Determinants of Relative Risk Aversion: The case of Thai High Net Worth Investor

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Abstract

To add to the empirical evidence of the relationship between wealth and relative risk aversion, this paper aims to study the proportion of risky assets holding for a special group of investors who are considered as High Net Worth Investors (HNWs) in Thailand and the characteristics of investors that effect the proportion of risky assets holding. The data are collected from High Net Worth Investors in order to determine the proportion of risky asset holding and their characteristics. OLS technique is utilized to find significant relationships among variables, and the mean difference test is also used to compare average proportional risky assets holding among sample characteristics. Results point to decreasing relative risk aversion and the demographic characteristics of age, sex, income, and occupation related to weight of risky assets in portfolio. When the definition of wealth is defined to be either only financial assets or financial assets less value of debt from total aggregated wealth, the findings on relative risk aversion were also presented showing decreasing relative risk aversion across investors.

Keywords: *Relative Risk Aversion, Demographics, High Net Worth Investor, Thailand*

Introduction

Household wealth in Thailand increased 8.2% from 2017 to 2018 while a number of HNWs distributed less than 0.8% of wealth range from total population, and the HNWs group held the wealth of more than of 66.9% of the total country's wealth. Then, the wealth management industry in Thailand also beneficially received an expansion pool of HNWs (Bangkok Post Online

Reporters, 2018). The group of HNWs need financial planning from advisors who show strategy for financial goals in areas of wealth accumulation, wealth preservation and wealth distribution through overall investment strategies. The financial advisor has to provide a portfolio strategy which supported the investment goals of clients, but the misallocation is an issue of HNWs' investment philosophy purpose (Mayer & Levy, 2003). The misallocation may result from investor's clarifications of their needs to advisors since they would normally construct actual portfolios differing from the way they say they would like to allocate assets. Thus, determination of actual structure of portfolio and risk behavior from the pattern of demographic data can be examined in terms of risk aversion and asset allocation better than merely asking investors to respond (Riley & Chow, 1992).

The studies of risk aversion and asset allocation provided mixed results of decreasing relative risk aversion (DRRA), increasing relative risk aversion (IRRA) and constant relative risk aversion (CRRA) since the sample was different based on demographics and countries; and each study defined wealth and type of risky and riskless assets differently. Tobin (1958) illustrated the portfolio theorem and explained the characteristic of a riskless asset was short-term Treasury Bills (T-Bills) because of no changes in the price risk. Nonetheless, the argument of riskless asset type was discussed upon the relevance of price change risk. Thus, this study classifies the riskless assets that provided the free relevance of uncertainty beyond the riskless proxy. Moreover, wealth is defined by the only summation of both financial assets and non-financial assets investment according to Cohn, Lewellen, Lease and Schlarbaum (1975). The investigation in this study presents DRRA for HNWs even if the definitions of wealth are adjusted to be only financial assets or financial assets less the value of debt. [Lease, Lewellen, & Schlarbaum, 1974; Cohn et. al, 1975]

Since, most literature provided the less context of Thai investor risk aversion, and study in the general group of investors, this will add more evidence to Thai HNWs and will possibly fill the gap of classification of asset types and wealth used in the specification of risk aversion. Moreover, this study aims to describe the risk-aversion type of Thai HNWs from demographic data to support the financial advisor who services this HNWs group and product manager who tries to find the type of product match to the group of investor to construct their portfolio for a lower chance of misallocation. Meanwhile, this study also attempts to

investigate empirically the effect of wealth on the proportion of individual portfolios allocation to risky assets together with demographic characteristics. Lastly, this also helps to support the wealth management industry in Thailand from the rapid growth of household wealth, especially for the group of HNWs.

This study is organized as follows: section 2 reviews literature regarding the study of risk aversion. Section 3 discusses the theoretical framework and describes the hypothesis of risk aversion from data of wealth, assets, and demographics. Section 4 classifies the data and methodology used in this study, as well as classifying the measurement of wealth, risky and riskless assets for risk aversion testing. In section 5, the empirical results and discussions are presented.. Finally, section 6 concludes the study with suggestions for further study and final remarks.

Literature Reviews

In *modern portfolio theory*, the investors were assumed to be rational and risk-averse in order to maximize the expected utility of wealth for compensation for uncertainty. They would construct their portfolio by combining risky and riskless assets to optimize risk and return according to their risk-preference [Markowitz, 1952; Markowitz, 1959; Tobin, 1958]. The *expected utility theorem* of return toward risk stated that the investors rank risk preference by expected utility, and they invest in a portfolio that provides a better expected utility than another (Von Neumann & Morgenstern, 1947).

To identify the risk aversion, Pratt (1964) and Arrow (1965, 1971) finally define the concept of absolute risk aversion (ARA) and relative risk aversion (RRA). ARA measured the level of risk aversion for a given level of wealth, while the RRA determines the risk aversion to a proportional loss of wealth.

Samuelson (1967, 1969) solved for the investment decisions and found portfolio choice was not independent of wealth which indicates the CRRA at all levels of risk. Merton (1969) also derived the portfolio selection under uncertainty under two assets of separation theorem which estimates the constant absolute and relative risk aversion.

