International Journal of Business and Economic Affairs (IJBEA)
6(2), 97-105 (2021)
DOI: 10.24088/IJBEA-2021-62004
ISSN: 2519-9986

Impact of Demographic Factors on Investment Risk Tolerance

ASMA ZEESHAN [1*], ABDUL SATTAR [2], SAMREEN BABAR [3], TABASSUM IQBAL [4], ASMA BASIT [5]

[1,2,3,4,5] Bahria University, Islamabad, Pakistan

Abstract: The study aims to investigate the impact of demographic factors on investment risk tolerance. The demographic variables taken include age, gender, marital status, income, work experience, and education. The primary data has been collected through questionnaires by adopting a deductive approach. The sample size consists of 106 respondents using convenience sampling. SPSS is used for data analysis and person correlation, and linear regression is applied to analyze the relationship between the variables. It was identified that gender, income, and education are positively related to risk tolerance level, whereas age, marital status, and work experience are negatively related to risk tolerance. Gender is found to have a significant positive impact on risk tolerance level, whereas marital status has been found to have a negative and significant relationship with the risk tolerance level of individuals. These findings will be helpful for the investors to improve their investment decision-making skills. The further risk tolerance of investors may depend on the behavioral factors too.

Keywords: Demographic factors, Investment, Risk tolerance, Investor, Impact

Received: 13 July 2020 / Accepted: 1 April 2021 / Published: 21 April 2021

INTRODUCTION

The study examines the role of demographics in the decisions of individuals on financial investments and their tolerance of financial risks. There are numerous factors that influence an individual's financial decisions, the most important of which are demographic variables such as age, gender, and occupation, as well as personal financial risk tolerance.

An investor who agrees to extreme insecurity during financial decision-making is referred to as tolerant of risks. That means that the individual is prepared to tolerate the degree of unpredictability in return. In investment decisions, risk tolerance is a major factor. Individually, their capacity and readiness to pay off and reduce the value of their investments must be considered realistically. Too much risk taking investors could panic and sell at the wrong time. Risk tolerance includes the ability and willingness to accept failed investment decisions while waiting for the value of the investment to be increased. Investors who do not take the risk of price drops have little or no risk tolerance. Risk tolerance is a key factor in a variety of financial decisions (Roszkowski & Snelbecker, 1990). Risk tolerance is defined as the readiness of individuals to engage in a financial activity with an uncertain outcome (Chavali & Mohan Raj, 2016; Ripain, Amirul, & Mail, 2017). The study adopted Grable and Lytton's financial risk tolerance scale (Grable & Lytton, 1999; Marobhe & Hembe, 2019).

All financial investments are aimed at achieving good returns. In reality, a gap between the perceived return of the individual and the actual return is observed a number of times. The error lies in the process of decision-making which is determined by a person's risk tolerance. Research shows that people overestimate their actual risk tolerance because they want to be socially acceptable. In his study, Moreschi (2005) concluded that only 4 percent could accurately assess their own risk tolerance. 73% underestimated the risk tolerance and 23% overestimated the risk tolerance. As a consequence, the investor finally makes irrational choices. The area in which the questions of investor psychology and

*Corresponding author: Asma Zeeshan
†Email: asmamasood872009@gmail.com

irrational decision-making are examined is behavioral finance.

Significance of study

The purpose of this study is to detect the effects on individual investors' asset allocation decisions of the demographic characteristics and level of risk tolerance. Therefore, the study is important in the following ways for policymakers, financial advisors, financial analysts and individual investors. Based on risk perception and investors' tolerance to the risk, policymakers adjust risk and returns related to newly issued securities. In the context of age, income and risk tolerance, financial advisors guide investors. Individual investors with a specific demographic feature need to understand risk tolerance and their investment decision-making. The study aims to examine:

- Effects on investor risk tolerance by demographic characteristics.
- The effect of demographic characteristics on investor.

