socio-demographic influences on financial behavior in a region undergoing significant economic growth.

2. LITERATURE REVIEW

Earlier economic theories assumed people made fully rational decisions. However, the concept of bounded rationality argues that real-life decisions are often limited by a person's knowledge, mental ability, and the time available to decide (Simon, 1957). When making investment decisions, people use this framework to systematically weigh risk and reward with the goal of maximizing profits for certain levels of risk. But by looking at investor behavior from a social science perspective and emphasizing how psychological, emotional, and socio-demographic aspects affect decision-making, the field of behavioral finance contradicts this traditional view (Kourtidis et al., 2015). While early studies focused on the rationality of investors (Grossman & Stiglitz, 1980), historical anomalies in market behavior have highlighted the need to reconsider these assumptions. This shift has spurred extensive research into factors influencing financial risk perception, a critical component of investment decisions. Researchers has shown that basic valuation measurements such as book value, dividends per share, and earnings per share are important factors in determining how risk is perceived (Brahmasrene & Whitten, 2022). Despite this surge in research, there remained a significant need for further investigation, particularly concerning socio-demographic factors, which shape financial risk perception.

While modern portfolio theory suggests that socio-demographic factors like gender are neither integral to financial modeling nor determinants of risk tolerance, research has consistently highlighted notable differences in investment attitudes and behaviors between men and women (Baeckström, 2022). Some prominent research has also shown that socio-demographic factors, such as gender and marital status, in addition to age, influence an individual's resources, priorities, and capacity to process information, which in turn shapes their financial risk perception and behavior (Aren & Zengin, 2016). These factors do not contradict bounded rationality; instead, they provide context for how individuals navigate their decision-making limitations, influencing how much information they can process, how they weigh risks versus rewards, and their access to financial education and advice, each of which plays a crucial role in shaping financial risk perception and decision-making.

Prospect Theory contends that people assess possible gains and losses in relation to a reference point, which makes them perceive the same in asymmetric manner like losses seem more significant than comparable gains (Kahneman & Tversky, 1979). This means they have a strong aversion to loss (Baker & Ricciardi, 2014). Empirical studies support this framework, demonstrating that investor sentiment significantly affects market volatility, as observed in the Asia-Pacific region (Zghidi, 2022) and in sectors like finance and manufacturing in the United States (Brahmasrene & Whitten, 2022). These findings also align with gender-based differences in financial behavior, as research has shown that men exhibit greater confidence than women when planning investments (Barber & Odean, 2001). Such cognitive biases, shaped by socio-demographic factors, reinforce the relevance of Prospect Theory in understanding risk perception across different populations.

The role of gender in financial risk perception is not limited to cognitive biases and is further explained by Gender Role Theory, which emphasizes how societal expectations and traditional gender roles shape individual behavior and decision-making (Eagly, 1987). Societal norms often associate women with caution and risk aversion, while men are expected to be more risk-seeking. This distinction has been validated by several studies. For instance, men and women process information differently when making financial decisions, with mood and emotional state playing a significant role (Graham et al., 2002). Furthermore, a study in India found that factors like family size, perceived expertise, and knowledge of the economy affected decisions to invest in mutual funds, with men and women showing different attitudes toward risk (Gill et al., 2011). Gender differences in financial behavior can also be seen in family settings. For example, in the southern United States, studies found that men in married couples tend to make most of the decisions about how savings are managed, which reflects traditional gender roles (Stilley Hopper, 1995). Gender disparities in financial risk tolerance can also be influenced by marital status. For example, research have shown that single individuals typically show more cautious financial behaviour than married individuals, as the latter are usually more willing to take risks due to shared financial responsibilities and long-term planning goals (Hallahan et al., 2004). Other researchers have found that single people, especially single men, may take on more financial risk than their married counterparts (Love, 2010). This is often linked to social and evolutionary pressures in developing countries like India. These studies provide strong evidences on how the marital status and gender role jointly influence perceptions of risk and financial decision-making.

