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Investigation of Factors Influencing Risk Tolerance among Investors using Ordinal Logistic Regression: A case from Nepal.

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Abstract: The paper investigates the factors that affect the risk tolerance of the general investors in Nepalese stock market. Using data of 99 investors, study applies ordinal logistic regression to evaluate the impact of investor's education level, gender, financial literacy, years in trading, prior history of loss and history of margin lending on risk tolerance capacity of the investor. The paper finds that with prior loss, chances of high-risk investor moving to moderate risk is 4.48 log odds while that of moderate risk investor moving to low risk is 1.33 log odds. Meanwhile financial literacy increases the risk level across risk spectrum by log odds of 1.59. On the other hand keeping other things constant with availability of margin lending,

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The current paper "Investigation of Factors Influencing Risk Tolerance among Investors using Ordinal Logistic Regression: A case from Nepal" is the ongoing research on risk profiling and its ultimate impact on asset allocation especially in developing country that author is currently involved. The author's previous scholarly contribution can be accessed at following link.

Academia: <https://independent.academia.edu/DipeshKarki>



Trijya Kafle

PUBLIC INTEREST STATEMENT

Risk tolerance determines the willingness of an investor to accept risk anticipating the return. Higher the risk tolerance more aggressive the investor is and vice versa. Based on the risk tolerance level the asset allocation decision and nature of financial product that investor prefers can be ascertained. Though several studies in risk tolerance of investor have been carried out in developed economies, similar study in least developed countries is still lacking. This study done in Nepal shows financial literacy level, availability of loan and prior loss experience shape investor's risk appetite. Meanwhile factors such as gender, investment experience and education have no impact. This information is thus valuable to financial planner and portfolio manager in order to provide proper financial advice to potential investor. Further this knowledge can be used by policy maker to draft a right strategy to encourage risk-taking ability of investor when market confidence is low and attenuate the high risk-taking behavior during market bubble.

there is 48% probability investor falls into moderate risk category. The study however didn't find any influence of gender, years in trading and education on risk tolerance. The research finds that financial literacy is an important driver in risk appetite of investors than their education level. Further it shows that past experience of the investor very much influences their level of riskiness. Finally paper finds margin lending having more influence on those investors that falls under moderate risk level. The study thus provides guidelines for policy maker in setting the margin rate, and also helps portfolio manager to assess the risk appetite of the potential investor and finally provides empirical evidence of financial literacy in stabilizing risk tolerance of investors.

Subjects: Credit & Credit Institutions; Investment & Securities; Risk Management

Keywords: risk tolerance; financial literacy; ordinal logistic regression; margin lending

JEL: G53; D12; G11; G18

1. Introduction

1.1. Overview

Securities Exchange Centre was established in Nepal in the mid-1970s for the promotion and growth of the capital market and was later transformed into Securities Exchange Board of Nepal in 1993 (Gurung, 2004). Though the concept of the stock market is rather new, risk has always been at the core when analyzing investment options in the country. Even though the investment scenario of Nepal is quite primitive, investors are constantly facing the challenge to choose from safe bait and risky gamble. In addition to this, people in the Least Developed Countries like Nepal are exposed to inexplicable volatility leading to higher risks (Vieider et al., 2014).

While it is imperative to analyze these baffling changes, it is more crucial to analyze the factors that shape the perception of investors regarding these changes. One of the major factors pertaining to risk perception is the level of education (Aren & Zengin, 2016). Despite the fact that South Asian adult literacy rate has grown to 72% in the year 2018 (UNESCO Institute for Statistics, 2019), Nepal is still behind with only 68% literate adults and of the total literate people 75% are women and 25% are men ("Women outnumber men in adult literacy", 2015).

Moreover, being a literate is not enough to make investment decisions and hence when we gauge specifically into financial literacy, the figure is equally disheartening. According to S&P Global Finlit Survey, only 18% of the total Nepalese population is financially literate while neighboring country Bhutan has financial literacy rate of 57% (Klapper et al., 2015). The reason behind such staggering difference could be attributed to the lack of financial services in the country where 39% of the total population do not have access to formal financial services (Pant, 2018).

And even though 82% of the population is not financially literate there are a million retail investors in the stock market (Ghimire as cited in Timilsina, 2018) and a total of 870,702 have Demat accounts (Nepal Rastra Bank, 2017). Moreover, 94.19% of capital operation is through stock market and NEPSE has an annual market capitalization of 1856.82 billion (Nepal Rastra Bank, 2018). Given the level of financial literacy, the popularity that capital market has is simply perplexing. This creates a query on what might be the driving force behind making investment decisions. Several studies (Hariharan et al., 2000; Nguyen et al., 2016)) have shown a positive relationship between investment decision and financial risk tolerance where risk averse investors tend to invest more in less risky assets. These findings lead to the crucial aspect of investment, i.e., risk tolerance. Discussion pertaining to risk tolerance and the factors behind it are quite limited in South Asian context. Therefore, the objective of

this paper is to identify whether in developing countries like Nepal, demographic factors such as gender, educational level, financial literacy and financial factors particularly prior loss, avail of loan and years in trading would have an impact on risk tolerance of the investor.