LITERATURE REVIEW

Financial risk tolerance is described as the investors willingness to get negative changes in investment value or it can be the result which contrasts or is different from the anticipated outcomes (Arceneaux, Gerber, & Green, 2006).

Through various assessment methodologies, it was found that financial risk tolerance is affected by various demographic as well as psychological factors (Angriani, Ariffin, & Rahmawati, 2017; Nguyen, Yosinski, & Clune, 2015; Van de Venter, Michayluk, & Davey, 2012).

Lucey, Larkin, and OConnor (2014) examined the extent of financial risk tolerance in adults of Ireland by means of survey and by applying statistical analysis. The 13 item risk tolerance instrument by (Grable & Lytton, 1999) was administered. It was found that Irish adults show similar patterns with those found anywhere else in literature.it was also concluded that age is not a key distinguishing factor while gender is a distinguishing one. The results showed that risk tolerance decreased with home ownership and increased with household earnings and level of education.

Jain and Mandot (2012) stated that due to dynamism and continuously changing markets the level of risk has been increasing due to which among different demographic profiles, more money is at stake. The article explored the relationship of level of risk and demographic factors in Rajasthan state (India). The study concludes that there are number of investment avenues depending upon the risk appetite of the investor such as bank deposits, government/private bonds, shares and stocks), mutual funds, gold, silver, currencies, insurance, derivatives, real estate, exchange traded funds (ETF) etc. The results of the study revealed that negative correlation exists between marital status, gender,age,education and occupation of investors. Also positive correlation exists between knowledge income level and cities. The results are obtained on the basis of application of cross analysis Correlation Analysis.

The relationship and impact of demographic factors on investment decision-making were investigated by Ahmad, Zakuan, Jusoh, Tasir, and Takala (2013). The findings of the study show that men and young people are more risk tolerant and more risky than women and older investors. An interesting fact was also found in the study that though males and young generation invested in dangerous investments, they do it with a lot of resistance due to insufficiency of financial resources.

Hoff and Bashir (2015) investigated the impact of demographic variables and risk tolerance on risk perception and portfolio management. These factors in turn impact the investors decisions. By collecting data from 120 respondents and using structural equation, the study concluded that the relationship between risk perception and risk tolerance is significant and positive. Demographic factors such as the age and education were found to have a positive and significant impact on perception of risk, while gender and income are significantly but negatively linked to perception of risk. In addition, risk tolerance, age, training and income have been found to maintain an important and negative relation to portfolio management. However, the relationship between gender and portfolio management is significant and positive.

According to Sadiq and Ishaq (2014) the behavior of an investor is affected by various factors. The demographic profile is of importance in influencing decision. The study aimed to inspect the impact of

demographic variables on risk tolerance level of individual investors concerning the preference of investment alternative. The study sample included 100 investors from twin cities of Pakistan i.e., Rawalpindi and Islamabad. By applying Chi square test and correlation, the results were generated that showed demographic factors such as income level, academic education, investment knowledge and experience of investment have impact on risk tolerance level whereas gender , marital status , occupation and size of family have no effect on individual investors financial risk tolerance level.

Want et al. (2015) conducted a study that investigated the role of age, marital status, gender, number of dependents, educational qualifications, future monetary planning, savings pattern and investments amount and returns from investments in influencing risk tolerance which in turn indicate whether the individual is risk averse or risk prone. Data was collected from 200 investors in Indian stock exchange with the application of binary logic model to validate the finidings. The study proved that as compared to young inexperienced investors, aged investors are more risk averse. Futhermore, married with number of individuals dependent are risk averse as compared to their unmarried counter parts, Higher education, higher income and savings decreases risk aversion and therefore increases risk tolerance level. It was also concluded that higher returns from investments increase the risk tolerance level. Surprisingly, the results also indicated that females are more risk prone as compared to males.

