Elucidating the Influence of Demographics and Psychological Traits on Investment Biases

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Abstract—This study explored the relationship between psychological traits, demographics and financial behavioral biases for individual investors in Taiwan stock market. By using questionnaire survey method conducted in 2010, there are 554 valid convenient samples collected to examine the determinants of three types of behavioral biases. Based on literature review, two hypothesized models are constructed and further used to evaluate the effects of big five personality traits and demographic variables on investment biases through Structural Equation Model (SEM) analysis. The results showed that investment biases of individual investors are significantly related to four personality traits as well as some demographics.

I. INTRODUCTION

TRADITIONAL finance theory is based on the efficient market hypothesis (EMH) and believes that the stock prices can completely reflect all relevant information in financial market, so that the general investors cannot earn abnormal returns by analyzing public information [13]. Until the later 1980s, some behavioral researchers found that the EMH cannot entirely explain the extraordinary phenomenon of the market and though of the investment decision were not completely rational. When investors face uncertain conditions, for benefit, they are likely to make different decisions [19] or they may follow the recommendations of professional investors or collecting the relevant information to make profit from optimal investment decisions. Though the professional investors would obtain more sufficient information, their decisions are not all completely rational due to the existence of investment biases [14], [27], [33]. These biases would consequently lead the return decline. According to prospect theory, investors will sell stock in order to realize the investment profits, but they may prefer the risks of continuing to own a stock that they would otherwise have sold if that stock is currently held for a loss that is so-called the disposition effect [28]. In some empirical research, [30] found that investors made 2.5 times realized gains than loses and proposed that the Taiwanese investors exhibit the disposition effect.

In addition to disposition effect, there are other types of investment biases. For instance, if investors overestimate their own abilities of accurate forecast, they may be regarded as overconfidence. Such as investment bias would also lead to a

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return decrease on investment. Reference [5] found that males were more overconfidence than females, and the return rate of males were causing decrease 2.65%, but only causing decrease 1.72% for females.

According to the evidence of prior empirical studies, if most of investors with strong investment biases such as disposition effect and overconfidence, it may be interfere with the entire financial market. For example, the financial market bubble in the 1990s results in the herding of mutual fund managers [9]. Generally speaking, investors with herding behavior are usually lack of confidence and professional competence to make a better investment decision so that they might take the market signs or the opinions of professional investors for the foundation of making investment decision.

Based on this, the impacts of investment biases should be the most concern of individual investors. In other words, what are the main causes of forming investment biases? Reference [12] suggested that human's behavior is formed by psychological factor and external factor, [21] indicated that investors' behavior will be affected by personality traits, interpretation of information, responses of sentiments, return and risk. There were many researches using various dimensions to deal with the measurements of personality traits, such as internal/external personality propose by [24]; investor types (i.e. BB & K model) proposed by [3] and Myers-Briggs Type Indicator (MBTI) by [22]; Big five personality traits by [8]. This study adopts Big Five personality to discuss the relationship between the personality traits and investment biases because Big Five is most common and easy to distinguish measures. In addition, this study incorporates demographic variables to reveal the influences on investment biases so that some contributive investment suggestions could be therefore derived from the research findings. In this way, we can more understand the antecedent of influence what caused investment biases.

II. METHOD

A. Hypotheses

According to the financial behavioral theory, some evidence shows the significant relationships among personality traits and financial behavioral biases. Reference [32] suggested that investors would be lack of confidence when they have anxiety traits. Therefore we infer that there is negative relationship between neuroticism and overconfidence. Besides, when investors have the trait of neuroticism, they would be anxiety, emotionally unstable and nervous. Therefore, they always sell the earning stock too early but hold losing one, and they follow friends' and professional investors' suggestions on invest that would also lead to herding. In addition, [26] found that the trait

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of extraversion was negatively associated with overconfidence. Reference [34] also indicated that the trait of optimistic has a positively relationship with overconfidence. Extraversion is used to describe the people who have the characteristics of zeal, accessibility, optimism, and volubility. Therefore, the investors with the trait seem to be prone to continue holding the loss stocks because they would believe a rise on those loss stocks.

In previous research, there has no evidence on the relationships of personality traits and investment biases [26]. The investors with the trait of openness mean that they are curiosity, fickle affection and intellectual curiosity, thus they frequently buy and sell stocks because of overconfidence [4]. The investors with the trait of agreeableness would be modesty, tolerance, and friendliness. The type of investors often makes their investment decisions relying on more market information that would lead to herding. Additionally, the investors with the trait of conscientiousness would be seriousness and excellence. The type of investors believes that their own performances in investment are better than other investors. Thus, the following hypothesis could be proposed:

Hypothesis 1: There are significant relationships among personality traits and investment biases.

