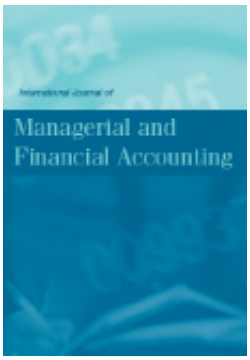

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Discriminants of risk tolerance among Indian investors: a dichotomous discriminant approach

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Discriminants of risk tolerance among Indian investors: a dichotomous discriminant approach

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Abstract: Financial risk tolerance is dynamic in nature, differs across demographic considerations and depends on time horizon and is considered as the most vital factor of sustainable investment decision. The volatility of FRT poses major challenge for the investment industry in designing a suitable portfolio and advising an investor to invest in it based on the risk-taking ability to fulfil investment objective at micro-level. The existing study emphasises identification of causes of risk discrimination. Data source are primary and cross-sectional in nature, and collected from 552 investors selected from small cities. To assess the FRT classification dichotomous discriminant analysis was referred. The most striking finding of the study is the conforming discriminating factors for male and female. The discriminating factor classifying the males into risk taker or risk avoider was found to be the understanding of risk whereas for the females it was the understanding of returns.

Keywords: financial risk tolerance; discriminant analysis; risk taker; risk avoider; demographics.

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1 Introduction

The Indian stock market has been quite volatile in the recent times (Mohanty and Pattnaik, 2021); bullish from 2014 to 2019 and giving attractive returns to the investors, to turning around in later part of 2019 and being bearish. However, the market has started performing very well in 2021 and has been reaching new heights. New investors who participated in the stock market over this period have experienced the bull market as well as the bear market within a short span of time. Such quick turn of market sentiments is enough to shake the investors' confidence, compelling them for a complete revision of their portfolio. The investor's investment decision is driven by risk-taking behaviour and investment objective, which is not uniform. The major challenge faced by the investment industry is designing a suitable portfolio and advising an investor to invest in that portfolio based on the risk-taking ability (Raza et al., 2014), which can fulfil the investment objective at the micro-level. This concerns the use of behavioural finance as a means of helping investors make the best decision on investment that they can. One of the foremost criteria in this decision is an understanding of investor's appetite for risk taking.

Risk tolerance of investors is the most vital factor of sustainable investment decision. There is a great deal of disorientation around the theory of risk tolerance, which is the estimated quantity of trade-off, that an individual is willing to accept interested to attain his investment objectives. Risk tolerance (RT) scientifically defined as an investor's willingness to take a decision whereas the outcomes are uncertain as well as potentially negative (Grable and Joo, 2004).

In India, the Securities and Exchange Board of India (SEBI) mandates every financial consultant get to know their clients and follow financial due diligence guideline to guarantee that the investment guidance is 'suitable' and well-matched with investors' financial and personal circumstances. The financial risk tolerance (FRT), on the other hand, is not mentioned specifically. Financial consultants estimate risk tolerance level of an investor by using their limited knowledge observing the investor over a short time span (Roszkowski and Grable, 2005b). Financial consultants have been shown to be incompetent at assessing their clients' risk tolerance. Consequently, it is neither sufficient nor sensible to simply believe the advice of the advisor on the client's tolerance to risk as a guiding rule for investment. Furthermore, it appears that advisors use heuristics to make client decisions, which can be simulated using regression statistics – a paramorphic representation – with a limited number of input variables (Roszkowski and Grable, 2005a).

A considerable volume of research has been devoted to exactly guesstimate the risk tolerance level of the individual and to classify the variables that have any impact on risk tolerance score. The research in this field can be loosely segregated under three groups. The first group of studies identifies the relationship between an individual's financial and non-financial risk tolerance and the impact of various demographic character on this

conduct (Ehm et al., 2014; Grable and Rabbani, 2014; Ramudzuli and Muzindutsi, 2018; Rolison and Shenton, 2020; Chhatoi et al., 2021). The majority of the studies were found in the second category where the researchers have measured the financial risk tolerance score (FRTS) of an investor using the standard questionnaires. Whereas the third group of studies concentrated on the perceived self-assessed RTS and investment behaviour of an individual, and identification of the demographic character have any impact on it. This current of research falls into the third category of study. However, the distinctiveness of current research lies in the fact that, the researchers have used an instrument comprising of a series of direct and indirect questions that can easily estimate the self-assessed risk perception of an individual investor and also discriminate the role of the demographic factors that have any impact on self-assessed RTS.

Excluding the introduction, the rest of the paper is organised as follows: Section 2 discusses the literature in two distinct sections. A general discussion on the research that has taken place to gauge the impact of the demographic variables on the financial risk tolerance of the investors and a more specific discussion on the research in the area of self-assessed risk tolerance. Section 3 presents a detailed discussion of the research methodology adopted. Section 4 deals with the analysis and interpretation of the results. Section 5 discusses the outcomes and provides explanations for the outcomes and the last section deals with the conclusion and limitations of the study.

2 Literature review

It has been evident that most people will categorise themselves to be risk avoiders rather than risk takers, when it comes to investment decision making. Given a choice between a certain small return and a uncertain large return, they will end up choosing the former (Olsen, 1998). The development in behavioural finance has revealed that even investment advisors end up making poor decision owing to over confidence and heuristics. So, the discussion on understanding investor risk profile led to the development of risk tolerance questionnaire.

Since the first risk tolerance instrument was published in 1984 in the Irwin mutual fund year book (Droms and Strauss, 2003), the subject has got a lot of attention from scholars all over the world. Most of the research, as previously stated, concentrated on the effect of socio-demographic influences on an individual's RTS. Generally, the RTS assessment of the investors was carried out by someone other than the investor by the help of a standard set of questions. Researchers have unanimously acknowledged the discriminated RTS over gender and concluded that the females are less tolerant than males (Bannier and Neubert, 2016; Bollen and Posavac, 2018; Chavali and Mohanraj, 2016; Donkers and Soest, 1999; Faff et al., 2009, 2011; Geetha and Selvakumar, 2016; Hallahan et al., 2004; Kannadhasan, 2015; Mishra and Mishra, 2016; Neelakantan, 2010; Rolison and Shenton, 2020; Shusha, 2017; Sulaiman, 2012).