1.2. Contribution of the study

In this regard the study contributes to current knowledge base of risk tolerance and investment in three ways

- (i) It explains the influence of demographic factors on the risk tolerance level of common investors in the Least Developing Countries like Nepal
- (ii) It examines how unit change in one demographic factor will transition the investor from one risk level to another risk level
- (iii) It helps in determining critical factors that can help to design asset allocation strategy as per investor's risk appetite.

Thus the outcome of the study, especially knowledge of factors influencing the risk appetite of the investor is extremely important as it helps investment firms, mutual fund manager and portfolio managers to identify the potential investors, provide them appropriate suggestions on financial advising and further help them to design and market a portfolio that best caters to the individual customer. Further this knowledge will be important for stakeholders such as banks to determine the risk profile of customers and help them to decide whether they are taking excessive risk or not. Meanwhile this knowledge will be helpful for regulatory bodies like Security board and Government as they can provide training and regulation to contain the excessive risk that can create economic distress or can motivate the conservative investor to take moderate risk which can be vehicle for economic growth. In addition, the study can provide guidelines to other economies in South Asia with similar cultural and development background as that of Nepal.

1.3. Research gap

Investment climate in the least developed country like Nepal is subjected to various noises and uncertainty (Karki & Ghimire, 2016). Further the herd behavior characterized by hasty decision making is very much prevalent in the market (Risal & Khatiwada, 2019). In such situation it is very difficult to gauge the risk tolerance level of average investors and accordingly cater to their needs. In this regard it is essential to see how the factors identified by literature actually influence the risk level in context of Nepal. Further the studies so far have used logistic regression to access the binary level of risk tolerance, i.e. either high risk or low risk based on the demographic variables (Sung & Hanna, 1996; Yao et al., 2011). However since the risk can be decomposed into several class such as Very Conservative, Conservative, Moderate, Aggressive and Very Aggressive; it will be interesting to see whether the demographic variable influences the transition from one risk level to other in same proportion. In this regard the paper proposes following hypothesis

H1. Education of investor has positive effect on risk tolerance.

H2. Financial Literacy of investor has positive effect on risk tolerance

H3. Gender of investor has effect on risk tolerance

H4. Experience of trading in years of investor has positive effect on risk tolerance.

H5. Experience of prior loss has negative effect in risk tolerance preference

H6. Availability of marginal lending has positive effect in risk tolerance preference.

2. Literature review

Avoiding risk has been an evolutionary aspect of being human and is more relevant when we discuss investment risk (Cashdan, 2019). In absence of risk aversion, capital markets would be too predictable. The price of bonds would have same return over time and portfolio construction would merely be the task of arranging the timing of expected payoffs (Hanna et al., 2011). Investors tend to craft their portfolio according to their risk appetite to maximize their utility. While Auerbach (1979) discusses how investors are utility maximizing creatures, St. Petersburg paradox, a coin flip game, shows how investors are not only wealth maximizers but also risk calculators (Finke & Guillemette, 2016). St. Petersburg paradox has to be one of the primordial studies of risk tolerance which portray risk tolerance as change in utility function.

Finke and Guillemette (2016) argue that investment risk resembles nothing but the volatility of your future spending. From this perspective, a more risk-averse investor gains high utility when there is decrease in spending and a more risk-tolerant investor gains high utility when there is an increase in spending (Finke & Guillemette, 2016). Weber (2014) associated risk tolerance with wealth of the investor wherein as wealth increases investors become more inclined towards taking risks. Similarly, Grable (2000) identified how income level also had an impact on the risk adversity of the investors in which investors with higher income had higher risk tolerance. But, Finke and Guillemette (2016) concluded income to be an insignificant predictor of risk tolerance.