Arrow (1971) theoretically proved that IRRA was the most favorable, and even his empirical studies presented relative risk aversion related to wealth as being almost constant (CRRA). However, some of the empirical studies on the cross-sectional data provide mixed results of relative risk aversion pattern when controlling for demographics. The cross-sectional analysis was the best method to illustrate wealth elasticity of combining assets according to its risk. Friend (1973) provided the result of risk aversion analysis which made an argument that investors increase their non-riskless asset class with wealth, or they behaved in the form of DRRA if their characteristics (age, occupation, employment, status, region, education, and size of family) were held constant. Cohn et. al. (1975) used a randomly mailed questionnaire survey to investigate the wealth effect on the proportions of risky assets in the investors' portfolio, and their results found strong evidence DRRA of investor. In the same year, Friend and Blume (1975) extended the relationship between the theory of expected utility and wealth. Their work concluded that investors were averaging CRRA by treating housing as a riskless asset and controlling age, education, income, and occupation as socioeconomic characteristics unless their finding is DRRA. They also found investors required a larger premium to hold the risky assets than their willingness when they were assumed constant proportional risk. Their result was supported by Landskroner (1977) who analyzed the risk aversion of individuals with the similar data to fill the gap of previous studies by empirically extending it to occupation and industry classes. In addition, the high RRA level was found in salaries of professionals and managers, while the low relative risk aversion groups were self-employed and labored for occupation grouping. If the sample was grouped by industry classes, he found high relative risk aversion in the class of real estate, construction, and government; while low levels were in services and trade.

Bajtelsmit and Bernasek (1996) summarized the logical reasons of level for risk aversion between women and men were different from wealth, income, and employment; and the women hold the smaller proportion of risky assets in their portfolios relative to men. Moreover, Schooley and Worden (1996) exhibited DRRA and individual investors' risky asset investment related to the socioeconomic variables as income, employment, race, gender, stage of life cycle, economic expectation, and risk-taking attitude. Moreover, Schieber and Shoven (1996) mentioned from their findings that the investor is DRRA since they normally have not adjusted their portfolio

investment in the period of stock prices rapidly rising. The evidence of DRRA was also investigated from Jianakoplos and Bernasek (1998) who used the sample in the U.S. to find the risk aversion of investor which focused on gender differences. They found that both male and female are DRRA, but women have the lower DRRA compared to men since woman have a lower level of wealth. In addition, the risk aversion level is also influenced by age, race, marital status and family size from their finding.

Cohen and Einav (2007) exhibited CRRA by selecting an Israel sample, and they also found demographic variables as gender and age are also effected the pattern of relative risk aversion. The study of Harrison, Lau and Rutström (2007) also investigated that CRRA is a popular characteristic of risk attitude of individuals in the Dutch sample when inputting the significant socio-demographics of age, gender and education. For the Taiwan sample, DRRA is estimated since the household with higher assets is less risk averse compared to those who have low total assets, controlled by age, gender, education, marital status, occupation and family size as the demographic effects (Lin, 2009). Also, the risk of investors increases with wealth proportionally (DRRA) from the portfolio composition in the U.S. household sample while it decreases with age (Bucciol and Miniaci, 2011). Nevertheless, Dohmen, Falk, Huffman, Sunde, Schupp and Wagner 2011) used age, gender and parental background as the economic impact to the willingness of individuals to take the risk of paying lottery choices in the German context. Their investigation showed that the relative risk averse of sample is mostly constant (CRRA).

The primary research study in Thailand about risk aversion was found by Hardeweg, Menkhoff, and Waibel (2013). Their investigation indicated that positive relative risk aversion (DRRA) was exhibited for the sample of individuals in the rural Thailand in the decision making of buying lottery tickets by controlling for age, income, and employment. Wei, Wu and Zhang (2018) studied the portfolio choice in China, they found the DRRA and the group of high wealth sample can find higher returns from holding risky assets compared to the low wealth group.

From the survey of literature, the conclusion can be drawn that the magnitude of RRA, it was respect to wealth, or demographic characteristics. The model and framework in the next section presented the calculation of risk aversion dimensions for the group of households. This study would help to explain some of the inconsistent investigations and fill gaps of previous studies.

Theoretical Model, Conceptual Framework and hypothesis

The primary model of estimation the risk aversion coefficient and conditions can be firstly described by the utility function of Von Neumann and Morgenstern (1947). They stated that the household utility function is concave which was given by $U(w)$, where U is the individual utility function and w is individual's wealth. Then, Pratt (1964) and Arrow (1965, 1971) denoted ARA or $R_A(w)$ which is equal to $\left(-\dfrac{U''(w)}{U'(w)}\right)$ and RRA or $R_R(w)$ which is equal to $\left(-w\dfrac{U''(w)}{U'(w)}\right)$.