Out of different socio-demographic character of investor, age of the respondent, inversely related to RTS, i.e., with increase in age the RTS of investors decreases. In case of young aged investors, the relationship is positive and linear as investment in early age provides a longer period to convert their negative return to positive one (Chavali and Mohanraj, 2016; Dhiman et al., 2015; Donkers and Soest, 1999; Duasa and Yusof, 2013; Faff et al., 2009, 2011; Riley and Chow, 1992; Kannadhasan, 2015; Mishra and Mishra, 2016; Shusha, 2017) whereas in case of investors nearing to retirement, the relationship is

nonlinear because of less time to recover the possible losses (Bateman et al., 2011; Hallahan et al., 2004; Yao and Curl, 2011) and more financial responsibilities. The second school of thought suggests age has no role and/or impact on RTS of an investor (Geetha and Selvakumar, 2016; Rahmawati et al., 2015; Sulaiman, 2012).

Similarly, in case of impact of income on RTS as an independent variable from the basket of socio-economic character of investor, researchers are split into two schools of thoughts. The first school of thought suggests positive association between income and risk tolerance, i.e., risk tolerance and income of respondents move in similar direction (Bateman et al., 2011; Faff et al., 2009; Geetha and Selvakumar, 2016; Grable and Joo, 2004; Shusha, 2017; Sulaiman, 2012) whereas the second school of thought advocates a contradictory view to the previous thoughts, i.e., income has no role for the RTS of investor (Dhiman et al., 2015; Kannadhasan, 2015). As regard the relationship between risk comprehension and education attainment, a positive relation was identified by the above researcher. Generally, the researchers agreed on the point that with increase in educational attainment the understanding on different complexities of financial instruments increase which increases the risk comprehension of the investor but this belief has been challenged by the thought education has no impact on enhancement of investor's risk comprehension (Dhiman et al., 2015; Geetha and Selvakumar, 2016).

Married state and dependant members in a family have significant effect on risk bearing capacity of an investor. Across gender, marriage increases the financial responsibilities of an individual and adversely affects the risk-taking ability and reduces it as compared to unmarried investors (Kannadhasan, 2015). Both marital status and dependents in the family have significant role in explaining cross sectional variation in RTS (Faff et al., 2011).

2.1 Self-assessed/subjective risk tolerance

Hariharan et al. (2000) estimated the association between RT and asset allocation for investors' approaching retirement using dataset of University of Michigan's Survey Research Centre. The RT of respondents was estimated from two interlinked questions on income in two different situations. Two questions are "if they would accept an opportunity to take a new and equally good job with a 50-50 chance of doubling family income and a 50-50 chance that family income would be reduced by a third. Depending on their response, individuals were next asked about their willingness to take a job that had a 50-50 chance of doubling their income and a 50-50 chance of either halving or reducing their income by 20%". A RT index was developed with four different scores where zero (0) stands for least risk-tolerant/most risk-averse to three (3) stands for most risk-tolerant/least risk-averse. The presumptions of capital asset pricing model (CAPM) were found to be correct but the allocation of resources over risk and risk-free assets is independent of RTS of investors.

Roszkowski and Grable (2005a) investigated to the effectiveness of the investment advisors by comparing estimated RTS (advisor) with self-assessed RTS of investor. The result of the study suggests that the financial advisors are less effective as compared the client in estimation of RTS. Discrimination of RT across gender is very common. Financial advisors without considering income and wealth of investors, believes males are more risk tolerant as compared to female (Roszkowski and Grable, 2005b). Gender as well as Financial education of the investor (Chhatoi et al., 2020) are two vital

socio-demographic character which have significant role in correct estimation of own RT and the biasness in estimation of SRT is because gender, age and education of investor (Grable and Roszkowski, 2007). Gender as well as education of the investor are two vital demographic which have significant role in correct estimation of own RT (Moreschi, 2005). The biasness on over and/or underestimation of SRT is very common across gender, education and age of investor (Grable and Roszkowski, 2007) and more prolific in case of young workforce (Grable et al., 2009). In establishing the relationship between return and self-assessed financial RT a positive relationship was identified. In case of market return, applicability of the principle was also reinforced by buying at high price and selling at low price (Yao et al., 2004).

The literatures discussed above highlights the fact that a little research has been done to illustrate the impact of demographic on the SRT, where most of the articles are relying only on the outcome of one or two specific questions pertaining to particular situation. A single question pertaining to a fixed scenario of investment never represents 'good proxy for people's true risk aversion' (Chen and Finke, 1996) and is able to estimate current risk preference of the investor. The risk perception of investors is directly proportionate to market return. Anticipation for higher return enhances the risk perception of investor whereas the anticipated low return leads to reduces risk perception (Yao and Curl, 2011). This is clearly a wrong assumption, upon which the long-term investment plans are architected for the client. Generally, the investors are expecting a higher return on investment during bullish market but protection of capital is the prime objective of same investors during bearish market. Accordingly, the change in market condition suggests the return on portfolio found in a range of optimistic return of 18–19% to pessimistic return of 8%. According to the results of empirical studies 'Survey of Consume Finances' (SCF) questions could be a strong indicator of investment RT than financial RT (Grable and Lytton, 2001). The limitation of single item question is "does not necessarily reveal pure preferences, as an answer may depend upon the respondent's situation" (Hanna and Chen, 1997).