Another perspective to look at risk tolerance is through the lens of education. Sung and Hanna (1996) identified positive relationship between educational level and risk tolerance. But because one cannot estimate the financial knowledge of the investors by just looking at their educational level, Grable studied impact of financial knowledge as well. According to President's Advisory Council on Financial Literacy [PACFL] (2008) Financial literacy is defined as "knowledge of basic economic and financial concepts, as well as the ability to use that knowledge and other financial skills to manage financial resources effectively for a lifetime of financial well-being". Studies show that investors who had better financial knowledge depicted higher risk tolerance than those with unsound financial knowledge (Grable, 2000; Linciano & Soccorso, 2012). Financial Literacy meanwhile has been shown to be very less among socially vulnerable groups putting them in further economic disadvantage (Hilgert et al., 2003)

Lusardi (2008) further analyzes the relation between financial literacy and demographic variables. Lusardi's findings show those with lower education and those who were women had lower financial literacy. While some researchers (Grable, 2000; Hallahan et al., 2003) consider women to be more risk averse than male Schubert et al. (1999) dive more into the type of decision making before giving the verdict. In their article, "Financial Decision-Making: Are Women Really More Risk-Averse?", they did not find any difference between risk tolerance and gender when making contextual decisions but when making gambling decisions gender had a role to play where female respondents had lower risk tolerance than male respondents.

Although these findings paint a picture of investor's risk preference it is evident that the risk tolerance of an investor changes over time in response to changes in surroundings (Weber & Klement, 2018). Grable (2000) concluded that married investors have higher risk tolerance than unmarried investors. But Hallahan et al. (2003) showed no significant relationship between marital status and risk tolerance of investors.

Founding work in the field of risk-taking behavior by Kahneman and Tversky (1979) explains how investors respond to investment risk through four aspects namely reference point, loss aversion, prior gains and losses and probability. Investors are more sensitive towards loss than gains as explained by myopic loss aversion wherein investors are more inclined towards break even when prior loss was present (Kahneman & Tversky, 1979). But in case of prior gain the investors depicted high risk-seeking behavior also termed as house money effect. More than prior gains and losses the investors are also eager to identify the probability of current gains and losses. When there was

a high probability of current loss they showed risk-seeking behavior and when the probability of current loss was minimal they were risk averse.

Additionally, prospect theory ascertains that an investment period of one year is utility maximizing. From previous literatures we have identified that utility maximization is positively related to risk tolerance which shows that an investor with investment history of one year will be willing to take more risk than those otherwise. Loss aversion and prior gains and losses are at the core of this paper when analyzing risk tolerance.

Another study identified the relationship between number of trading and risk tolerance. When investors traded more regularly it showed a high-risk tolerance given that the number of trading was less than 25 times (Wood & Zaichkowsky, 2004). Likewise, a study of Finish investors shows positive attitude towards risk when the investors were male backed by debt history (Alanko, 2009).

Besides these variables margin lending is considered as one of the major factors that increases the riskiness and eventually the market volatility (Fortune, 2001). Margin lending is the technique that allows the investor to take in loan using the securities as the collateral. It is considered that margin lending results in stimulating demand for stocks that leads to further borrowing for purchase of additional stocks ultimately pushing the stock above its intrinsic price creating market bubble. This phenomenon is known as pyramiding (Bogen & Krooss, 1960). Further when market goes down leads to margin call that results in forced sell off that further decreases the prices causing by pyramiding (Bogen & Krooss, 1960). Koudijs and Voth (2016) have argued that changes in beliefs on lenders can shift the leverage resulting from margin lending. In this regard it will be interesting to see whether margin lending is practiced by investors from broad risk spectrum or is only done by risky investors.

Thus these studies have identified connecting link of demographic and financial variables with risk tolerance of an investor. But almost all of these studies have been carried out in developed setting which makes it incomparable to South Asian context. A few studies that have been done show the connection of the variables with the Nepalese stock market in general. For example, Shrestha and Subedi (2014) have shown that tightening of margin lending results in decline in NEPSE index. Similarly Pokharel (2018) has shown various demographic factors such as age, gender, education influencing the investment decision in stock market. However, these studies do not reveal how variables of interest influences risk motivation of general investor. This creates a need for a research to extend the findings into developing part of the world where capital market is dominated only by shares. Moreover, studies related to independent relation between loan and risk tolerance are minimal. Consequently, the paper has identified the relationship between risk tolerance of investors and their demographic and financial variables.

3. Methodology

3.1. Data and variables

Paper uses the standard risk tolerance survey from Morningstar (2018). The questionnaire analyzes the risk appetite of an investor including three aspects, i.e., time horizon, long-term goal and expectations and short-term risk attitudes. There are total seven questions among which two questions are related to time horizon, three questions gauges long-term goals and expectation and two questions on short-term risk. Each question has five responses with weights from 5 to 1 in order of decreasing risk appetite. Responses from these three variables are added to classify risk profile of an investor into five categories. Subcategories of risk profile of an investor include conservative, moderately conservative, moderate, moderately aggressive and aggressive. Following is the risk score and corresponding risk category is as below Table 1.

Table 1. Risk Score and Risk Category level

Risk Score	Risk Category
7–10	Very Conservative
11–17	Conservative
18–24	Moderate
25–31	Aggressive
32–35	Very Aggressive

Based on the findings of the literature review, the paper has identified variables (Table 2) which will be used to establish relationship with investor’s risk tolerance.