RRA is the measurement which is directly related to an individual's insistence on favorable odds when putting some portion of wealth at risk which is a more appropriate way to measure the individual risk aversion (Pratt ,1964). To estimate the RRA, Friend and Blume (1975)'s model is normally utilized, and it is estimated by maximizing the individual's expected utility function from the investment choice between risky and riskless assets. They generalized the proportion of portfolio invested in risky assets (α) as the following:

$$\alpha = \left[\frac{E(r_m - r_f)}{\sigma^2(r_m)}\right] \cdot \left[\frac{1}{(1-t)(1-h)C}\right] - \left[\frac{h}{1-h}\beta_{h,m}\right] \tag{1}$$

where: r_m is the rate of return on the risky marketable assets, r_f is the rate of return on the riskless assets, $\sigma^2(r_m)$ is the variance of market portfolio of risky assets, t is the individual's tax rate, h is the ratio of individual's human capital to total net wealth, $\beta_{h,m}$ is the ratio of the covariance of r_m and the return on human capital (r_h) to σ_m^2, and C is the measurement of relative risk aversion by Pratt (1964) which is described similarly to Eq. (2) as follows

$$C = w\left[\frac{(-U'')(w)}{U'(w)}\right] \tag{2}$$

Then, the market price of risk equilibrium, and the first part of Eq. (3) is simplified to **MRP** or the market price of risk which is also assumed to be constant across individual. The simple version of Eq. (3) is

$$(1-t)(1-h)\alpha = [MRP] \cdot \left[\frac{1}{C}\right] - \left[\frac{h}{1-h}\beta_{h,m}\right] \tag{3}$$

Since C is a function of total net wealth (w), forming the measurement of risk aversion by Pratt (1964). Also, the studies of Fama and Schwert (1977) and Liberman (1980) empirically presented that $\beta_{h,m}$ nearly closes to zero, such that the last part of Eq. (3) will be eliminated from the equation (Schooley & Worden, 1996; and Bellante & Green, 2004). Also, the variables can

be collected from previous literatures of significant socio-demographic that show the unimportance of t and h to α which is not different from the simpler model in Eq. (4) that do not contain the information of human capital and tax. (Morin & Suarez,1983; and Bellante & Green, 2004).

$$\alpha = f(w, V) \tag{4}$$

where: V is the group of other variables besides wealth (w) which is estimated to influence the portfolio allocation between risky and riskless proportion. The Eq. (5) can express the estimation purpose of risk aversion by expanding V from Eq. (4) which examines the factors that explain variables of RRA measurement from asset allocation.

$$\alpha_i = \hat{\beta}_0 + \hat{\beta}_1 \ln(w) + \Sigma_i \hat{\delta}_1 D_{AGE_i} + \Sigma_i \hat{\delta}_2 D_{SEX_i} + \Sigma_i \hat{\delta}_3 D_{STATUS_i} + \Sigma_i \hat{\delta}_4 D_{INC_i} + \Sigma_i \hat{\delta}_5 D_{EUD_i} + \Sigma_i \hat{\delta}_6 D_{OCC_i} + \Sigma_i \hat{\delta}_7 D_{LOCATION_i} + + \Sigma_i \hat{\delta}_8 D_{RELIGION} + \Sigma_i \hat{\delta}_9 D_{HEALTH_i} + \Sigma_i \hat{\delta}_{10} D_{BG_i} + \hat{\gamma}_1 R_{DEP_i} + \hat{\gamma}_2 R_{INF_i} + + \hat{\gamma}_3 R_{ReInc_i} + \hat{\varepsilon}_i \tag{5}$$

where $\hat{\beta}_0$ is intercept, $\ln(w)$ is log of net wealth, D_{AGE_i} is dummy variable equal to 1 for below 21 (DAGE1), 2 for age between 21-34 (DAGE2), 3 for age between 35-44 (DAGE3), 4 for age between 45-54 (DAGE4), 5 for age between 55-64 (DAGE5) and 0 for otherwise as 65 onward respectively; D_{SEX_i} is a dummy variable equal to one for male person (DMALE); D_{STATUS_i} is dummy variable of marital status of married (DSTATUS1), unmarried (DSTATUS2), and widowed; D_{INC_i} is dummy of annual income which is from 1 to 7 for the annual income in term of baht respectively for below 150,000 Baht (DINCOME1), 150,000-300,000 Baht (DINCOME2), 300,001-500,000 Baht (DINCOME3), 500,001-750,000 Baht (DINCOME4), 750,001-1,000,000 Baht (DINCOME5), 1,000,001-2,000,000 Baht (DINCOME6), 2,000,001-4,000,000 Baht (DINCOME7) and equal to 0 for above 4,000,000 Baht; D_{EUD_i} is dummy variable equal to 1 if the level of education is less than high school (DEDU1), 2 for high school level (DEDU2), 3 for Bachelor Degree (DEDU3) and equal to 0 for Master degree and above; D_{OCC_i} is dummy variables equal to 1 for clerical, sales and services (DOCC1), 2 for non-employed group (DOCC2), 3 for professional and technical group (DOCC3), and equal to 0 for managerial and proprietor; $D_{LOCATION_i}$ is dummy variable equal to one for person who lives in Bangkok Metropolitan (DLOCATION1), 2 for person who lives in central region besides Bangkok Metropolitan (DLOCATION2), and 0 for other region; $D_{RELIGION_i}$ is dummy variable equal to 1 for Buddhism (DRELI1), 2 for Christianity (DRELI2), and 0 for Islam; D_{HEALTH_i} is dummy variable equal to 1 if a person defines his health status