Measurement of RT comprises of multiple dimensions and is difficult to quantify it appropriately with a single question. One question on risk tolerance only estimates a single dimension not all the dimensions of FRT. In the realm of FRT, most of the studies have been carried out with a single item which is less credible as compare to a larger number of items meant to measure the risk tolerance. To bridge the chasm in existing domain of knowledge, the researchers have developed an instrument consists of eleven different dimensions of investment to estimate the risk tolerance of an investor. The eleven questions included in the questionnaire are the representative of eleven different situations and how these situations discriminate the FRT is also taken care in the current research.

Further, the current research fills the research gap created by the use of discriminant analysis in domain of FRT and establishes the source to group the investors in to 'risk taker' (RT) and risk avoider (RA). The issue is novel and imperative because earlier studies had estimated risk tolerance of an investor based on a single question or from the data base created for common and there are no such studies on risk tolerance which uses both 11 parameters of FRT and discriminant analysis to group the investors into RA and RT on the basis of risk tolerance level.

3 Research methodology

Current section elaborates methodology adopted to accomplish the present research. This study falls into the category of non-experimental and quantitative research (Baruah and Parikh, 2018) where the researchers try to understand causes of risk discrimination by limiting its geographical scope only to urban areas. The study has used the survey design to accomplish research objectives. Individuals having experience of investment in stock market and market- linked instruments are considered as the respondents of the study. The respondents residing in cities like; Cuttack, Bhubaneswar, Berhampur and Rourkela formed the universe of the study. In order to ensure the respondents' active participation, a well in advance selected sub groups of respondents from the universe are selected by deploying random stratified sampling technique (Hair et al., n.d.).

The investor's interest of magnifying return by bearing investment or financial risk associated with investment is termed as Risk Tolerance. Risk taking is a subjective notion and has four different dimensions namely Social, ethical, physical and monetary (Jackson et al., 1972). Risk tolerance is a complex attitude that balances the two different dimensions of attitude namely *expressed beliefs* and *unexpressed feelings and emotions* (Callan and Johnson, 2003). Being a psychosomatic notion, accurate estimation of risk tolerance is possible only based on the information collected from the investors. The article combined the questions on investment decision based on hypothetical situations (Hey, 1999) and subjective explanation (Hanna et al., 1998) to investment decision to estimate FRT of the investors, whereas discarded 'assessment of behaviour' of investor from real investment (Schooley and Worden, 1996).

The attitudinal complication to risk (Hallahan et al., 2004) is the key point to be addressed by questionnaire developed for FRT. Survey through questionnaire distribution for data collection is considered as most suitable method (Callan and Johnson, 2003; Gilliam et al., 2010). A new instrument has been developed adopting questions from few existing questionnaire (Grable and Lytton, 2001) used by assets management companies and few questions from experts' opinion as well as own experience. Different types of validity like; Face and predictive validity, reliability (Callan and Johnson, 2003) were calculated for the acceptance of the instrument. The face and content validity were attained by a panel of experts (stock brokers, investment advisors and Managers from asset management companies) and faculties (Finance and Accounting). A pilot survey was designed to estimate the reliability by calculating Cronbach's alpha. The calculated alpha ranged from 0.760 to 0.84 and more than the accepted value 0.7 (Taber, 2018). The result suggests the internal consistency between the variables of FRT and the questionnaire (11 questions on FRT) is suitable for data gathering.

The instrument designed for the research is split into two sections. Demographic of respondents gathered in the first section whereas questions formulated with the objective to collect information on FRT are placed together in second section. In the second section, 12 questions are put together out of which 11 questions are meant to measure the FRT whereas only 1 question is on self-declared risk-taking ability of respondent. The aspects attained are on *financial literacy*, *investor's confidence*, *understanding return*, *understanding of risk*, *capital protection and return*, *capital protection and risk*, *self-acclaimed risk classification*, *comfortable level dealing with risk*, *risk return trade off, understanding short-term volatility* and *interment objective, considered as predictor*

of risk tolerance. The eleven questions on FRT are formulated in a uniform five-point (1 to 5) scale expressing different level of risk tolerance of the investor.

Table 1 Frequency distribution of respondents' score

Variables of risk assessment/score	*Code*	*Frequency distribution*					*Basic statistics*	
		1	*2*	*3*	*4*	*5*	*Mean*	*Std. dev*
Financial literacy	*FL*	72 (13.0)	172 (31.2)	44 (8.0)	96 (17.4)	168 (30.4)	3.21	1.48
Investors' confidence	*IC*	79 (14.3)	134 (24.3)	47 (8.5)	99 (17.9)	193 (35.0)	3.35	1.51
Capital protection and return	*CPRETURN*	65 (11.8)	187 (33.9)	60 (10.9)	56 (10.1)	184 (33.3)	3.19	1.49
Understanding return	*URETURN*	119 (21.6)	148 (26.8)	27 (4.9)	244 (44.2)	14 (2.5)	2.79	1.28
Capital protection and risk	*CPRISK*	62 (11.2)	128 (23.2)	35 (6.3)	121 (21.9)	206 (37.3)	3.51	1.46
Understanding of risk	*URISK*	89 (16.1)	193 (35.0)	65 (11.8)	54 (9.8)	151 (27.4)	2.97	1.48
Self-acclaimed risk classification	*SARC*	93 (16.8)	110 (19.9)	38 (6.9)	120 (21.7)	191 (34.6)	3.37	1.53
Comfortable level dealing with risk	*CLDR*	125 (22.6)	157 (28.4)	58 (10.5)	76 (13.8)	136 (24.6)	2.89	1.52
Risk return trade off	*RRTO*	164 (29.7)	134 (24.3)	47 (8.5)	88 (15.9)	119 (21.6)	2.75	1.55
Understanding short-term volatility	*USTV*	55 (10.0)	178 (32.2)	53 (9.6)	196 (35.5)	70 (12.7)	3.09	1.26
Investment objective	*IO*	47 (8.5)	102 (18.5)	48 (8.7)	112 (20.3)	243 (44.0)	3.73	1.40

Note: Values in parenthesis represent percentage.