Though several studies in literature of risk tolerance suggest level of income of the investor has positive impact on the risk appetite (Grable, 2000; Shaw, 1996), among the variables chosen the level of income and wealth of the respondent were not considered because it has been found that in questionnaire survey income is generally underreported (Moore & Welniak, 2000). For instance, a recent study in developed economy New Zealand has shown underreporting of the income in survey by almost 20% (Cabral et al. (2019). Further Lavrakas (2008) opines that household income survey suffers from response bias due to underreporting. Similarly, a study of 17 developing countries so that the underreporting is more prevalent in agri-based economy (Azzarri et al., 2010). Meanwhile according to Neri and Zizza (2010) the underreporting is particularly severe among self-employed, rent earner and those with secondary income. In addition this underreporting is more prevalent in informal economies (Van der Molen, 2018). In context of Nepal, according to Charmes (2012) 86.4% of employment is in informal economy. Thus it enforces the possibility of increased response bias in income. In addition a recent study has shown that in Nepal tax evasion is major reason behind income underreporting (KC, 2018). In fact Nobel Laureate Angus Deaton has even questioned the logic of using income data in study stating that collecting good income data faces both practical and conceptual difficulties. As a result doubts are raised in using these data considering the cost associated with it and value it adds in overall research (Deaton, 1997). Thus considering this cogent the income is not included in the overall study.

Financial literacy meanwhile is considered as ability of individual to make wise decisions regarding their personal finance, investment decision and financial planning. However there is no general consensus and no proper operational definition regarding financial literacy (Hung et al., 2009). Further, according to Huston (2010) unlike health literacy there is no standardized test to measure the financial literacy. In the context of Nepal, according to central bank only 45% of population has bank accounts and further financial market and stock exchange in general are concentrated in main cities (Nepal Rastra Bank, 2018). This implies very poor financial literacy among general public. Though often it is considered that personality, demographic and influence from others can induce people towards investment, it doesn’t necessarily provide sound knowledge required for proper financial planning and investment decision for future (Thapa & Nepal, 2015). Thus to be financially literate and avoid herding behavior at least knowledge of compound interest and time value of money is essential. Since these tools are taught only to those who have studied basic finance courses at the high school level or above, the study thus considers anyone who took these courses during their formal studies as financially literate.

3.2. Econometric tools

The paper primarily uses Ordinal Logistic Regression to analyze the influence of demographic factors of investors on their individual risk tolerance. Ordinal logistic regression is chosen as it is the form of

Table 2. Variables of Study

Variables	Symbol	Operational Definition	Literature Support
<i>Independent Variable</i>			
Education	$X_{education}$	This is a categorical demographic variable that assess the education level. It is has following level 1: No Formal Education 2: School Leaving Certificate 3: College 4: University 5: Phd	Literature shows mixed impact of education on risk level. Several studies (Gutter and Fontes, Gilliam & Chatterjee, 2011) have shown education as a factor influencing risky investment while Yoo et al. (2011) shows education is not that a factor
Gender	X_{gender}	Dummy variable to denote gender. It assumes following values 0: Female 1: Male	Hanna et al. (2011), Friedberg and Webb (2006) and Aren & Zengin, (2016) didn't find any role of gender in risk. Meanwhile Neelakantan (2010) found women to be less risk tolerant than their male counterparts.
Financial Literacy	$X_{financial_literacy}$	Dummy variable to denote whether the respondent is formally financially literate. Those respondent who has studied finance in college is considered as financially literate. It assumes following values 0: Not financially literate 1: Financially literate	Hallahan et al. (2003) and Aren & Zengin, (2016) have shown Financial Literacy has major role in shaping the risk tolerance of the investor. On the other hand Cooper et al. (2014) want' able to establish any such connection
Years In Trading	$X_{years_in_trading}$	This is another categorical variable that assesses respondent's number of years in trading. It can assume following values 1: less than six months 2: 6 month to year 3: year to 5 years 4: 5 to 10 years 5: more than 10 years	Grable et al. (2006) and Malmendier and Nagel (2011) posit that period effect has effect on risk tolerance. Especially those who have experienced boom in stock are more likely to be risk tolerant
Prior Loss	X_{prior_loss}	This is dummy variable to denote whether respondent had experienced prior loss or not. It can assume following value 0: No prior loss 1: Prior Loss	Thaler and Johnson (1990) has shown that prior loss results in disutility among investors resulting in fall in risk tolerance
Margin Lending	X_{loan}	This is dummy variable to denote whether investor has taken loan against securities. It can assume following values 0: No loan taken 1: Loan taken	Fortune (2001) has shown that margin lending provision increases the risk taking ability of investors
<i>Dependent Variables</i>			
Risk Tolerance	RiskTolerance	Risk Tolerance of the customer is measured using the MorningStar (2017) survey using the formula	

nonlinear regression that can model the dependent variable (regressand) is ordinal in nature (Bender & Grouven, 1997). Ordinal data are those which are categorical and have certain order. In our data set the risk tolerance variable ranges from Very Conservative to Very Aggressive in the order of increasing risk appetite. Hence the ordinal logistic regression is applicable. Before understanding the ordinal logistic regression however the basic fundamental logit function needs to be understood.