Another important socio-demographic factor much discussed by scholars and practitioners as a strong determinant of financial risk perception and risk-taking capability is “age.” It is reported in U.S.-based research that older people are more risk-tolerant than their younger counterparts (Grable, 2000). However, another study conducted in the U.K. found a decline

in financial risk tolerance with age (Brooks et al., 2018). Although the results of both studies are contradictory, both confirm the relationship between age and financial risk-taking. This relationship is further intersected by gender; i.e., age and gender jointly decide the risk perception and risk-taking capability of individuals (Zhu et al., 2021).

Despite the wealth of research, significant gaps remain, as the above-mentioned intersection among socio-demographic factors complicates the understanding of financial risk perception. Most studies focus on single variables, such as gender, age, or marital status, without fully exploring how these factors interact. Additionally, there is limited research on financial risk perception in emerging markets, where socio-economic and cultural contexts differ significantly from those of developed economies. Therefore, the present study aims to integrate existing theories with empirical evidence, offering a holistic perspective on the complex interplay of factors influencing financial decision-making.

Objective of the study

1. To examine the relationship of gender and age on the risk-taking capacity of an individual.
2. To explore the relationship of gender and marital status on the risk-taking capacity of an individual.

3. METHODOLOGY

The study is descriptive in nature and explores how gender, age, and marital status influence an individual's risk-taking capacity. Data was collected using a structured questionnaire administered to 550 respondents in Indore city. The questionnaire gathered demographic information from the respondents and asked them to rate various statements to assess their risk-taking capacity (Singh & Bhattacharjee, 2019) and decision-making. Consistent with the method described by Singh & Bhattacharjee (2019) , responses were categorized into two levels: low and high risk-taking. The categorization of the demographic factors, i.e., age, gender, and marital status, is shown in Table 1:

Table 1: Categorization of Demographic Variables

Variable	Categorization
Age	20-30 years, 31-40 years, 41-50 years, and 51+ years
Gender	Male, Female
Marital Status	Single, Married

Out of the 550 respondents, 507 responded to the questionnaire, but some responses were incomplete and couldn't be used. In total, 488 valid responses were analyzed. The reliability of the questionnaire was tested using Cronbach's Alpha. Since the study aimed to examine the joint relationships of gender and age, as well as gender and marital status, with an individual's risk perception, the CHAID technique was used. A decision tree approach was employed to capture the combined effects of these variables. Data analysis was conducted using the Statistical Package for Social Sciences (SPSS), version 20.0.

Data Analysis

Reliability Test

To ensure the reliability of the data collected, Cronbach's alpha was calculated. The result, as shown in Table 2, is a Cronbach's alpha value of 0.979, which exceeds the commonly accepted threshold of 0.7. This indicates that the questionnaire demonstrates excellent internal consistency and is a reliable tool for measuring the variables.

Table 2: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.979	.979	37

Decision Tree Analysis of Gender, Age, and Risk-Taking Capacity

The table 3 indicates that the proposed model or tree diagram includes 5 nodes inclusive of 3 terminal nodes. The depth level is 2. Both the independent variables gender and age have been included. The table also presents that minimum cases in parent node is 100 while in child node is 50.

The resulting tree (presented in Fig 1) has 5 nodes, where 3 are terminal nodes. A node in a decision tree basically represents a group or sub-group, while a terminal node represents a node that cannot be further classified on the basis of any other variable under study.

Node 0 is known as the parent node, which shows the low risk-taking capacity of individuals is 43.7% while 56.3 % are high risk-taking individuals. Such a division is good to move further as the number of individuals having low risk-taking capacity, and those having high risk-taking capacity are almost equivalent in number.

Studies' dependent variable, i.e., risks taking capacity of individuals, thus serves as the parent node, and further division in the tree is on the basis of gender ($\chi^2 = 4.401$, df = 1, p-value = 0.036). The p-value is 0.036, which is less than 0.05 and thus is significant.

The first group, or node 1, is of females. Further analysis shows that 38.8% of the females are low risk-taking individuals while 61.2% are high risk-taking. This is a terminal node, and thus, we conclude that females cannot be further classified on the basis of age group. The second group, or node 2, is of males. Further analysis shows that 48.2% of the males are low risk-taking individuals while 51.8% are high risk-taking. This number is almost close to 50%, and thus, a further step in the decision tree is required to understand the nature of males.