Defining and insight of risk is considered to be an important challenge for financial analysts and financial planners for their clients as it is somehow related with their demographic factors (Gondaliya & Dhinaiya, 2016). A study by these two investigated the effect of various selected demographic, attitudinal and socioeconomic factors on financial risk tolerance level. By collecting data from 500 equity investors of Gujrat (India), the results of the study indicated that the outcome of study was as anticipated; marital status, housing ownership, self-esteem, age, income, occupation and education held a significant effect on risk tolerance level whereas gender and liabilities were found to be insignificant (Gondaliya & Dhinaiya, 2016).

Chavali and Mohan Raj (2016) conducted an empirical study to investigate the financial decision making and investment patterns in relation to risk tolerance level of individual investors. Different dimensions of financial risk have been measured by adopting the Grable and Lytton scales of tolerance. In order to assess the relationship of demographic variable to investment patterns Kendall's W test was used to define preferred investment sources and the chi square test. In the study, gender has a significant impact on investors' investment patterns during investment decision-making. Investment decisions include expectation to earn certain return but the actual return received differs from the expected rate. People have differentiated level of risk tolerance with the objective to identify the impact of demographic variables on investors risk tolerance level, a study was conducted. The studys result depicted that demographic variable such as age, education, investment experience and income level are correlated with level of risk tolerance but gender, occupation and civil status do not have any impact on financial risk tolerance level of the investors (Subramaniam & Athiyaman, 2016).

Ikeobi and Arinze (2016) stated that demographic factors indicate the level of risk and type of investment selected by an investor. The study determined the effect of demographic characteristics on investment objectives of investors in Nigerian Capital Market by collecting data from 180 respondents through a structured questionnaire and applying simple descriptive techniques such as Chi-square and correlation the results were formulated. The results showed that among the most influencing factors are employment status and income the hold the most significant effect on investment objectives. Educational qualification also holds a significant impact on investment objectives. It was found that age, gender, marital status and capital market experience have no significant impact on Nigerian capital market investors objectives.

The inevitability of risk in human life cannot be denied. Almost all investors take risk within their comfortable zone. Therefore the investor should analyses their risk profiles before taking investment decisions (Praba, 2016). The study by Praba (2016) investigated the association between the financial risk tolerance and socio-demographic characteristics of individual investors in India. The study provides evidence of that 45% of investors lie under average level of risk tolerance. The study revealed that age, gender and income have significant association with financial risk tolerance.

Ansari and Phatak (2017) defined financial risk tolerance as the minimum capacity of bearing risk by an investor while taking the investments decisions. According to them it is most important factor that directs the investors mind to select a particular investment alternative. Their study analyzed the effect of demographic factors on risk tolerance level of individual investors by collecting data through 974 investors through questionnaire. The independent variables were taken as age, gender, income, occupation and education and risk tolerance as dependent variable. By using scale by Grable and Lytton (1999) it was found that the investors majorly belonged to category of average risk tolerance. Moreover all the demographic variables had significant effect on financial risk tolerance of individual investors.

Onsomu, Kaijage, Aduda, and Iraya (2017) conducted a study to determine whether demographics (age, gender, experience and education) of investors cause difference in their risk tolerance levels. The study also aimed to investigate the relationship between risk tolerance level and portfolio returns through a sample of 279 investors of Nairobi securities exchange, Kenya. Though ANOVA and regression analysis it was found that those investors without educational qualification, female investors, experienced and older investors were more tolerant to risk. All of the above mentioned investors held risky equity portfolios. The results also depicted that risk related positively with portfolio returns excluding the effect of demographic factors. But when this relationship is moderated by demographic variables the relationship turns out to be insignificant.

Bhavani and Shetty (2017) investigate the effect of casted by demographics and perceptions on investment choices. The study highlighted the fact that demographic variables and perceptions affect the investment choices. By applying Mann Whiteny U test, Kruskal- Wallis to test the hypotheses I, it was found that age, education, occupation and gender have a significant influence on selection of investment alternatives.