a. Logit Model

In statistics a Logistic regression can be employed to model the binary responses where the dependent variable (regressand) can take one of the two values (Gujarati, 2009). For instance, should a stock be bought or sold or should a customer be granted loan or not. This form of binary response can be represented using the logistic regression in following manner:

$$P_i = f(z) = \frac{1}{1 + e^{-z}} \quad (i)$$

Where,

$$z = b_0 + \beta'X$$

$\beta = \{\beta_1, \beta_2 \dots \beta_n\}$ are n coefficients

$X = \{X_1, X_2 \dots X_n\}$ are n explanatory variables

P_i : Bernoulli probability distribution for true response.

And $f(z)$ is a logistic or sigmoid function

Here the sigmoid or the logistic function has the ability to converge the domain $[-\infty, +\infty]$ to $[0,1]$. As a result P_i will range from 0 to 1. But since the function is non-linear, Ordinary Least Square cannot be used to estimate the parameters (b_0, b_1, b_2, b_3). In order to make it a linear form an odd ratio is introduced which is actually ratio of probability of success by probability of failure. It is obtained by dividing Probability of Success by Probability of failure which is obtained as

$$\text{Old - ratio} = \frac{P_i}{1 - P_i} = e^z \quad (ii)$$

By taking natural log in both sides we get,

$$\text{Logit} = L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z = b_0 + \beta'X \quad (iii)$$

The equation iii) is known as Logit model or Logistic Regression equation for dichotomous qualitative response.

b. Ordinal Logistic Regression

Ordinal Logistic Regression is the extension of Logistic regression where the dependent variable has multiple categories in an order. Thus it is non-linear regression technique that can be used to model the relationship between an ordinal response variable and one or more explanatory variables Therefore in order to accommodate the information about the ordering, Ordinal Logistic Regression makes use of cumulative probabilities, cumulative odds and cumulative logits. Hence if there are "k" number of categories then for any category "i",

$$\text{Cumulative Probability, } P(Y \leq i) = p_1 + \dots + p_i \tag{iv}$$

$$\text{Odds}(Y) = \frac{P_1 + P_2 + P_3 + \dots + P_i}{P_{i+1} + P_{i+2} + \dots + P_k} \tag{v}$$

$$\text{Logit}(Y) = \ln\left(\frac{P(Y \leq i)}{1 - P(Y \leq i)}\right) = \alpha_i + \theta_1 X_1 + \theta_2 X_2 + \dots + \theta_n X_{k-1} \tag{vi}$$

Where $i = 1, 2, \dots, K-1$

As it can be seen from the equation vi) the constant α_i is a threshold or cutoff for any i th category

c. Parallel Line Assumption

The standard ordinal logistic regression assumes that coefficients explaining the relationship between lowest versus cumulative highest are same as those describing next lowest versus all higher categories. As a result the coefficient is same across all categories except for the threshold points (Williams, 2006). However it is not necessary that the parallel line assumption holds in this case the brant test is used to test the parallel line assumption (Long & Freese, 2006). The null hypothesis is there is no difference in the coefficients between the model, hence significant result implies the parallel line test is violated. In such situation the constant coefficient across the categories doesn't hold and thus it requires modified less parsimonious model such as partial proportional odds model

Under this equation (vi) is modified into

$$\text{Logit}(Y) = \ln\left(\frac{P(Y \leq i)}{1 - P(Y \leq i)}\right) = \alpha_i + \theta_{1i} X_1 + \theta_{2i} X_2 + \dots + \theta_{ni} X_n \tag{vii}$$

As can be seen from equation vii) the coefficient β is dependent on the category “ i ”.

d. Final Model for Analysis

Based on the discussion above, following are the models the paper used for this analysis. Under parallel line assumption the logit model appears as in equation (viii)

Logit(Risk\,Tolerance $\leq i$) =

$$\ln\left(\frac{P(\text{Risk Tolerance} \leq i)}{1 - P(\text{Risk Tolerance} \leq i)}\right) = \alpha_i + \theta_{\text{Education}} X_{\text{Education}} + \theta_{\text{Financial Literacy}} X_{\text{Financial Literacy}} + \theta_{\text{Gender}} X_{\text{Gender}} + \theta_{\text{Years_in_trading}} X_{\text{Years_in_trading}} + \theta_{\text{Loan}} X_{\text{Loan}} + \theta_{\text{Priorloss}} X_{\text{Priorloss}} + \epsilon \tag{viii}$$