The branch of node 2, which represents males, is divided into 2 nodes ($\chi^2 = 9.660$, df = 1, p-value = 0.013). The p-value is 0.013, which is less than 0.05 and thus is significant. The node is divided into 2 terminal nodes on the basis of age. Node 3 comprises age groups 20-30 years, 31-40 years, and 51 and above, while node 4 comprises age group 41-50 years. Further analysis shows in node 3 i.e., age group of groups 20-30 years, 31-40 years and 51 and above; 53.6% of the males are low-risk-taking individuals while 46.4% are high-risk-taking. In node 4, i.e., age group of 41-50 years, 30.5% of the males are low-risk-taking individuals while 69.5% are high-risk-taking. In males, this is the age where they are financially stable and growing and thus believe in high risk-taking to earn for their future.

Table 3: Model Summary

Specifications	Growing Method	CHAID
	Dependent Variable	Risk
	Independent Variables	Gender, Age
	Validation	None
	Maximum Tree Depth	3
	Minimum Cases in Parent Node	100
	Minimum Cases in Child Node	50
Results	Independent Variables Included	Gender, Age
	Number of Nodes	5
	Number of Terminal Nodes	3
	Depth	2

Source: Compiled by the Authors

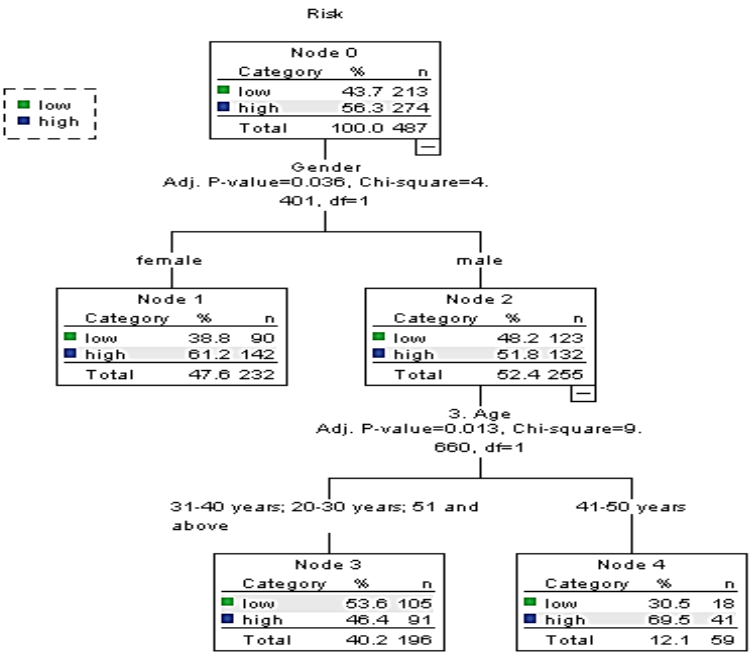

Fig 1: CHAID with risk-taking capacity as dependent variable and gender and age group as independent variable

Validity evaluation of the classification model

A model cannot be considered complete until its accuracy and error is presented. Tables 4 and 5 give basic information on the accuracy and robustness of the created CHAID model. Table 4 shows prediction risk expressed as a proportion of incorrectly categorized observations. It can be stated that if the gender and age group of an individual is known, the likelihood that the individual would be incorrectly labelled in terms of risk-bearing capacity (based on the complete sample) is 40.9%. Table 5 presents the classification matrix. Risk bearing capacity is divided into low and high. The matrix presents the actual (observed) and predicted classifications. Overall accuracy of the model is 59.1%. The model has classified 288 out of 488 individuals in the observed sample.

Table 4: Risk

Estimate	Std. Error
.409	.022

Growing Method: CHAID

Dependent Variable: Risk

Table 5: Classification

Observed	Predicted		
	low	High	Percent Correct
low	105	108	49.3%
high	91	183	66.8%
Overall Percentage	40.2%	59.8%	59.1%

Growing Method: CHAID

Dependent Variable: Risk

Decision Tree Analysis of Gender, Marital Status, and Risk-Taking Capacity

The table 6 presented below indicates that the proposed model or tree diagram includes a total of 5 nodes, of which 3 are terminal. The depth level is 2. Both the independent variables gender and marital status have been included. The table also presents that minimum cases in parent node is 100 while in child node is 50.