Source: Estimated through primary data – 2020–2021

The demographics considered for the survey are gender of the investor (Bayar et al., 2020; Faff et al., 2011; Ferreira and Dickason-Koekemoer, 2020; Suarez and Morin, 1983), age of investor (Bayar et al., 2020; Ferreira and Dickason-Koekemoer, 2020; Santacruz, 2009; Wallach and Kogan, 1960), academic attainment of investor (Gilliam and Chatterjee, 2011), marital status of investor (Arano et al., 2010; Bayar et al., 2020), size of family (Chaulk et al., 2003). The researchers have followed direct personal interview method for data collection over a period of six months, i.e., from October 2020 to March 2021. Before the survey, 587 investors were contacted through various means but 18 investors showed their unwillingness to participate in the survey. The attrition rate of respondents in the survey is little more than 3% which indicates success of the survey. Out of the 569 investors who participated in the survey, the responses of 17 investors were found to be incomplete and were rejected from the final sample size of 552 respondents. Table 1 summarises the frequency distribution of the respondents' choices and descriptive statistics of 11 questions are meant to measure the FRT.

The opinion of respondents was collected on a five-point scale for all the 11 options. The mean and standard deviation of all the variables is estimated and presented in

Table 1. The mean value of eleven variables is in the range bound of 2.75 (risk return trade-off) to 3.73 (investment objective) whereas the standard deviation score is in the range bound of 1.26 (understanding short-term volatility) to 1.55 (risk return trade-off). Accordingly, the scores obtained by respondents in all the eleven questions were cumulated to find his/her RTS. Investment objective is the most important variable and Risk return trade-off is the list important from FRT point of view.

Discriminant analysis was used to investigate investors risk tolerance across two levels: risk taker (RT) and risk avoider (RA). This technique is useful to analyse the data where the criterion is categorical and the predictor is interval in nature (Wetcher-Hendricks, 2011). Discriminant analysis suggests one or a set of functions called discriminant function. The discriminant function is the linear combination of predictors which discriminate between the groups of dependent variables in a perfect manner to evaluate the accuracy of the grouping/classification (Härdle and Simar, 2012). Dichotomous or two-group discriminant analysis is the appropriate for the current research as the dependent variable have only two groups (Green and Salkind, 2013). The discriminant function is an equation that predicts each person belongs to which group according to their characteristics (McLachlan, 1992). The equation proposed for the current study is

$$\begin{aligned} Fl = a + b_1FL + b_2IC + b_3CPRETURN + b_4URETURN + b_5CPRISK + b_6URISK \\ + b_7SARC + b_8CLDR_+ b_9RRTO_+ b_{10}USTV + b_{11}IO \end{aligned}$$

Being a multifaceted statistical method, discriminant analysis (DA) assists researchers in determining and categorising a set of variables (Hansen, 2005) for dimensionality reduction and effectively in guessing group membership. DA is similar to analysis of variance and regression (Fisher, 1936; McLachlan, 1992). As compare to ANOVA the selection of type of variable in DA is reverse in case of DA (Wetcher-Hendricks, 2011). DA follows the principle of linear combination of variables which is similar to Factor analysis (Martinez and Kak, 2001). DA is a vital statistical tool for the research where the independent variable is continuous in nature and dependent variable is categorical in nature. The application of DA is not scant in management research (Eisenbeis, 1997) and more specific to the domain of finance (Basheikh, 2012; Santoso and Wibowo, 2018; Zhang and Jia, 2020). This current research examines the effect of FRT on risk-taking ability of investors and discriminate it across the socio-demographic character of investors. The independent variables (11 FRT parameters) are continuous variable whereas RT is a categorical variable. Methodological or statistical support for this research can be provided by dichotomous discriminant analysis. By applying 'split the data' as per sub-variables of each social character of investors the DA is performed to trace the cause of discrimination of RT.

4 Analysis and interpretation

Information collected on different demographic characteristics is summarised in Table 2. It is witnessed that about 36% of respondents are female. The investors within the age range bound of 'less than or equal to 34 years' to 'greater than or equal to 55 years' are considered as respondents. The lowest percentage of investors (13%) belongs to the group 'greater than or equal to 55 years whereas highest percentage of investors (32.3%)

is from age group of 35–44 years. Out of two educational attainments, little more than 73% of investors are post-graduate. The investors are segregated into 'married' and 'un-married' on the basis of their marital status. Out of total sample investors, about 75% of investors are married. The dependency on the respondent's income measured through 'family structure'. Out of sample investors little more than 36% of respondents are from 'couple with kid' family whereas 12% of respondents from 'couple without kid' family.

Table 2 Socio-demographic character of respondents

Category	*Sub category*	*Frequency*	*Percent*
Gender	Female	198	35.9
	Male	354	64.1
Age	</= 34 Years	135	24.5
	35-44 Years	184	33.3
	45-54 Years	161	29.2
	>/= 55	72	13.0
Education	UG	147	26.6
	PG	405	73.4
Marital	Un Married	140	25.4
	Married	412	74.6
Family	Single	140	25.4
	Couple without kid	66	12.0
	Couple with kid	199	36.1
	Mature family with adult children	147	26.6

Source: Estimated through Primary data – 2020–2021

Table 3 contains the distribution of respondents across risk taking ability. Respondents are classified as 'risk taker' and 'risk avoider'. Out of 552 investors, little more than 52% of investors are 'risk taker' whereas rest of the investors are 'risk avoider'. The trend is reverse when the risk avoiders are higher than the risk takers in case of 'female', '35–44 years', 'unmarried' and 'single' investors.