Meanwhile under the partial proportional odds the model will appear as in equation (ix)

$$\begin{aligned} \text{Logit}(\text{RiskTolerance} \leq i) &= \ln\left(\frac{P(\text{RiskTolerance} \leq i)}{1 - P(\text{RiskTolerance} \leq i)}\right) \\ &= \alpha_i + \theta_{\text{Education},i} X_{\text{Education}} + \theta_{\text{FinancialLiteracy},i} X_{\text{FinancialLiteracy}} + \theta_{\text{Gender},i} X_{\text{Gender}} \\ &\quad + \theta_{\text{Years_in_trading},i} X_{\text{Years_in_trading}} + \theta_{\text{Loan},i} X_{\text{Loan}} + \theta_{\text{Priorloss},i} X_{\text{Priorloss}} + \epsilon \end{aligned} \tag{ix}$$

It should be noted that in the proposed model, omission of income can lead to omitted variable bias, however it is reported that in case of logistic distribution this bias is more conservative as it

leads to underestimation of coefficient by depressing it towards zero (Cramer, 2005; Mood, 2010). In this regard tradeoff between the omitted bias and response bias is acceptable.

4. Empirical results and discussion

The data analysis was done in two stages. The first stage dealt with the assessment of risk tolerance and the second stage focused on investigating the relationship of risk tolerance with demographic and financial variables.

4.1. Descriptive statistics

Data were obtained from a sample of investors (n = 99 respondents) of varying demographic characteristics. The respondents were selected randomly by visiting the five different brokerage houses and interviewing the customer in convenience basis. Respondents included 49 females and 50 males where most of them have graduated from college and are involved in trading since 5 to 10 years (Table 3). Most of the participants depicted moderate and aggressive risk-taking behavior. Based on the responses, this paper categorizes investor's risk profile as conservative, moderate and aggressive eliminating the two extremities. The demographic variables include educational level, and gender and the financial characteristics of an investor are measured with financial literacy, years in trading, loan and prior loss.

Table 3. Respondent's information

Variables	Respondents (%)	Mean	S.D
Risk Tolerance			
Very Conservative	0		
Conservative	10.1		
Moderate	49.5	3.30303	6,460,957
Aggressive	38.4		
Very Aggressive	2.0		
Education			
No formal education	8.1		
School Leaving Certificate (SLC)	24.2	3.101	1.156128
College	30.3		
University	24.2		
PHD	13.1		
Financial Literacy			
No Financial Knowledge	52.5		
Financial Knowledge	47.5		
Years in trading			
less than six months	15.2		
6 month to year	20.2		
year to 5 years	21.2	3.070707	1.295617
5 to 10 years	29.3		
more than 10 years	14.1		
Loan			

(Continued)

Variables	Respondents (%)	Mean	S.D
No loan	48.5		
Loan	51.5		
Gender			
Female	40.4		
Male	59.6		
Prior Loss			
No	45.5		
Yes	54.5		

Among 99 respondents it is found that majority of investors have moderate risk tolerance of 49.5% followed by aggressive risk-taking behavior of 38.4%. The average risk tolerance is computed to be 3.30 which falls in moderate category. Meanwhile conservative risk takers were of only 10% while very aggressive were of 2%. In terms of education level of the respondents, most of the respondents had college degree (30.3%) followed by equal incidence of university degree holder and SLC passed (upto 10th grade) respondents with 24.2%. Furthermore, 59.6% of the collected responses were from male investors.

4.2. Reliability analysis

As the questionnaire for Risk Tolerance is perception based it is imperative that scale reliability be tested in order to check the internal consistency among the response. In this regard, Cronbach alpha statistics was computed for all three dimensions of risk component that includes Time Horizon, Long-Term Goals and Expectation and Short-Term Risk Attitude. Cronbach coefficient of greater than 0.7 is considered as consistent (Santos, 1999). The result tabulated in Table 4 shows for all the scales the Cronbach coefficient is within the acceptable range.

Table 4. Cronbach Alpha

Risk Dimensions	Cronbach Alpha
Time Horizon	0.7
Long Term Goals and Expectation	0.89
Short Term Risk Attitude	0.859

4.3. Risk tolerance and parameters under proportional odds assumption

Following table provides the result of applying the ordinal logistic regression with parallel line assumption or proportional odd assumption (Table 5). The parameters include education, financial literacy, gender, years in trading, loan and prior loss. Table 5 depicts the odds ratio of the parameters where the probability of education having an effect on risk tolerance is 0.88.