The resulting tree (presented in Fig 2) has 7 nodes, where 4 are terminal nodes. A node in a decision tree basically represents a group or sub-group, while a terminal node represents a node that cannot be further classified on the basis of any other variable under study.

Node 0 is known as the parent node, which shows the low risk-taking capacity of individuals is 43.7% while 56.3 % are high risk-taking individuals. Such a division is good to move further as the number of individuals having low risk-taking capacity, and those having high risk-taking capacity are almost equivalent in number.

Studies' dependent variable, i.e., risks taking capacity of individuals, thus serves as the parent node, and further division in the tree is on the basis of gender ($\chi^2 = 4.401$, df = 1, p-value = 0.036). The p-value is 0.036, which is less than 0.05 and thus is significant.

The first group, or node 1, is of females. Further analysis shows that 38.8% of the females are low risk-taking individuals while 61.2% are high risk-taking. This node is further divided on the basis of marital status. The second group, or node 2, is of males. Further analysis shows that 48.2% of the males are low risk-taking individuals while 51.8% are high risk-taking. This number is almost close to 50%, and thus, a further step in the decision tree is required to understand the nature of males.

The branch of node 1, which represents females, is divided into 2 nodes ($\chi^2 = 12.279$, df = 1, p-value = 0.000). The p-value is 0.000, which is less than 0.05 and thus is significant. The node is divided into 2 terminal nodes on the basis of marital status. Node 3 comprises of marital status as single while node 4 comprises of married females. Further analysis shows in node 3, i.e., single females, 52.7% of the females are low-risk-taking individuals while 47.3% are high-risk taking. In node 4, i.e., married females, 29.8% of the females are low risk taking individuals, while 70.2% are high-risk taking. In females, marriage can be considered to provide them with financial security, and thus, they become more confident about their investments and using their money for earning returns.

The branch of node 2, which represents males, is divided into 2 nodes ($\chi^2 = 9.955$, df = 1, p-value = 0.002). The p-value is 0.002, which is less than 0.05 and thus is significant. The node is divided into 2 terminal nodes on the basis of marital status. Node 5 comprises of marital status as single while node 6 comprises of married males. Further analysis shows in node 5, i.e., single males, 64.3% of the males are low-risk-taking individuals while 35.7% are high-risk taking. In node 6, i.e., married males, 42.4% of the males are low risk taking individuals, while 57.8% are high-risk taking. In males, marriage can be considered to be an additional responsibility, and thus, they are more sincere towards their investments and are ready to take risks to earn returns.

Table 6: Model Summary

Specifications	Growing Method	CHAID
	Dependent Variable	Risk
	Independent Variables	Gender, Marital status
	Validation	None
	Maximum Tree Depth	3
	Minimum Cases in Parent Node	100
	Minimum Cases in Child Node	50
Results	Independent Variables Included	Marital status, Gender
	Number of Nodes	5
	Number of Terminal Nodes	3
	Depth	2