as good health (DHEALTH1), 2 for fair health (DHEALTH2) and 0 for poor health; D_{BG_i} is dummy variable equal to 1 if parent background includes completing high school and above (DEDUB), R_{DEP_i} is valued from 0 to 10 to indicate the expectation of economy for major depression within 10 years which 0 is almost no risk and 10 is very great risk (ATTITUDE1), R_{INF_i} is valued from 1 to 10 to indicate the expectation of economy for double digit inflation during the next 10 years where 0 is almost no risk and 10 is very great risk (ATTITUDE2), R_{REInc_i} is valued from 1 to 10 to indicate the expectation of adequacy of retirement income where 0 is almost inadequate and 10 is very satisfactory (ATTITUDE3), and $\hat{\varepsilon}_i$ is an error term. The conceptual framework is also presented in Figure 1.

From Eq. (9)[*], the main null hypothesis for this study is RRA of individual's portfolio is constant (H$_0$1: $\hat{\beta}_1 = 0$) or the RRA is not related to wealth (w). According to portfolio theory of Markowitz (1952) and utility function of Von Neumann & Morgenstern (1947), the risk-averse investor will buy at least a little bit of risky assets in portfolio and their utility function is concave such that increasing relative risk aversion (IRRA) is hypothesized. Also, as mentioned in the literature, various studies presented the effect of socio-demographics and attitudes regarding the economy on the proportion of risky assets to wealth which were included as controlled variables. This study then proposed to investigate such relationships and hypothesized that age, sex, marital status, annual income, education, occupation, location, religion, health status, parental background, attitudes toward risk of depression and of inflation have no significant relationship to the proportion of risky asset in portfolio (H$_0$2 - H$_0$13).

Data and Methodology

This study is an investigation of individual investor behavior which is classified as HNWs according to SEC. So, the data is obtained based on a questionnaire survey among HNWs. The survey is conducted among HNWs randomly selected with the self-clarification of HNWs qualifications according to SEC. If the sample is not qualified as HNWs, it is cut out from this study. Thus, this study obtains totally 154 samples[1].

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[*]Race is not included in the model since this study focus on only Thai investos.

The questionnaire contained 4 sections. The first section is the qualification of HNWs according to SEC. According to study of Cohn et. al (1975), Schooley and Worden (1996), and Lease et. al. (1974), the second and third sections sought the information of demographic characteristics and wealth which are gathered for all for both real and financial assets, and liabilities. The last section seeks to find the investment attitudes of the sample toward expectations of economy and assets categories by using 10 Likert scale to measure attitudes of economic risk over 10 years.

Regarding the theoretical framework of RRA, the important part was to measure the proportion of risky assets to total wealth because misidentification of risky assets lead to change in type of RRA. Thus, this study is limited by the definition of the type of assets and wealth measurement as follows: First, the riskless asset is discussed. Normally, capital market theory and modern portfolio theory defined short-term Treasury Bills (T-Bills) as a proxy of riskless asset (Tobin, 1958) but there are any types of asset that could be satisfied since those assets are not complete from the protection of change in price. Thereby, short-term T-Bills also are not riskless assets but they provided only a free relevance of uncertainty. Hence, assets would be classified as riskless assets as similar as short-term T-bills if those assets provided a free of relevant uncertainty Cohn et. al (1975). Thus, this study establishes alternative classification of riskless assets to resolve the appropriate definition of riskless assets which included proxy of riskless assets and the assets that provided no relevance of uncertainty which consisted of saving account, checking account, fixed deposit, Certificate of Deposit, Cash value of Life-insurance, other assets, and non-financial assets as personal residence and personal property, Promissory Note, Bill of Exchange, Government bond, Corporate Bonds, Preferred Stock, and Money market & Fixed income funds.

To evaluate another variable, wealth is also defined by summation of risky and riskless assets as financial assets, and the value of personal residences, personal properties, and other non-financial assets in order to measure the level of financial wealth in a sample's portfolio (Cohn et. al, 1975).

Thus, α_i as a dependent variable in this study would be measured on the percentage of numerator as classification of risky assets investment and using denominator as wealth measurement with others as independent variables. Then, the OLS regression is first used to analyze the relationship

between proportion of risky assets and the level of wealth, and such other independent variables based on Eq. (9). Also, the significant independent variables for demographic data which relates to the α_i would be continued to compare mean differences among the group of sample by utilization of the mean difference test to examine and compare means of proportion of risky asset holding among the group of demographic variables.

Figure 1: Conceptual Framework
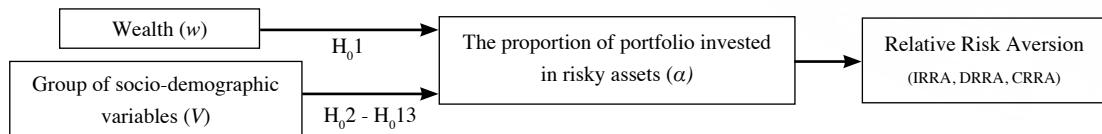
Results and discussion

The characteristic of the data sample and the means of holding wealth, riskless assets, risky assets and the average of proportional of risky asset in portfolio are presented in Table 1.