The model chi-square value is highly significant suggesting the model fit. Meanwhile among the result only Prior Loss and Financial literacy appear to be significant. The result shows that with one unit increase in Financial Literacy level the odds of being Aggressive Risk taker increases by 3.926763 times than the combined odds of being other risk taker (Moderate, Conservative and

Table 5. Odds ratio of risk tolerance parameters

Parameter	Odds Ratio
Education	0.884191
Financial Literacy	3.926763*
Gender	1.305212
Years in trading	0.9784
Loan	2.3692
Prior Loss	0.0195409**
Chi-Square	66.64***
McFadden R2	0.3559

*and ** denotes significant at 5% and 1% significance level, respectively

Very Aggressive). Similarly odds of being Moderate Risk taker again increases by 3.926763 times than the combined odds of other risk taker (Aggressive, Conservative, and Very Aggressive). Similarly, as the investor moves from having no prior loss to experiencing loss the odds of being in one risk category increases by 2.3692 to combined odds ratio of other risk categories.

4.4. D. Testing parallel lines

The underlying assumption of linear ordinal regression is that the relationship between dependent and independent variables and the logits are same for all logits. This ensures that the result gathered from the dataset forms a parallel line. To check whether this holds we conduct a brant test (Brant, 1990) was conducted statistic where the null hypothesis assumes that lines are parallel.

The result from parallelism is shown in Table 6. A significant test statistic provides evidence that the parallel regression assumption has been violated for both loan and prior loss. Therefore the results obtained assuming proportional odds could not hold.

Table 6. Testing parallelism

Parameter	Chi square
Education	0.04
Financial Literacy	0.13
Gender	1.42
Years in trading	1.86
Loan	3.40*
Prior Loss	4.86**

**and*denotes significant at 5% and 10% significance level respectively

4.5. E. Generalized ordered logit estimates: in terms of coefficients

As parallel line assumption failed the generalized ordered logistic regression was applied Table 7. From the observed significance level, financial literacy is significant in case of conservative investor and loan and financial literacy is significant predictor for moderate risk-taking investor. R square of the model is 39.39% which has been computed through the data set of 99 responses.

Table 7. Generalized order logit in terms of parameter coefficient

Parameter	Coefficient (Conservative)	Coefficient (Moderate)
Education	-0.19047	-0.19047
Financial Literacy	1.59664**	1.59664**
Years in trading	-.040289	-.040289
Loan	.9710278*	.9710278*
Prior loss	-1.330857	-4.482927***
Gender	.306432	.306432
Cons	2.692354**	0.8739
Chi-Square	73.77***	
McFadden R2	0.3952	

*, ** and *** denotes significant at 10%, 5% and 1% significance level respectively

The result shows that among all the parameters, Financial Literacy, Loan and Prior Loss have significant influence on the risk tolerance of investor. Financial Literacy that meets parallel line assumption shows that with increased financial literacy, the level of risk taking also increases by 1.59 units. Meanwhile, in case of those investors who take loan one unit rise in loan increases risk profile by 0.97 units. This shows that financial literacy and loan acquiring behavior increase the risk appetite of investor. Similarly in case of experience with prior loss a moderate risk taker moves towards conservative risk profile by -1.33 unit while risky investor moves towards moderate risk spectrum by -4.48 unit. This demonstrates that experience of loss has larger significant impact on risky investors in recalibrating their risk than in absence of it.

4.6. F. Generalized ordered logit estimates: in terms of odds ratio

In terms of odds ratio the result is same and it shows that with a unit rise in Financial Literacy the odds of increase in risk level from lower to higher level is 4.93 times. Meanwhile, in case of loan financing, odds of rising risk appetite is by 2.64 times. If person has experienced prior loss then odds of moving from Conservative to Moderate is very low with 0.26, while odds of moving from Moderate to Higher Risk is even lower with 0.011. This shows that Prior loss has negative impact on risk level Table 8.

Table 8. Generalized ordered logit in terms of odds ratio

Parameter	Odds Ratio (Conservative)	Odds Ratio (Moderate)
Education	.8265739	.8265739
Financial Literacy	4.93642**	4.93642**
Years in trading	.9605118	.9605118
Loan	2.640657 *	2.640657*
Prior loss	.2642506	.0113003***
Gender	1.358569	1.358569
Cons	14.7664	2.93612

*, ** and *** denotes significant at 10%, 5% and 1% significance level respectively

4.7. G. Predictive margins

If the investor has no prior loss, the probability of depicting risk-averse behavior is 4% whereas if the investor has prior loss then the probability increases to 14%. Likewise, in absence of prior loss the probability of enduring moderate level of risk is 16% and it surges to 77% when in presence of prior loss. An investor who has no preceding loss history has 79% probability of being aggressive risk taker whereas the probability that an investor with prior loss history willing to take high risk is only 7%.