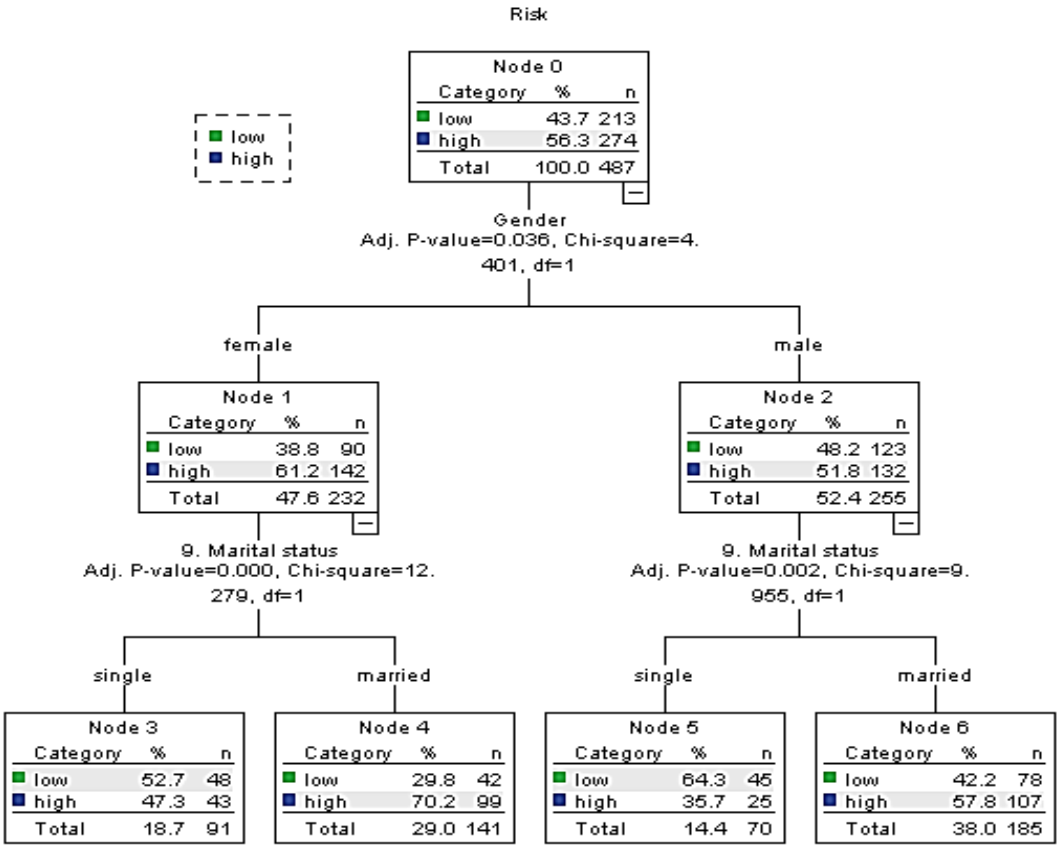

Fig 2: CHAID with risk-taking capacity as the dependent variable and gender and marital status as the independent variable

Validity evaluation of the classification model

The categorization process is not complete until all of its performance has been evaluated. Tables 7 and 8 give basic information on the accuracy and robustness of the created CHAID model.

Table 7 shows prediction risk expressed as a proportion of incorrectly categorized observations. It can be stated that if the gender and marital status of an individual is known, the likelihood that the individual would be incorrectly labelled in terms of risk-bearing capacity (based on the complete sample) is 38.6%.

Table 8 presents the classification matrix. Risk bearing capacity is divided into low and high. The matrix presents the actual (observed) and predicted classifications. Overall accuracy of the model is 61.4%. The model has classified 299 out of 488 individuals in the observed sample.

The purpose of this study was to use CHAID as a tool to identify the groups on the basis of gender and age, gender, and marital status to support the organization's understanding of the risk-bearing capacity of individuals. Behavioral characteristics, no matter what, influence the risk-bearing capacity, but these characteristics are hard to assess. Understanding more complex behavioral characteristics, such as decision-making skills and risk-taking tendencies, requires a deeper understanding of an individual's personality traits and psychological makeup. These factors play a crucial role in determining an individual's risk-bearing capacity but may require additional effort to evaluate accurately.

Table 7: Risk

Estimate	Std. Error
.386	.022

Growing Method: CHAID

Dependent Variable: Risk

Table 8: Classification

	Predicted		
Observed	Low	High	Percent Correct
Low	93	120	43.7%
High	68	206	75.2%
Overall Percentage	33.1%	66.9%	61.4%

Growing Method: CHAID

Dependent Variable: Risk

4. DISCUSSIONS

Basic demographic information is easily available and commonly shared by individuals without any reluctance. This information can be asked and assessed at the first meeting itself. This data provides valuable insights into understanding the individual, thereby helping portfolio managers understand the risk-bearing capacity of an individual and suggest products according to their needs. The CHAID model reflects that risk bearing of an individual can be divided into low risk bearing capacity and high risk bearing capacity on the basis of gender. Gender of an individual plays an important role in identifying the risk propensity of an individual. Further analysis according to CHAID model reveals that most of the females are high risk takers irrespective of their age group. In males, age group does play a role in the risk bearing capacity of an individual. Maximum percentage of males in age group 41-50 years are high risk takers while in other age groups namely 20-30 years, 31-40 years and 51 years and above, equal percentage of males are high risk takers and low risk takers. This phenomenon is explainable as males in age group 41-50 have stable and good pay in their career and most of their liabilities are settled and thus they have a sense of financial security and are in a position to take more risks.