On the other hand, there are some evidence of demographic variables and investment biases. For example, reference [11] indicated that females were more herding than male. From the prospect of age, elder people might have more sufficient investment experiences, and they have different ideas than younger people in investment. For educational background, [6] suggested that investors with higher education background are more overconfidence than those who have lower education level. In geographical, [1] have verified that Asians are more overconfidence than Britons. Based on these, this paper attempts to identify whether gender, age, educational background, and residential area will be associated with investment biases. The following hypothesis is thus proposed:

Hypothesis 2: Demographic variables have significant relationships with investment biases.

B. Instrument

Most studies use secondary data to perform a longitudinal analysis and construct specific indicators to identify behavioral biases in investment. However, owing to that behavior finance explores psychological attitudes of investors towards investment decisions primary data can accurately reflect the inner motivation of investors. Thus, in contrast with previous studies, which focus on detecting behavioral biases and the impacts of behavioral biases, this study performs a cross-section analysis via Structural Equation Modeling (SEM) that constructs a comprehensive path to link five types of personality traits with three proposed behavioral biases. The causal processes are represented by a series of structural equations that can be modeled graphically to facilitate the conceptualization of a theoretical framework [7]. Using SEM allows us to evaluate simultaneously the factor loadings and error variance of the measurements and to test the significance of the relationships between the latent variables of interest. However, for the consideration of the principle of parsimony,

reference [17] argued that SEM should be simplified as much as possible in order to reduce the under-identification and to improve the goodness of fit of a structural model.

The questionnaire is divided into three parts. The first part involves the measures of Big Five personality modified from [8], i.e. neuroticism, extraversion, openness, agreeableness, and conscientiousness. Each trait is regarded as a latent variable measured by 5-7 observed variables. The second part involves evaluating three proposed investment behavioral biases, i.e. disposition effect, herding, and overconfidence. The measures involving these behavioral biases are well defined in the behavioral finance and psychology literature, as well as based on the theoretical works of [10], [25], [28], [29], and [31]. Each behavioral bias is treated as a latent variable and measured by 6-7 observed items. Each item in these two parts adopts five-point Likert-scale to measure the psychological agreement of respondents. Categories for the scale ranged from strongly disagree (1) to strongly agree (5). Table I lists the measures with the reworded items. The third part is demographics of the investors, including gender, age, occupation, education level, and residential location.

For the both considerations of measurement reliability and goodness of fit of the model, the final measurement scales for each latent variable are determined that satisfy the following criterion: (a) eliminate items with communalities (item-total) lower than 0.3 [36]; (b) eliminate items with square multiple correlation (SMC) lower than 0.2; (c) eliminate items with standardized factor loadings higher than 0.95; (d) suggest the modification index (MI) provided by LISREL 8.71 package [18]. Additionally, the internal consistency, i.e. the values of Cronbach's α, are calculated by SPSS 12.0 for Windows. The corresponding composite reliability (ρ_c) for each latent variable is also calculated by the indicator of $\rho_c = (\sum \lambda_i)^2 / [(\sum \lambda_i)^2 + \sum \theta_i]$, where λ_i denotes the standardized factor loadings on latent variables, θ_i denotes the measurement errors of observed variables. The value of ρ_c that is higher than 0.6 may be represented as good construct reliability [2].

Additionally, to further assure the reliability and validity of questionnaires, there are two steps to test these measures: First, we have executed a pre-test by using 102 convenience samples collected from the security companies. Second, we conduct a confirmatory factor analysis (CFA) using 202 confirmatory samples to evaluate the constructed items. The final measures and the reliabilities of each item and composite concept (i.e. latent variables) are shown in Table I.

By using CFA to test the reliability and validity of the measures of Big Five personality traits and investment biases, we find that the goodness of fit of the Big Five personality traits (χ^2/df =1.59, CFI=0.99, GFI=0.97, AGFI=0.96, NFI=0.97, NNFI=0.99, RMSEA=0.033, SRMR=0.033, IFI=0.99) and investment biases (χ^2/df =2.21, CFI=0.97, GFI=0.97, AGFI=0.95, NFI=0.95, NNFI=0.96, RMSEA=0.047, SRMR=0.037, IFI=0.97), which all indicates reasonable model fit and composite reliability as shown in Table I. Reference [23] suggested the composite reliability must be bigger than 0.5. Besides, the questions of disposition effect needed to be revised