Meanwhile in case of loan financing the result shows that keeping other things constant if the investor has carried out margin lending then there is just 6% probability that he falls under Conservative segment in risk spectrum. Meanwhile probability of being investor with moderate risk capacity is almost equal for both loan taker and those that finance their investment out of pocket. Finally, probability of loan-financed investor being high risk taker is almost 45%. This finding is interesting as investor that used margin lending doesn't necessarily mean high risk taker, instead his is used by investors with risk evenly spread to moderate spectrum. On the other hand, it is also found that financially literate investor has very low probability of 3% in falling into conservative risk category meanwhile their probability to be on higher risk rises upto 48%. Compared to that, those with lack of financial literacy are more clustered towards moderate risk spectrum at 51%. Further financially illiterate investor has 15% probability of falling under the conservative segment Table 9.

4.8. H. Overall analysis

Table 9. Predictive margins analysis for prior loss, loan financing and financial literacy

	Conservative	Moderate	High
No prior loss	.0467232	.1613041**	.7919727**
Prior loss	.1456654**	.776112**	.0782226*
No Financial Literacy	0.1536082***	0.5162253***	0.3301665***
Financial Literacy	.037986*	0.4768826***	0.4851313 ***
No Loan	0.1424387***	0.4962641***	0.3612972 ***
Loan	0.0632603**	0.4841045***	0.4526352***

*and ** denotes significant at 5% and 1% significance level, respectively

The study shows overall mixed result compared to that provided in literature. Unlike Sung and Hanna (1996) paper didn't find any significant relation between education and risk behavior of the investor. This is aligned with the findings of Yao et al. (2011). Meanwhile the paper, congruent to findings of Friedberg and Webb (2006) and Aren & Zengin, (2016), didn't find any role of gender in influencing risk level of the investors. These findings are important from policy implication view as education level and gender do not play major role in risk level conforming to Schubert et al. (1999). This suggests while designing an investor awareness program, Security Board of Nepal does not have to contextualize it around the gender and education level. On the other hand, contradictory to period effect explained by; Grable et al. (2006) and Malmendier and Nagel (2011), the paper didn't find any effect of trading experience on the risk tolerance of the individual investor. This result can be explained by similar findings by Glaser and Weber (2007) which suggests that the investors didn't necessarily learn from past mistakes or the past experience doesn't induce them to remove their old biases. This is important for the financial planners as they should consider both experienced and inexperienced investor in same manner while providing financial advices.

However, paper did find significant impact of financial literacy on risk level which is aligned with the previous findings by Hallahan et al. (2003) and Aren & Zengin, (2016). This shows that by introducing financial literacy as a part of broader education spectrum the risk-taking "animal spirit" among investor can be enhanced. Meanwhile the study shows experience of prior loss reduces the riskiness of an investor. This is especially important as it is congruent with Kahneman and Tversky (1979) assertion that prior loss can

result in risk aversion among the investor. Also it corroborates the theory of fall in disutility after experiencing the loss as explained by Thaler and Johnson (1990). This information is important especially for low-risk investment scheme managers such as mutual fund and insurance agent. They can target investor with prior loss as potential customer for their investment schemes.

The research also shows that margin lending is not that prevalent among the conservative and odds of unit rise in margin lending increases across the rising risk spectrum. Further analysis of marginal prediction shows that those investors who have taken loans have higher probability of falling into moderate risk category. This implies that margin lending doesn't necessarily imply high risk takers and even investors with the lower risk profile might exercise the practice given suitable climate such as lower rates. This is in line with the study that has shown that those who want to invest but are lacking money usually resort to such practice and hence increase the overall riskiness (Constantinides et al., 2002). This has policy level implication as decline in margin lending rates can lead to speculative practice rather than real investment. Therefore, the regulators need to be careful while calibrating margin lending rates as it can influence the investor of moderate risk level which as survey shows makes the majority of investor in the market.

5. Conclusion

This study shows that risk tolerance of Nepalese investors is mainly influenced by their level of financial literacy, their prior profit and loss experience and availability for margin lending. By focusing on financial literacy and properly regulating margin lending riskiness in the stock market, risk tolerance level can be influenced that can lead to overall market stability. The main caveat of the study was the sample was drawn from the investors that are already involved in stock trading and were willing to take survey. As a result, possibility of self-selection bias can't be ruled out. In addition to this, omission of income can result in possible omitted variable bias. Further the paper used survey at particular instant of time and hence can't explain how the risk profile may change over the time. It is recommended that longitudinal study be carried out following the training in financial literacy or policy change in margin lending and better survey questionnaire be designed to assess the income level of industry. Overall the study provides the guidelines for financial planner, adviser as well as government to assess the risk appetite of the potential investor and customize the financial product according to their risk-bearing potential.

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