A study conducted by Sutejo, Pranata, and Mahadwartha (2018) aimed to study the impact of demographic variables on financial risk tolerance. The study was conducted on retail investors of Indonesia who are involved in stock investment transactions in Indonesian stock exchange. Quantitative approach to binary logistic regression analysis model was used with questionnaire as data collection method. The results indicated that demographic variable such as income showed a significant partial positive impact whereas gender, age ,marital status, education and occupation do not have any significant impact on financial risk tolerance.

According to Dickason and Ferreira (2018) the degree of risk an investor is willing to take during the process of making financial decisions is referred to as financial risk tolerance. The study was conducted in South Africa aimed towards the accurate risk profiling of investors considering demographic variables such as gender and age. The results of study were consistent with previous work which indicates that male are more risk tolerant than females. The study also implied that based on binary regression, all categories of age are more risk tolerant for investors above the age of 50 years (Dickason & Ferreira, 2018).

The above discussion concludes that various demographic factors influence the risk tolerance level of individual investors. The results of different studies show different significance due to the difference in cultures and countries and in which the study is conducted and many other factors.

Hypotheses

H1: Gender has an impact on risk tolerance level of individual investor

H2: Age affects risk tolerance of individual investors

H3: Marital status has an effect on risk tolerance level of investors

H4: ncome of investor has an impact on his risk tolerance level

H5: Education has an effect on risk tolerance level of individual investor

H6: Work experience effects risk tolerance level of individual investor

Theoretical framework

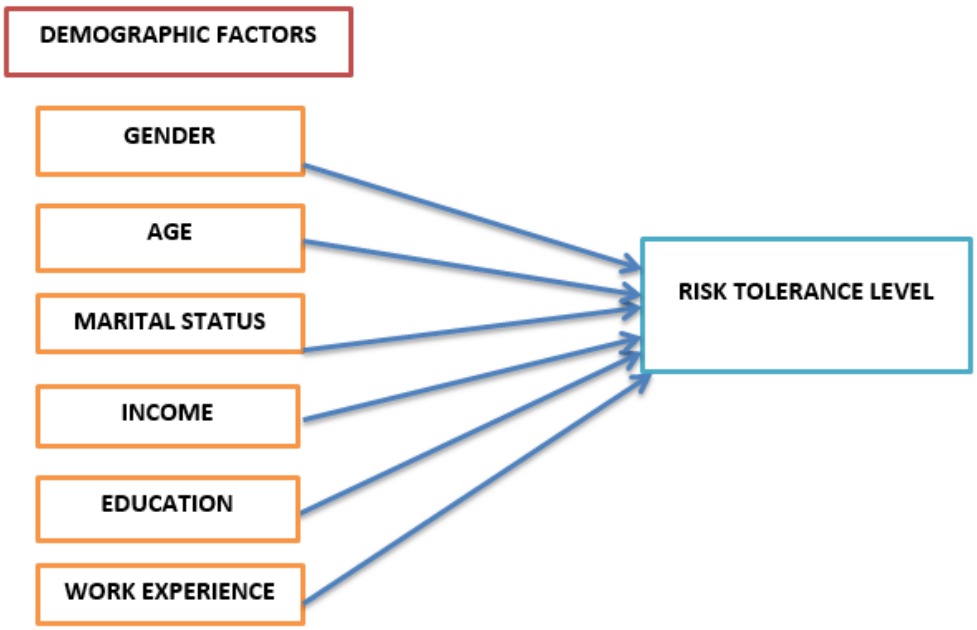

Figure 1. Theoretical framework

RESEARCH METHODOLOGY

The aim of this study is to analyses the effect of demographic factors on individual investors risk tolerance level. The demographic variables taken include age, gender, marital status, income, work experience and education. For this purpose, primary data has been collected through questionnaires by adopting deductive approach which is based upon cross sectional data. As it is easier to process and analyse and is the best choice for collection of standardized data, Questionnaire is the best choice. This method is also time saving (Bell & Bryman, 2007). Questionnaire help to collect data about non observable things such as motivations, attitude, feelings as well as experience of the individuals (Mellenbergh, 2008). The data has been collected from a sample of 106 respondents which include investors, finance students and teachers of Numl and Bahria University Islamabad.