For further analysis, the CHAID model was applied to understand the relation of marital status on risk taking behaviour of an individual. The model reveals that married individuals exhibit different risk taking behaviour as compared to unmarried individuals. Gender and marital status do have a combined effect on risk taking behaviour of individual and it is concluded that high percentage of married females are high risk takers. Marriage often brings about a sense of stability and support, which can provide the confidence to married females to take more risks in their financial investments. The shared responsibilities and decision-making within a marriage encourage women to explore better opportunities to earn better returns. In the case of males, the data is not in alignment with females. A higher percentage of single males exhibit low risk-taking behavior. This can be attributed to the cause of more freedom in males when they are single as compared to when they are married. Additionally, they do not have the responsibility of their partner or kid, and thus, they are not inclined towards earning huge returns. The risk-taking behavior of any individual is related to the number of returns he wishes to earn, and thus, they exhibit low risk-taking behavior. While in the case of married males, they are interested in earning higher returns, and thus, more than 50% are high-risk takers.

5. CONCLUSION

Technological growth in human activities has resulted in the rapid creation of massive volumes of data. As an investor, using this overwhelming information for forming risk perception and investment decision-making is difficult, and as an organization, it is tough to understand this behavior of an individual and accordingly give the options and the information required by the investor. Nevertheless, it is important, and thus, this inevitable task needs to be achieved. As a result, researchers are confronted with the difficulty of determining suitable methods of converting the existing volumes of data mass into usable information or knowledge for decision-making. This paper presents a useful and tangible analysis using CHAID to understand the risk perception of an investor with the most basic information like gender, age group, and marital status that is readily available.

The paper concludes that regardless of age, a higher proportion of females are high-risk takers. It implies that female risk-taking conduct is not restricted to a certain age range. Further analysis of gender and marital status reveals that married females are in a better position to take high risks. As a portfolio manager, an individual can consider these traits and can help such females form a high-risk taking portfolio. Single females are more comfortable in low-risk, and thus, a balanced fund can be beneficial for them. Males in the age group 41-50 years are high-risk takers, and the majority of married males are high-risk takers. This implies that a single male may be interested in investing, but he is not concerned about higher returns, while married males are more inclined towards earning high returns. Married males of age group 41-50 would prefer a basket with maximum investments in high-risk-taking avenues, while other males would, in general, prefer low-risk-taking or balanced funds.

Implications

The study has various implications in various interconnected fields.

For Individuals: Individuals can consider their gender, age group and marital status and can assess in which bracket of risk taking they belong. An insight into whether they are low risk takers or high risk takers can help them to understand how they can strategize to achieve their financial goals. They can also understand that as couples they need to consider their partners preferences towards investment.

For Society: High risk tolerance among females also suggests that there is financial independence among women and a shift towards gender equality. This is an important milestone for women empowerment. A clear indication is provided for a relationship between social dynamics and financial planning. This relationship is important to analyze and use it for benefit of the nation's economy and for the society as a whole.

For Financial institutions and Service providers: The analysis helps to understand the risk tolerance of individuals on the basis of very basic demographic information thereby helping portfolio managers to suggest investment options accordingly or to design specific options for individuals in different categories.

For Educational institutes: The analysis points out the differences due to gender and age group, thereby highlighting the importance of gender specific financial education programs for the individuals. As a major decision maker in the family, a male is more prone towards such knowledge. But for females, basic knowledge of investment and its importance needs to be imbibed.

For Government: For a new Bharat, financial inclusion and literacy is a must. For our economy to progress towards a developed nation requires, appropriate policies according to the gender and age group of an individual. Further, policies can promote joint financial planning for married individuals.

Limitations and Future Scope

The study, if carried out on a larger group (respondents), may reveal different results. Future research may also consider a particular option like mutual funds or share market in detail. The future study may cover other factors that affect the risk perception of an individual.

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