The classification of investors into risk taker (RT) and risk avoider (RA) reveals the difference in both types of investors across the demographics under study. The research question that is being addressed here is "can the probability of classifying an investor into RT or RA be correctly predicted given her FRT parameters?". The discriminant analysis has been used to determine the cause of discrimination on any group of predictors. Accordingly, the table 4 presents the results of three different models.

Table 4 has three different sections. In Section 1, the discrimination of each predictor is estimated and compared. The outcome variable in this model is unequal (RT = 289, RA = 263) and smallest group is 'RA couple without kid' with n = 31 which is higher than number of variables in the study. The mean score of all eleven predictors compared across the group members. The 'F' score of all 11 variables is in the range bound of 8.475 (IO) to 129.589 (RRTO) and is significant at 0.01 level. Further the Wilks' lambda value is significant for all variables. The result suggests a significant difference in value

of all variables across group members. From the results of Box's test, the null hypothesis of equal population covariance matrices is tested. The score of Box's M and F statistics is 700.468 and 10.39, and significant at 0.0001 level, rejects the null hypothesis. The eigenvalue of the model is 1.805 indicates more variance the discriminant function explains in classifying the investor into RA and/or RT. The canonical corelation score for the model is estimated the effect size and is 0.802 which is too high (Hair et al., n.d.) and accepted. Prediction fit of the model is acceptable as the overall Wilks' lambda value is 0.357 and significant at 0.0001. The structure matrix contains the scores estimated pooled within-groups correlations between discriminating variables and standardised canonical discriminant functions. Eleven predictors are ranked on the basis of absolute size of correlation within function and are found in the range of 0.088 (CPRETURN) to 0.361 (RRTO). Out of 11 predictors, discriminant score of 8 variables is less than threshold level of 0.3 and excluded from the final model. The predictors included in the final model and occupied top three ranks are RRTO (0.361), CLDR (0.347) and USTV (0.323), are considered as the most important causes of discrimination for investment decision. In case of both male and female investors seven predictors have discriminant score less than 0.3. The predictors important for male respondents are RRTO (0.372), CLDR (0.335), USTV (0.322) and URISK (0.301) whereas among female respondents the important factors of discrimination are CLDR (0.364), RRTO (0.331), USTV (0.314) and URETURN (0.3).

Table 3 Classification of investors across demographic character

Demographic group	*Demographic character*	*Risk taker (RT)*	*Risk avoider (RA)*
Gender	Female	85 (29.4)	113 (43.0)
	Male	204 (70.6)	150 (57.0)
Age	</= 34 years	71 (24.6)	64 (24.3)
	35-44 years	90 (31.1)	94 (35.7)
	45-54 years	90 (31.1)	71 (27.0)
	>/= 55 years	38 (13.1)	34 (12.9)
Education	UG	78 (27.0)	69 (26.2)
	PG	211 (73.0)	194 (73.8)
Marital	Unmarried	68 (23.5)	72 (27.4)
	Married	221 (76.5)	191 (72.6)
Family	Single	68 (23.5)	72 (27.4)
	Couple without kid	35 (12.1)	31 (11.8)
	Couple with kid	108 (37.4)	91 (34.6)
	Mature family with adult children	78 (27.0)	69 (26.2)

Note: Values in parenthesis represent percentage.

Source: Estimated through primary data – 2020–2021

Table 4 Discrimination test result

Section	Variables/details	Basic statistics			Structure matrix					
		Discrimination			Global matrix		Male		Female	
		RT (mean)	RA (mean)	F (Sig)	Score	Rank	Score	Rank	Score	Rank
1	FL	289 (3.692)	263 (2.681)	72.898** (.0001)	0.271	7	0.283	5	0.243	8
	IC	289 (3.799)	263 (2.851)	59.651** (.0001)	0.245	9	0.280	6	0.197	9
	CPRETURN	289 (3.359)	263 (3.011)	7.653** (.006)	0.088	11	0.066	11	0.117	11
	URETURN	289 (3.235)	263 (2.301)	83.270** (.0001)	0.290	5	0.274	7	0.300	4
	CPRISK	289 (3.965)	263 (3.001)	66.062** (.0001)	0.258	8	0.233	9	0.290	6
	URISK	289 (3.491)	263 (2.401)	85.958** (.0001)	0.294	4	0.301	4	0.269	7
	SARC	289 (3.878)	263 (2.811)	75.236** (.0001)	0.275	6	0.257	8	0.293	5
	CLDR	289 (3.505)	263 (2.221)	119.779** (.0001)	0.347	2	0.335	2	0.364	1
	RRTO	289 (3.397)	263 (2.041)	129.589** (.0001)	0.361	1	0.372	1	0.331	2
	USTV	289 (3.564)	263 (2.561)	103.754** (.0001)	0.323	3	0.322	3	0.314	3
	IO	289 (3.892)	263 (3.541)	8.475** (.004)	0.092	10	0.078	10	0.125	10
Classification matrix										
	Details	*Count*			*Global matrix*		*Male matrix*		*Female matrix*	
					RT	*RA*	*RT*	*RA*	*RT*	*RA*
2	RT	Actual value			281	8	198	6	79	6
	RA				34	229	16	134	16	97
	RT	Percentage value			97.2	2.8	97.1	2.9	92.9	7.1
	RA				12.9	87.1	10.7	89.3	14.2	85.8
	Original grouped cases correctly classified (%)				92.4		88.9		93.8	
Model significance										
3	Wilks' lambda = 0.357**, chi-square = 561.604**, Sig. 0.0001; eigenvalue = 1.805, canonical correlation = 0.802; Box's M = 700.468, F = 10.391 (approx), Sig. 0.0001									

Note: **Significant at 1% level.