The questionnaire items include demographics and items about risk attitude of the individuals. Nominal scales are used to categorize objects (Ghauri & Grønhaug, 2010). The sampling method used is convenience sampling because it is one of best methods to get a higher response rate and saves time and money (Bell & Bryman, 2007). The population includes investors, finance students and teachers from which the sample is collected from respondents in twin cities of Pakistan i., Rawalpindi and Islamabad.

SPSS is used for data analysis and person correlation and linear regression are applied to analyse the relationship between the variables. Cronbach alpha is used to check reliability of the questionnaire.the Cronbach's alpha value is 0.646 which is greater than 0.5 which indicates reliability and validity.

Table 1: The descriptive statistics of respondents is as follows

Gender	Male Female	%
Age	20-28	73.7%
	28-36	10.5%
	36-44	8.8%
	44-52	4.4%
	Above 52	2.6%
Marital status	Single	72.8%
	Married	27.2%
Income	Less than 30000	53.2%
	30000-60000	18.9%
	60000-90000	7.2%
	90000-120000	7.2%
	Above 120000	14.4%
Education	Intermediate	8.8%
	Graduation	31.6%
	Masters	46.5%
	Others	16.7%
Work experience	1-5yrs	73.2%
	5-10yrs	9.8%
	10-15yrs	6.3%
	15-20yrs	7.1%
	Above 20	3.6%

RESULTS AND DDISCUSSION

The results of the table below depict that gender and education has positive and significant relationship with risk tolerance at 0.05 level of confidence. Age, marital status and work experience has a significant but negative relationship with risk tolerance. Moreover income has insignificant and negative relationship with risk tolerance level of investors.

Table 2: Pearson correlation

Demographic Variables	Risk Tolerance
Gender	.120
Age	-.078
Marital status	-.086
Income	-.041
Education	.113
Work experience	-.096

Linear regression model is used to investigate the effect of demographic variables on risk tolerance of investor. In the regression equation, the risk tolerance level of investor is taken as dependent variable whereas the demographic factors such as age, gender, marital status, income, education and work experience are taken as the independent variables. The regression equation is:

$$\mathbf{Y} = \alpha + \boldsymbol{\beta}\ (\text{Gender})\ + \boldsymbol{\beta}\ (\text{Age})\ + \boldsymbol{\beta}\ (\text{Marital Status})\ + \boldsymbol{\beta}\ (\text{Income})\ + \boldsymbol{\beta}\ (\text{Education})\ + \boldsymbol{\beta}\ (\text{Work Experience})\ + \text{e}$$

Table 3: Analysis of variance

ANOVA Model	Sum of Squares	*df*	Mean Square	*F*	Sig.
1 Regression	22.761	6	3.794	49.713	.000
Residual	556.644	99	5.623		
Total	579.406	105			

a. Dependent Variable: Risk Tolerance

b. Predictors: (Constant), work experience, education, gender, income, marital status, age

The above table shows that the value for model fitness that is value for F is greater than threshold 4. This means that the overall model is fit.

Table 4: Coefficients

ANOVA Model	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
1 (Constant)	9.967	1.274		7.824	.000
Gender	.450	.485	.095	2.928	.356
Age	-.054	.322	-.022	-.167	.868
marital status	-.264	.682	-.048	-3.87	.700
Income	.036	.210	.021	.174	.862
Education	.415	.297	.141	1.395	.166
work experience	-.177	.373	-.073	-.473	.637

The above table shows that gender, income and education are positively related with risk tolerance level whereas age, marital status and work experience are negatively related with risk tolerance level. Gender is found to have a positive significant impact on risk tolerance level whereas marital status has been found to have a negative and significant relationship with risk tolerance level of individuals.

Investors' level of education is positively linked to risk tolerance. Higher educated investors have more knowledge about different investment options and their characteristics. They also use various techniques to manage the risk. It was also concluded that investors' incomes are also related positively to risk tolerance.