Table 1 Asset Portfolio Composition

	Type of Asset*	Mean	Percentage Having Zero holding	% of risky asset	% of total asset
Common_Stock	R	5,504,705.84	57.90%	14.99%	6.67%
Preferred_Stock	F	-	100.00%	0.00%	0.00%
Equity_in_own_firm	R	6,032,425.32	76.62%	16.43%	7.31%
Equity_Fund	R	4,266,292.21	27.92%	11.62%	5.17%
Index_Fund	R	403,175.32	72.73%	1.10%	0.49%
Saving_Act	F	3,010,891.46	0.65%	8.20%	3.65%
Checking_Act	F	8,425.64	72.73%	0.02%	0.01%
Fixed_Act	F	1,898,896.10	61.04%	5.17%	2.30%
CDs	F	194.81	99.35%	0.00%	0.00%
PN	F	-	100.00%	0.00%	0.00%
BE	F	-	100.00%	0.00%	0.00%
Money_market_funds	F	8,392,161.79	13.64%	22.86%	10.17%
Warrant_Put_Calls	R	10,500.00	97.40%	0.03%	0.01%

	Type of Asset*	Mean	Percentage Having Zero holding	% of risky asset	% of total asset
GBond	F	757,272.73	73.38%	2.06%	0.92%
CBond	F	2,362,337.66	53.25%	6.43%	2.86%
Fixed_income_funds	F	6,970,707.79	27.27%	18.98%	8.44%
Commodity_Futures	R	13,948.05	96.75%	0.04%	0.02%
Balanced_funds	R	3,241,180.52	31.17%	8.83%	3.93%
Personal_Residence	F	16,811,948.05	11.69%	45.79%	20.36%
Other_Real_Estate	R	12,964,285.71	62.34%	35.31%	15.70%
Specialty_funds	R	1,650,920.78	58.44%	4.50%	2.00%
Personal_Property	F	3,389,733.77	2.60%	9.23%	4.11%
Precious_Mental	R	1,247,961.04	38.96%	3.40%	1.51%
PensionAccount_PVD	R	1,218,282.47	61.69%	3.32%	1.48%
CV_insurance	F	2,048,920.71	29.87%	5.58%	2.48%
Loan_to_individual	R	163,974.03	88.96%	0.45%	0.20%
Other_Assets	F	187,727.27	90.26%	0.51%	0.23%
Def1_total_wealth	-	82,556,869.08	-	224.84%	100.00%
Class2_riskless	-	45,839,217.79	-	124.84%	55.52%
Risky asset	-	36,717,651.30	-	100.00%	44.48%

*F is riskless asset, and R is risky asset

The data show that the mean of holding risky assets and riskless assets were 44.48% and 55.52% respectively, and the mean of total wealth was around 82 million baht. The type of riskless asset holding is personal residence which may be considered as non-investment assets while the two highest weight of risky assets are other real estate asset and equity in own firm which are considered to non-open market capital and high chance of market imperfection.

Table 2 Data Characteristic and Asset Holding

Total Sample size = 154		Sample Mean Holding (Baht)			
		Wealth	Riskless Assets	Risky Assets	% of risky asset α_i
Age	Under 21 (1 ,6%)	63,723,500.00	10,241,500.00	53,482,000.00	84.00%
	21 - 34 (8 ,5.2%)	31,192,500.00	13,431,250.00	17,761,250.00	43.12%
	35 - 44 (19 ,12.3%)	70,784,831.58	41,294,410.53	29,490,421.05	37.26%
	45 - 54 (33 ,21.4%)	79,182,261.24	43,854,337.00	35,327,924.24	35.27%
	55 - 64 (44 ,28.6%)	105,748,691.40	54,351,877.77	51,396,813.64	41.00%
	65 and over (49 ,31.8%)	77,339,295.84	47,311,806.04	30,027,489.80	34.47%
Sex	male (67, 43.5%)	77,881,672.27	35,249,291.67	42,632,380.60	47.16%
	Female (87, 56.5%)	86,157,308.01	53,994,678.13	32,162,629.89	30.28%
Status	Married (95 ,61.7%)	91,465,694.04	49,513,875.09	41,951,818.95	41.84%
	Unmarried (54 ,35.1%)	71,804,924.17	41,755,563.06	30,049,361.11	30.57%
	Widowed (5 ,3.2%)	29,410,200.00	20,124,200.00	9,286,000.00	33.60%
Income	Under 150,000 (13 ,8.4%)	39,048,230.77	21,400,846.15	17,647,384.62	46.31%
	150,000–300,000 (4 ,2.6%)	107,640,000.00	64,190,000.00	43,450,000.00	38.50%
	300,001-500,000 (10 ,6.5%)	57,846,600.00	46,943,150.00	10,903,450.00	24.30%
	500,001-750,000 (13 ,8.4%)	66,935,307.69	41,471,769.23	25,463,538.46	31.00%
	750,001-1,000,000 (16 ,10.4%)	51,107,168.75	33,924,493.75	17,182,675.00	29.81%
	1,000,001-2,000,000 (16 ,10.4%)	61,089,531.25	33,311,843.75	27,777,687.50	41.87%
	2,000,001-4,000,000 (31 ,20.1%)	65,235,710.35	40,247,565.19	24,988,145.16	34.00%
	4,000,001 and above (51 ,33.1%)	127,637,090.50	62,593,100.35	65,043,990.20	42.96%
Education	Less than High School (2 ,1.3%)	71,617,500.00	43,542,500.00	28,075,000.00	38.00%
	High School (4 ,2.6%)	301,609,875.00	179,857,375.00	121,752,500.00	32.00%
	Bachelor Degree (69 ,44.8%)	71,196,628.93	44,671,986.90	26,524,642.03	34.54%
	Master Degree or Better (79 ,51.3%)	81,664,758.77	40,131,113.20	41,533,645.57	40.59%
Occupation	Clerical, Sales and Services (16, 10.4%)	51,689,150.00	29,371,650.00	22,317,500.00	43.69%
	Non-employed (61, 39.6%)	88,214,216.39	55,080,768.85	33,133,447.54	34.52%
	Professional and Technical (30, 19.5%)	56,217,110.73	32,126,977.40	24,090,133.33	35.33%
	Managerial and Proprietor (47, 30.5%)	102,535,125.90	48,203,338.66	54,331,787.23	41.04%
Location	Bangkok Metropolitan (149 ,96.8%)	82,528,019.05	46,154,084.15	36,373,934.90	37.23%
	Central (besides Bangkok) (4 ,2.6%)	76,843,250.00	28,542,750.00	48,300,500.00	52.25%
	Other (1 ,0.6%)	109,710,000.00	68,110,000.00	41,600,000.00	38.00%