Source: Estimated through primary data – 2020–2021

The classification matrix of three models suggests the predictability, sensitivity, specificity for the group membership. From the result of RT, the sensitivity and from the RA the specificity of the models is estimated. From the global matrix it is clear that the sensitivity and specificity of the model is 97.2% and 87.1%. High sensitivity suggests few false RA in group of RT and high specificity indicates few false RT in the group of RA. The result of higher sensitivity and specificity cross validated from the overall grouped cases classification score which is little more than 92%. This result communicates the model is capable of classifying the groups 92% accurately. In case of male investors, the sensitivity and specificity of the model is 97.1% and 89.3% whereas in case of female respondents, sensitivity and specificity of the model is 92.9% and 85.8%. The overall capable of classifying the groups for male and female respondents are 88.9% and 93.8% respectively.

The classification of investors into group of RT and RA made across different age group of the respondents and the discriminating importance of FRT parameters estimated (Table 5). Out of 11 FRT parameters, number of parameters having the absolute size of correlation scores higher than 0.3 in the age group '</= 34 year', '35–44 years', '45–54 Years', and '>/= 55 Years' is 4, 5, 4 and 4 respectively. For '</= 34 year' age group the classification investor into RT or RA highly discriminated due to USTV (0.388), RRTO (0.377), SARC (0.360) and CLDR (0.355). Vital FRT parameters for classifying an investor into RT or RA for the '35–44 years' aged respondents are USTV (0.381), RRTO (0.378), CLDR (0.311), URISK (0.307) and URETURN (0.301). Four important discriminating factors of group classification of investors over '45–54 years' aged investors are CLDR (0.380), RRTO (0.354), IC (0.321), and SARC (0.310). Among the investors of age '>/= 55 Years' the discriminating function factors are URETURN (0.97), URISK (0.337), IC (0.330) and CPRISK (0.330)

The sensitivity of four discriminant functions suggested for four different age group of investors are in the range bound of 94.4% to 100% whereas specificity for the group membership is in the range bound of 79.4% to 89.4%. Higher sensitivity and specificity cross validated from the overall grouped cases classification. The predictability the 4 models is more than 89%.

Table 6 demonstrates discrimination test result across education and marital status of the respondents. CLDR (0.520), URISK (0.325) and RRTO (0.319) are 3 vital discriminating FRT factors responsible for segregating the under graduate (UG) investors in to RT and RA. Similarly, in case of post-graduate (PG) respondents vital FRT factors accountable for the discrimination are RRTO (0.360), URETURN (0.331) and USTV (0.320). The sensitivity and specificity of discriminant functions of UG respondents are 97.4% and 85.5% whereas for PG Respondents the sensitivity and specificity score are 95.3% and 90.7%. The overall predictability of both the models is greater than 91%.

It is observed from the Structure Matrix of married respondents that RRTO (0.371), CLDR (0.352), USTV (0.313) and URISK (0.303) are the four FRT factors included in the final discriminant function out of 11 FRT factors. Similarly, the FRT factors included in discrimination function of Unmarried respondents are USTV (0.339), RRTO (0.325), CLDR (0.315) and SARC (0.305). The overall predictability of two models is greater than 91%.

Table 5 Discrimination test result across age of the respondents

Variables/details	*Structure matrix*									
	Global		*</= 34 year*		*35–44 years*		*45–54 years*		*>/= 55 years*	
	Score	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*
FL	0.271	7	0.258	6	0.273	6	0.295	5	0.189	8
IC	0.245	9	0.293	5	0.117	10	0.321	3	-0.036	11
CPRETURN	0.088	11	0.056	11	0.076	11	0.175	10	0.330	3
URETURN	0.290	5	0.254	7	0.301	5	0.231	9	0.397	1
CPRISK	0.258	8	0.187	9	0.249	7	0.269	6	0.330	4
URISK	0.294	4	0.247	8	0.307	4	0.310	4	0.337	2
SARC	0.275	6	0.360	3	0.311	3	0.263	7	0.202	7
CLDR	0.347	2	0.355	4	0.202	8	0.380	1	0.274	5
RRTO	0.361	1	0.377	2	0.378	2	0.354	2	0.236	6
USTV	0.323	3	0.388	1	0.381	1	0.245	8	0.177	9
IO	0.092	10	0.072	10	0.128	9	0.047	11	0.104	10

Count		*Classification matrix*									
		Global		*</= 34 year*		*35–44 years*		*45–54 years*		*>/= 55 years*	
		RT	*RA*	*RT*	*RA*	*RT*	*RA*	*RT*	*RA*	*RT*	*RA*
RT	Actual value	281	8	67	4	86	4	88	2	38	0
RA		34	229	10	54	10	84	12	59	7	27
RT	Percentage value	97.2	2.8	94.4	5.6	95.6	4.4	97.8	2.2	100.0	0.0
RA		12.9	87.1	15.6	84.4	10.6	89.4	16.9	83.1	20.6	79.4
Original grouped cases correctly classified (%)		92.4		89.9		92.4		91.3		90.3	

Source: Estimated through primary data – 2020–2021

Table 6 Discrimination test result across education and marital status of the respondents