LIMITATIONS AND RECOMMENDATIONS

The current study is conducted only on education sector. To increase its generalizability, it must be replicated in other sectors and different context. These findings will be helpful for the investors to improve their investment decision making skills. Further risk tolerance of an investors may depend on the behavioural factors too. Thus future studies may consider effect of behavioural factors on risk tolerance.

CONCLUSION

The study aimed to analyze which demographic variable afffcets the level of risk tolerance of individual investors. It was found that out of all the variables selected, gender and marital status are the one that significantly impact the risk tolerance level of Pakistani investor. Age, income ,educaton and work experience do no impact the risk tolerance of investors in Pakistan. Age is not a distinguishing factor whereas gender and marital status is (Corbet, Larkin, & Lucey, 2020). The other independent variables consisted of gender, education, income did not exhibit any significant impact on financial risk tolerance. Investors in Pakistan are often not well educated and lack information on their investments (Hoff & Bashir, 2015). This is the reason why education does not effect risk rolerance of inverstors in Pakistan. The risk tolerance score is significant related with marital status (Gondaliya & Dhinaiya, 2016). In Pakistan, the marital status effects risk tolerance of investors as well as the gender of investor.

REFERENCES

Ahmad, M., Zakuan, N., Jusoh, A., Tasir, Z., & Takala, J. (2013). Meta-analysis of the relationship between TQM and business performance. In *IOP Conference Series: Materials Science and Engineering,* New York.

Angriani, M. R., Ariffin, Z., & Rahmawati, R. (2017). The influence of psychological climate to the organizational commitment through of job involvement (study at University Foundation Lecturer Achmad Yani (UVAYA) Banjarmasin). *International Journal of Business and Economic Affairs*, *2*(5), 288-296. doi:https://doi.org/10.24088/ijbea-2017-25003

Ansari, S., & Phatak, D. Y. (2017). A study on financial risk tolerance and preferred investment avenues of investor. *International Journal of Application or Innovation in Engineering & Management (IJAIEM)*, *6*(7), 149-155.

Arceneaux, K., Gerber, A. S., & Green, D. P. (2006). Comparing experimental and matching methods using a large-scale voter mobilization experiment. *Political Analysis*, *4*(6), 37-62.

Bell, E., & Bryman, A. (2007). The ethics of management research: An exploratory content analysis. *British Journal of Management*, *18*(1), 63-77. doi:https://doi.org/10.1111/j.1467-8551.2006.00487.x

Bhavani, G., & Shetty, K. (2017). Impact of demographics and perceptions of investors on investment avenues. *Accounting and Finance Research*, *6*(2), 198-205.

Chavali, K., & Mohan Raj, P. (2016). Impact of demographic variables and risk tolerance on investment decisions: An empirical analysis. *International Journal of Economics and Financial Issues*, *6*(1), 169-175.

Corbet, S., Larkin, C., & Lucey, B. (2020). The contagion effects of the covid-19 pandemic: Evidence from gold and cryptocurrencies. *Finance Research Letters*, *35*, 101-150. doi:https://doi.org/10.1016/j.frl.2020.101554

Dickason, Z., & Ferreira, S. (2018). Establishing a link between risk tolerance, investor personality and behavioural finance in South Africa. *Cogent Economics & Finance*, *6*(1), 151-200. doi:https://doi.org/10.1080/23322039.2018.1519898

Ghauri, P., & Grønhaug, K. (2010). *Research methods in business studies.* Harlow, UK: Financial Times Prentice Hall.

Gondaliya, V., & Dhinaiya, G. (2016). Assessing financial risk tolerance: Do demographic, socioeconomic and attitudinal factors work. *International Journal of Marketing & Financial Management*, *4*(5), 32-38.