Total Sample size = 154		Sample Mean Holding (Baht)			
		Wealth	Riskless Assets	Risky Assets	% of risky asset α_i
Religion	Buddhism (141 ,91.6%)	85,654,520.70	47,148,958.29	38,505,562.41	38.01%
	Christianity (9 ,5.8%)	44,510,268.89	32,058,491.11	12,451,777.78	28.11%
	Islam (4 ,2.6%)	58,969,500.00	30,677,500.00	28,292,000.00	45.25%
Health	Good Health (106 ,68.8%)	86,890,375.84	46,262,689.05	40,627,686.79	39.09%
	Fair Health (37 ,24%)	67,739,783.78	41,622,689.19	26,117,094.59	32.97%
	Poor Health (11 ,7.1%)	90,636,909.09	54,014,090.91	36,622,818.18	39.09%
Education Background	Complete High-School and above (101 ,65.6%)	76,947,296.31	38,897,639.87	38,049,656.44	40.27%
	Below High-School (53 ,34.4%)	93,246,809.66	59,067,507.77	34,179,301.89	35.28%
Race	Thai (154, 100%)	82,556,869.08	45,839,217.79	36,717,651.30	37.67%

Table 2 describes the demographic characteristics with the risky assets holding of the sample. The observed information, the mean of holding risky assets is different among the characteristics of the sample. Nonetheless, the large differences of means among group characteristics between the highest and lowest holding occur in age (49.53%), sex (16.88%), income (22.01%). For different age group, those who are under 21 years old hold the highest percentage of risky asset which is 84.00% of total assets. Males tend to hold a higher portion of risky assets than females. Married status holds the highest portion of risky assets of 41.84% compared to other status among marriage status. For different income groups, trends of proportion of risky asset is unclear because the highest is income Under 150,000 Baht at 46.31% and the second is highest group of income which is 4,000,000 Baht and above at 34.00%. Group of master degree and above for the education is highest at 40.49% while the lowest is high school level. For occupation group, Clerical, Sales and Services is observed 43.69% of holding risky asset which is the largest amount compared to others and the unemployment group is observed for the lowest risky assets holding. The sample who live in Central areas besides Bangkok Metropolitan hold the highest percentage of risky assets at 52.25% but notice that most of the sample lives in Bangkok Metropolitan. Among religion groups, the sample shows Islam has the biggest proportion of risky assets in portfolio compared to Christianity and Buddhism. Health status does not show the

differentiation of mean among good, fair, and poor health. Those who have parents completing high school and above tend to hold a higher portion of risky assets than another group. Lastly, all of the sample averaged holding risky asset at 37.67%.

When the OLS linear model is first estimated, the regression result is also described in table 3 with non-problem of heteroscedasticity, the variance of error terms was constant.

Table 3 OLS Estimation on Eq. (5)

	OLS				Coefficient	Prob.	
	Coefficient	Prob.					
C	-0.2607	0.6636		DEDU1	0.0605	0.7506	
Total Wealth (lnw)	0.0773	0.0134	*	DEDU2	0.0225	0.8831	
DAGE1	-0.2880	0.2189		DEDU3	0.0943	0.5467	
DAGE2	-0.4511	0.0481	*	DOCC1	-0.1309	0.0703	
DAGE3	-0.4524	0.0474	*	DOCC2	-0.1830	0.0103	*
DAGE4	-0.3940	0.0859		DOCC3	-0.0867	0.2174	
DAGE5	-0.4016	0.0876		DLOCATION1	0.0640	0.6558	
DMALE	0.1484	0.0002	*	DLOCATION2	-0.1071	0.6246	
DSTATUS1	0.0087	0.9353		DRELI1	0.1037	0.4604	
DSTATUS2	-0.0453	0.6677		DRELI2	-0.1037	0.1758	
DINCOME1	-0.1680	0.1925		DHEALTH1	-0.0255	0.7437	
DINCOME2	-0.2167	0.0200	*	DHEALTH2	-0.0922	0.1034	
DINCOME3	-0.1347	0.1206		DEDUB	-0.0036	0.9391	
DINCOME4	-0.1336	0.1043		ATTITUDE1	-0.0158	0.1489	
DINCOME5	-0.0378	0.6851		ATTITUDE2	-0.0095	0.3777	
DINCOME6	-0.1536	0.0592		ATTITUDE3	-0.0082	0.4497	
DINCOME7	-0.1370	0.1192					
R^2						39.55%	
Heteroskedasticity Test: Breusch-Pagan-Godfrey						0.6834	