Variables/details	*Structure matrix*									
	Global		*Education*				*Marital*			
			UG		*PG*		*Married*		*Unmarried*	
	Score	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*
FL	0.271	7	0.170	8	0.297	4	0.259	7	0.286	5
IC	0.245	9	0.241	7	0.233	9	0.250	8	0.219	9
CPRETURN	0.088	11	0.138	10	0.065	11	0.097	11	0.056	11
URETURN	0.290	5	0.153	9	0.331	2	0.291	5	0.275	6
CPRISK	0.258	8	0.277	6	0.237	8	0.249	9	0.264	7
URISK	0.294	4	0.325	2	0.267	6	0.303	4	0.257	8
SARC	0.275	6	0.288	4	0.256	7	0.261	6	0.305	4
CLDR	0.347	2	0.520	1	0.277	5	0.352	2	0.315	3
RRTO	0.361	1	0.319	3	0.360	1	0.371	1	0.325	2
USTV	0.323	3	0.287	5	0.320	3	0.313	3	0.339	1
IO	0.092	10	0.043	11	0.106	10	0.102	10	0.066	10
	Classification matrix									
Count	*Global*		*UG*		*PG*		*Married*		*Unmarried*	
	RT	*RA*	*RT*	*RA*	*RT*	*RA*	*RT*	*RA*	*RT*	*RA*
RT Actual value	281	8	76	2	201	10	216	5	63	5
RA	34	229	10	59	18	176	28	163	7	65
RT Percentage value	97.2	2.8	97.4	2.6	95.3	4.7	97.7	2.3	92.6	7.4
RA	12.9	87.1	14.5	85.5	9.3	90.7	14.7	85.3	9.7	90.3
Original grouped cases correctly classified (%)	92.4		91.8		93.1		92.0		91.4	

Source: Estimated through primary data – 2020–2021

Table 7 Discrimination result across family type of the respondents

Variables/details	*Structure matrix*									
	Global		*Single*		*Couple without kid*		*Couple with kid*		*Mature family with adult children*	
	Score	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*
FL	0.271	7	0.286	5	0.152	8	0.272	4	0.255	7
IC	0.245	9	0.219	9	0.120	10	0.211	9	0.346	3
CPRETURN	0.088	11	0.056	11	0.121	9	0.065	11	0.120	10
URETURN	0.290	5	0.275	6	0.267	5	0.264	5	0.307	5
CPRISK	0.258	8	0.264	7	0.108	11	0.237	8	0.300	6
URISK	0.294	4	0.257	8	0.310	3	0.247	7	0.348	2
SARC	0.275	6	0.305	4	0.271	4	0.251	6	0.246	9
CLDR	0.347	2	0.315	3	0.231	6	0.371	2	0.359	1
RRTO	0.361	1	0.325	2	0.332	2	0.388	1	0.328	4
USTV	0.323	3	0.339	1	0.407	1	0.306	3	0.248	8
IO	0.092	10	0.066	10	0.168	7	0.081	10	0.093	11

	Count	*Classification Matrix*									
		Global		*Single*		*Without kid*		*With kid*		*Mature family*	
		RT	*RA*	*RT*	*RA*	*RT*	*RA*	*RT*	*RA*	*RT*	*RA*
RT	Actual value	281	8	63	5	34	1	102	6	77	1
RA		34	229	7	65	4	27	8	83	12	57
RT	Percentage value	97.2	2.8	92.6	7.4	97.1	2.9	94.4	5.6	98.7	1.3
RA		12.9	87.1	9.7	90.3	12.9	87.1	8.8	91.2	17.4	82.6
Original grouped cases correctly classified (%)		92.4		91.4		92.4		93.0		91.2	

Source: Estimated through primary data – 2020–2021

Table 7 reports the result structure matrix and classification matrix across the family structure of the respondents. Out of four subcategories of family structure, highest six variables of FRT are included in the final discrimination model proposed for 'mature family with adult children'. USTV (0.339), RRTO (0.325), CLDR (0.315) and SARC (0.305) are the variable of FRT which can group 91.4% correctly 'Single' respondents into RT (92.6%) and RA (90.3). The model proposed for 'Couple without kid' respondents can predict the risk preference of the respondents correctly up to 92.4%. The correct classification of investors into RT (97.1%) and RA (87.1%) is possible because of the discriminating factors like USTV (0.407), RRTO (0.332) and URISK (0.310). In case of respondents from 'couple with kid, family', final model has only three variables namely: RRTO (0.388), CLDR (0.371) and USTV (0.306). The overall predictability of the model is 93.0% whereas classification of investor into RT is 94.4% and RA is 91.2%. Out 15 models proposed, the most complicate and complex model is the model purposed for 'mature family with adult children'. This model includes six variables namely; CLDR (0.359), URISK (0.348), IC (0.346), RRTO (0.328), URETURN (0.307) and CPRISK (0.300) for better classification of investors. The overall likelihood of classification is correct up to 91.2%. The probability of identifying RT investors is 98.7% whereas the probability of identifying RA investors is 82.6%.

5 Findings and discussion

The purpose of this paper was to identify the variables responsible for classifying the investors into RT and RA across the many socio-demographics such as gender, age, education, marital status and family structure.

The gender has long been associated with the risk tolerance of an individual, with existing research suggesting that male investors are substantially more risk tolerant than the female investors (Chavali and Mohanraj, 2016; Faff et al., 2009; Fisher and Yao, 2017; Geetha and Selvakumar, 2016; Roszkowski and Grable, 2010). This study goes a step further and shows that the most significant variables that classifies male investors into risk takers and risk avoiders are risk-return trade-off (RRTO), comfort level of dealing with risk (CLDR), understanding short-term volatility (USTV) and understanding risk (URISK) in order of importance. Similarly, variables that classifies female investors into risk takers and risk avoiders are comfort level of dealing with risk (CLDR), risk-return trade-off (RRTO), understanding short-term volatility (USTV) and understanding return (URETURN) in order of importance. It is evident that for both male and female investors the similar kind of variables contributes to the risk-taking ability, with the only exception of URISK for males and URETURN for females. The reason for the female investors giving more importance to understanding returns may lie in the fact that women need to generate higher returns from their investment due to their higher longevity as compared to men. Further it has been observed that "income uncertainty had a negative effect on having some or high-risk tolerance among women, but a positive effect on men's likelihood of having high or some risk tolerance" (Fisher and Yao, 2017). This further reinforces our findings that income uncertainty and understanding returns from investment is of utmost significance to women whereas, understanding risk plays a major part in the risk profile of men. It is a remarkable finding as it throws light on the source of gender difference in the ability to take financial risk. This has considerable

significance for the investment industry where the advisors frequently downplay the risk-taking ability of women (Roszkowski and Grable, 2005b). In the long run the investment advice handed over to women does not match up to their investment objective of generating above average returns, as a conservative portfolio is designed for them (Bajtelsmit and Bernasek, 1996).