Grable, J., & Lytton, R. H. (1999). Financial risk tolerance revisited: The development of a risk assessment instrument. *Financial Services Review*, *8*(3), 163-181. doi:https://doi.org/10.1016/S1057-0810(99)00041-4

Hoff, K. A., & Bashir, M. (2015). Trust in automation: Integrating empirical evidence on factors that influence trust. *Human Factors*, *57*(3), 407-434. doi:https://doi.org/10.1177/0018720814547570

Ikeobi, N. R., & Arinze, P. E. (2016). The influence of demographic factors on the investment objectives of retail investors in the nigerian capital market. *European Journal of Business and Management*, *8*(11), 147-155.

Jain, D., & Mandot, N. (2012). Impact of demographic factors on investment decision of investors in Rajasthan. *Researchers World*, *3*(2), 81-100.

Lucey, B. M., Larkin, C., & OConnor, F. (2014). Gold markets around the world who spills over what, to whom, when? *Applied Economics Letters*, *21*(13), 887-892. doi:https://doi.org/10.1080/13504851.2014.896974

Marobhe, M., & Hembe, L. (2019). The nexus between dividend policy and financial gearing of listed non financial companies in Tanzania. *International Journal of Business and Administrative Studies*, *5*(5), 294-302. doi:https://dx.doi.org/10.20469/ijbas.5.10004-5

Mellenbergh, G. J. (2008). Tests and questionnaires analysis. *Advising on Research Methods: A Consultant's Companion*, *5*(6), 235-268.

Moreschi, R. W. (2005). An analysis of the ability of individuals to predict their own risk tolerance.

Journal of Business & Economics Research (JBER), *3*(2), 45-60. doi:https://doi.org/10.19030/jber.v3i2.2744

Nguyen, A., Yosinski, J., & Clune, J. (2015). Deep neural networks are easily fooled: High confidence predictions for unrecognizable images. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition,* California, CA.

Onsomu, Z. N., Kaijage, E., Aduda, J., & Iraya, C. (2017). Risk tolerance, demographics and portfolio performance. *Journal of Business and Economic Policy*, *4*(3), 69-74.

Praba, M. R. S. (2016). Financial risk tolerance and the influence of socio-demographic characteristics of retail investors. *ISBR Management Journal*, *1*(1), 65-79.

Ripain, N., Amirul, S. M., & Mail, R. (2017). Financial literacy and SMEs potential entrepreneurs: The case of Malaysia. *Journal of Administrative and Business Studies*, *3*(2), 60-68. doi:https://doi.org/10.20474/jabs-3.2.1

Roszkowski, M. J., & Snelbecker, G. E. (1990). Effects of framing on measures of risk tolerance: Financial planners are not immune. *Journal of Behavioral Economics*, *19*(3), 237-246. doi:https://doi.org/10.1016/0090-5720(90)90029-7

Sadiq, M. N., & Ishaq, H. M. (2014). The effect of demographic factors on the behaviour of investors during the choice of investments: Evidence from twin cities of Pakistan. *Global Journal of Management and Business Research*, *14*(3), 11-20.

Subramaniam, V., & Athiyaman, T. (2016). The effect of demographic factors on investor's risk tolerance. *International Journal of Commerce and Management Research*, *25*(9), 9-20.

Sutejo, B. S., Pranata, Y. K. N., & Mahadwartha, P. A. (2018). Demography factors, financial risk tolerance, and retail investors. In *International Annual Symposium on Management Insyma,* Bangkok, Thailand.

Van de Venter, G., Michayluk, D., & Davey, G. (2012). A longitudinal study of financial risk tolerance. *Journal of Economic Psychology*, *33*(4), 794-800. doi:https://doi.org/10.1016/j.joep.2012.03.001

Want, M. Y., Islamuddin, M., Chouhan, G., Ozbak, H. A., Hemeg, H. A., Dasgupta, A. K., ... Afrin, F. (2015). Therapeutic efficacy of artemisinin-loaded nanoparticles in experimental visceral leishmaniasis. *Colloids and Surfaces B: Biointerfaces*, *130*, 215-221. doi:https://doi.org/10.1016/j.colsurfb.2015.04.013