*Significant at 0.05 level

Based on the results, the regression coefficient suggests that the HNWs exhibit a pattern of decreasing relative risk aversion (DRRA). The positive coefficient of wealth to the proportion of risky asset portfolio was 0.0773 at 5% significant level. This positive coefficient implies an increase of wealth of HNWs related to a higher proportion of risky assets in portfolio on average or HNWs with higher wealth had lower risk averse than lower wealth. The hypothesis of CRRA is rejected, and the hypothesis of DRRA therefore is consistently supported. This result was supported by the study of Cohn. et.al (1975), Morin & Suarez (1983), Carroll (2000) who separated the study of RRA to the upper wealth class and found DRRA for this group. Carroll (2000) provided alternative reasons of holding the risky assets of richer. First, the richer group chooses risky assets with expected high return portfolio to received reward of higher return and therefore ends up being richer than lower wealth group on the average. Next, market imperfection required large self-finance and large minimum scale of investment, thus portfolios of higher wealth would be heavily weighted on risky assets of non-open capital market such as equity in owned firms or real estate. This reason s parallel to the descriptive results that the sample holds, on average these two assets were at 51.74% of total risky assets and 23.01% of total assets, see also Table 1 for details.

The results from Table 3 also show that age, sex, income and occupation effects in proportion to risky assets which were similar to the study of Hardeweg et. al. (2013). These results are also approximately similar to data in Table 2 of demographic data and risky asset holdings, omitted for occupation variables. From OLS estimation, the dummy variable of age 35-44 and 45-54 has the negative coefficient statically significant, while the mean of holding risky assets in portfolio of these two group are not significantly different from other age group. The results support investigations of Morin and Suarez (1983) that none of the age variables are not significantly different from each other for the upper class wealth sample besides it has an interaction of wealth effect. However, the younger group who was lower 45 years old had the higher mean of proportional of risky assets in portfolio, even if it is not significant. This factor is similar to occupation variable as dummy of professional and technical which is significantly related to proportion of risky assets, but its mean is not different from others statistically.

Table 4 presents the mean comparison of percentage of risk assets holding for variables that the coefficients are statistically significant from the above regression. The investment behavior in risky assets between male and female is presented. The investigations show that males have positive coefficient to the proportion of risk asset holding and the mean of risky asset proportion is 0.4716 which significantly higher than female at 0.3028 on average. This result is anticipated because females are willing to take less risk in every context and males were less risk averse than female (Dohmen et al., 2011; and Lin, 2009). For the next factor as income, the results describe the income range of 300,001 -500,000 Baht is negatively related to the proportion of wealth, and its average mean proportion of risky asset holding is also at 0.2430 which is lower than other income group at 0.3855. This result implies that the higher risk aversion of the sample group which has an income at 300,001 – 500,000 Baht since 60% of this range is non-employed group since the older retired group allocated less of risky assets in portfolio (Schooley & Worden, 1996).

Table 4 Test of Mean Difference

Variable	Group	Mean	Sig.	
Age	Age 35 - 44	0.3726	0.9460	
	Other Age Group	0.3767		
	Age 45 - 54	0.3527	0.4830	
	Other Age Group	0.3826		
	Age under 45	0.396	0.7150	
	Age 45 up	0.3733		
Sex	Male	0.4716	0.0000	*
	Female	0.3028		
Occupation	Professional and technical	0.3533	0.5740	
	Others	0.3818		
Income	300,0001 - 500,000 Baht	0.2430	0.0080	*
	Others	0.3855		

*Significant difference across groups at 0.05 level

Lastly, Table 5 presents the result of the robustness checks regarding the classification of risky assets. The Eq. (10) is re-estimated but the definitions of wealth are changed to (A) only financial assets were employed as wealth which includes total wealth of risky and riskless assets, subtracting the value of personal residences, personal properties, and other non-financial assets, and (B) aggregation of the financial assets less the value of consumption assets (personal residences, personal properties, and other non-financial assets), and value of debt outstanding. (Cohn et. al, 1975; Lease et. al.,1974). The estimation results are consistent with decreasing risk aversion of HNWs when demographic variables are controlled. The results are exhibited in table 6 and present positive coefficient of wealth to the proportion of risky asset portfolio was 0.3345 and 0.3430 at 5% significant level for additional of wealth definition (A) and (B) respectively.