The role of age as a contributing variable towards FRT of an individual has long been examined and discussed (Ehm et al., 2014; Ferreira and Dickason-Koekemoer, 2020; Hallahan et al., 2004; Kannadhasan, 2015; Mishra and Mishra, 2016; Wallach and Kogan, 1960). Many researchers have produced evidence to establish a negative relationship between age and FRT with a conclusion that as an individual progresses in age his/her risk-taking ability reduces and the investment portfolios become increasingly conservative (Ferreira and Dickason-Koekemoer, 2020; Grable and Joo, 2004; van de Venter et al., 2012). The possible reason attributable to such a relationship is that the younger investors can absorb the shock of a loss better as they have time on their side to recover the losses. Whereas, the older investors are completely exposed to the time available for recovery of losses (Grable et al., 2009). This paper which is committed to identify the sources of age related FRT scores, suggests that for our universe of investors the most contributing variables are risk-return trade-off (RRTO), comfort level of dealing with risk (CLDR) and understanding short term volatility (USTV) in order of significance. However, a look at the contributing factors for different age groups suggests an interesting perspective. The self-acclaimed risk classification (SARC) variable appears as a significant fourth contributing factor towards FRT for the age groups ≤34 years and 35–44 years. The most plausible argument for this may be that younger investors consider themselves to be risk takers and generally are represented by high FRT scores. Whereas for the older investors, i.e., ≥55 years, the capital protection and understanding of risk and return turn out to be the most significant factors. These findings try to base their argument on the belief that with increasing age the earning potential of an individual reduces. So, the future stream of cashflows decreases. Investors try to counterbalance this diminished future cashflow by reducing their financial risk (Mishra and Mishra, 2016). Hence the portfolio composition becomes more conservative with the singular objective of protecting the capital with rational understanding of risk and return. Hence our evidences are not only consistent but also reinforce the findings of earlier research (Dahlback, 1991; Jagannathan and Kocherlakota, 1996).

The positive correlation between level of education and FRT has been established in many previous studies (Donkers and Soest, 1999; Gilliam et al., 2010; Sung and Hanna, 1998). Though some other studies produced contrary evidence that education did not influence the FRT (Hallahan et al., 2003). However, in their subsequent study they prove the opposite (Hallahan et al., 2004). The findings of our research suggests that CLDR, URISK and RRTO are the major differentiating factors for the investors having undergraduate qualification whereas for the more qualified post graduate investors the RRTO, URETURN and USTV are significant. It is evident that the more qualified investors are taking calculated risk while keeping their eyes on the return component. They are pursuing both the short-term gains (USTV) as well as long term returns (RRTO). It is consistent with the observation that the investors having higher levels of educational attainment can make more informed decisions leading to taking better advantage of opportunities. As a result, the highly educated investors demonstrate greater risk tolerance (Grable and Joo, 2004).

It has been postulated that marital status has effect on the FRT of an individual, though the exact nature of the relationship is not clearly established. The general observation in the previous studies has been that unmarried individuals tend to take more risk as compared to the married individuals as they don't have family burden and nothing much to lose. The married investors on the other hand have quite a few financial burdens and exposed to many social risks and loss of self-esteem arising out of financial loss (Lazzarone, 1996; Lee and Hanna, 1991; Roszkowski et al., 1993). Still there are a number of studies that have a contradictory view and argue that there is no significant contribution of marital status towards the FRT of an individual (Geetha and Selvakumar, 2016; Hallahan et al., 2003; Riley and Chow, 1992). So, the association between marital status and FRT remains inconclusive and open to debate. Even in our study we found that the discriminating factors for both the unmarried (USTV, RRTO, CLDR and SARC) as well as married (RRTO, CLDR, USTV and URISK) are more or less the same. The best possible reasoning for such an outcome may be that both the married as well as unmarried investors have similar outlook towards the FRT. This outcome may be read along with the results of the family size where we see that a mature family with adult children has six significant discriminating variables, highest among all observation. The members of the family put high demand on financial resources, which leads to less availability of resources for taking investment risks (Grable and Lytton, 1998; Schooley and Worden, 1996). So, such a family has a careful financial planning which is reflected in the significant FRT variables such as, CLDR, URISK, IC, RRTO, URETURN and CPRISK. This observation is in resonance with the argument that "children increase the salience of meeting basic survival needs through low-risk investments" (Xiao and Anderson, 1997).

6 Conclusions

The financial risk tolerance is dynamic in nature and which differs across and depends on time horizon. The volatility of FRT mandates an accurate estimation across different social dividend of investors for selection of an appropriate investment avenue and investment plan. The FRT of investors is prejudiced by socio-demographic and risk assessment factors. The existing study emphases on identification of causes of risk discrimination. Data source are primary and cross-sectional in nature, which were collected from 552 investors who belong to mostly small cities through structured questionnaire. To examine the effect of 11 variables of risk assessment of investment on FRT dichotomous discriminant analysis was referred. The findings of the current research will be the referral for studies on behavioural finance inclined more towards FRT. Though most of the findings were consistent with the existing literature, the authors would like to highlight the most striking finding of the study to be the discriminating factors for male and female. The discriminating factor classifying the males into risk taker or risk avoider was found to be the understanding of risk whereas for the females it was the understanding of returns. The insight provided by the discriminating variable is expected to have significant managerial implication in designing and delivering the suitable portfolio to investors based on their unique demographic characteristics.

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