Table 5 Robustness check OLS estimation on Eq. (5)

OLS													
Wealth (1)						Wealth (2)							
	Coefficient	Prob.		Coefficient	Prob.			Coefficient	Prob.			Coefficient	Prob.
C	-4.5764	0.0001	DEDU1	-0.0305	0.9386		C	-4.7289	0.0001		DEDU1	-0.0438	0.9141
(lnw)	0.3345	0.0000 *	DEDU2	-0.1925	0.5475		(lnw)	0.3430	0.0000 *		DEDU2	-0.2059	0.5302
DAGE1	0.0498	0.9184	DEDU3	0.0093	0.9773		DAGE1	0.0106	0.9831		DEDU3	-0.0159	0.9622
DAGE2	-0.4733	0.3190 *	DOCC1	-0.2994	0.0452 *		DAGE2	-0.4729	0.3317		DOCC1	-0.3050	0.0467 *
DAGE3	-0.4409	0.3525 *	DOCC2	-0.2823	0.0553		DAGE3	-0.4273	0.3795		DOCC2	-0.3066	0.0424 *
DAGE4	-0.3126	0.5125	DOCC3	-0.1113	0.4455		DAGE4	-0.2953	0.5460		DOCC3	-0.1455	0.3308
DAGE5	-0.3060	0.5317	DLOCATION1	-0.0929	0.7552		DAGE5	-0.2963	0.5548		DLOCATION1	-0.0792	0.7954
DMALE	0.2528	0.0018 *	DLOCATION2	-0.1201	0.7923		DMALE	0.2520	0.0024 *		DLOCATION2	-0.1417	0.7618
DSTATUS1	-0.0972	0.6621	DRELI1	0.3919	0.1812		DSTATUS1	-0.0361	0.8742		DRELI1	0.3822	0.2032
DSTATUS2	-0.1376	0.5320	DRELI2	-0.1625	0.3077		DSTATUS2	-0.0756	0.7376		DRELI2	-0.1855	0.2566
DINCOME1	-0.4912	0.0662	DHEALTH1	-0.1520	0.3526		DINCOME1	-0.5035	0.0661		DHEALTH1	-0.1501	0.3706
DINCOME2	-0.3892	0.0443 *	DHEALTH2	-0.2245	0.0572		DINCOME2	-0.4126	0.0378 *		DHEALTH2	-0.2376	0.0497 *
DINCOME3	-0.2024	0.2613	DEDUB	-0.0467	0.6333		DINCOME3	-0.2034	0.2707		DEDUB	-0.0411	0.6820
DINCOME4	-0.2318	0.1745	ATTITUDE1	-0.0189	0.4088		DINCOME4	-0.2429	0.1651		ATTITUDE1	-0.0245	0.2971
DINCOME5	-0.0156	0.9364	ATTITUDE2	0.0147	0.5108		DINCOME5	-0.0037	0.9854		ATTITUDE2	0.0151	0.5092
DINCOME6	-0.3009	0.0744	ATTITUDE3	-0.0290	0.2024		DINCOME6	-0.3027	0.0801		ATTITUDE3	-0.0301	0.1962
DINCOME7	-0.4606	0.0113 *					DINCOME7	-0.4707	0.0115 *				
Heteroskedasticity Test: Breusch-Pagan-Godfrey					0.4297		Heteroskedasticity Test: Breusch-Pagan-Godfrey						0.4582
R^2					43.80%		R^2						43.74%

*Significant at 0.05 level

Conclusion, Recommendation and further study

This study analyzes data from a survey of HNW investors in order to supply additional empirical evidence of the relationship of wealth on the proportion of risky asset in portfolio. It concludes that the decreasing relative risk aversion, DRRA, is supported in the study since the result of positive coefficient of wealth to the percentage of risky asset holding in portfolio. This HNWs group on average increases the proportion of risky assets as wealth increases. This result is consistent even when the wealth is calculated on total asset holding, only financial assets, or financial asset less value of debt.

Moreover, the analysis also finds the significant impact of demographic data as age, sex, income and occupation relate to proportion of risky assets. However, statistical significance can only explain that males are less risk averse than females, and the group of sample income of 300,000–500,000 Baht is more risk averse than other income group.

The results in this study would add to the knowledge of financial advisors and product managers in understanding the structure and implication of the relative distribution of risky assets for HNWs. The average risk averse pattern of HNWs that can provide the accurate advice to them in term of portfolio construction and product types, besides only basic information of expected return since HNWs may not be truly expressing their ability to take risks. The duty of financial advisors must observe the characteristics of advisees based on demographic characteristic, behavior, investment style and wealth to serve clients. This result would help them as a guideline to perform a better service.

Nonetheless, the risk aversion of investors should be revisited because it might change overtime, and this study only assumes that proportional of risky asset related to wealth is linear which it strongly supports while some researches assumed logarithmic form. However, non-linear forms provided lower statistical significance and unusual residual pattern. [Friend & Blume, 1975; Morin & Suarez, 1983]. So, further study should employ the investigation of the change between total wealth and proportion of risky asset holding overtime by using time series or simulation. Moreover, it should be recognized that the implications of this study to the risk profile questionnaire of investors prior to investment decided. Lastly, an updated version of various type of asset categories should be examined.

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