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TABLE I
THE INTERNAL QUALITY OF LATENT VARIABLES

Variables	Item	SMC	Cronbach α	Composite reliability
Neuroticism	N1	0.51		
	N2	0.56		
	N3	0.40	0.78	0.78
	N5	0.43		
Extraversion	E8	0.51		
	E9	0.89	0.79	0.81
	E10	0.45		
Openness	O17	0.78		
	O18	0.49	0.76	0.77
Agreeableness	A20	0.64		
	A21	0.57	0.76	0.75
Conscientiousness	C27	0.56		
	C28	0.64	0.80	0.80
	C29	0.51		
Disposition effect	D2	0.14		
	D4	0.28	0.41	0.43
	D5	0.18		
Herding	H8	0.49		
	H9	0.43		
	H10	0.40	0.74	0.74
	H11	0.34		
Overconfidence	O16	0.42		
	O17	0.61		
	O18	0.67	0.84	0.84
	O19	0.60		

for this research, others composite reliabilities are bigger than 0.7. This shows that most of the measures for the latent variables have high internal quality.

C. Data

This study adopted convenience sampling method to totally issue 810 formal questionnaires to the voluntary individual investors attending at security companies located in Taipei during Sep. 2010 to Oct. 2010. After deducting the invalid and incomplete questionnaires, 554 valid respondents have been collected, so the valid response rate is 73%. In the composition of the valid respondents, there are 273 male and 281 female, and with 29.6% are between ages 26 to 35, with 26% between ages 36 to 45, and 25.8% between age 46 to 55. These ages accounted for 81.4% of the entire sample. The education level accounted for 47% is the college graduate of the entire sample. And also, the geographical segmentation difference between 297 in the south of Taiwan and 257 in the north area.

D. Analytical Model

The study uses SEM to simultaneously estimate and test how latent variables and their measurements are related. Based on previous literature, two hypothetical structure equation models are proposed and analyzed with the LISREL 8.70 statistics package, respectively. Model I is developed to explore how the Big Five personality traits and the three behavioral biases are related. The structure equation of Model 1 is process and the

three behavioral biases are related. The structure equation of Model I is

$$\eta_i = \gamma_{ij}\xi_j + \varsigma_i, i, j = 1, 2, 3, ..., \quad (1)$$

where ξ_j denotes exogenous latent variables, i.e. demand identification; η_i denotes endogenous latent variables, i.e. searching information, evaluating alternatives, disposition effect, herding, and overconfidence; γ_{ij} denotes the regression coefficient of ξ_j on η_i; and ζ_i denotes the error variance of structure equation. The measurement equation of Model I is

$$X_i = \lambda_{xij}\xi_j + \delta_i, \quad (2)$$
$$Y_i = \lambda_{yij}\eta_j + \varepsilon_i, \quad (3)$$

where; λ_{xij} denotes the regression coefficient of X_i on ξ_j; λ_{yij} denotes the regression coefficient of Y_i on $\eta_{i,j}$; δ_i, ε_i denote measurement errors of exogenous (ξ_j) and endogenous (η_i) latent variables, respectively.

Similarly, Model II is constructed to examine how demographic variables of investors vary in various behavioral biases. This model assesses how well the exogenous observed variable forecast the endogenous latent variables, i.e. disposition effect, herding, and overconfidence. The structure equation of Model II is

$$\eta_i = \gamma_{ij}X_i + \varsigma_i, i, j = 1, 2, 3, ..., \quad (4)$$

and the measurement equation of Model 2 is only for Y_i, shown as (3).

By using maximum likelihood estimation, the fitness indices of the structure models are assessed by goodness of fit index (GFI), comparative fit index (CFI), and non-normed fit index (NNFI), where the values greater than 0.90 are regarded as acceptable. A situation in which the value of the root mean square error of approximation (RMSEA) is 0.05 or lower implies that it is a close fit. Additionally, values up to 0.08 are recognized as a reasonable error of approximation. In addition, according to the principle of parsimony, Critical N (CN) should be greater than 200 [16], parsimony normed fit index (PNFI) should be higher than 0.5, and normed chi-square (χ^2/df) should be lower than 0.3.

III. RESULTS

A. Diagnosis of Offending Estimation

The standardized coefficients of path analysis between personality traits, demographics and behavioral biases are shown in Figs. 1 and 2, respectively. In Fig. 1, we find that the values of measurement errors are positive between 0.19 and 0.88. In addition, factor loadings are shown between the values of 0.35 and 0.90; in Fig. 2, the values of measurement errors are 0.34 to 1.00 and factor loadings are 0.35 to 0.81. Thus, the hypothesized model have no the phenomenon of offending estimation. In addition, the absolute values of skewness and kurtosis for all observed items are lower than 3 and 10 (see Table II), respectively. It means that all of these measurements could be regarded as approximate normal distribution and the Maximum Likelihood method is suitable to be used to estimate the parameters in the proposed model [20].

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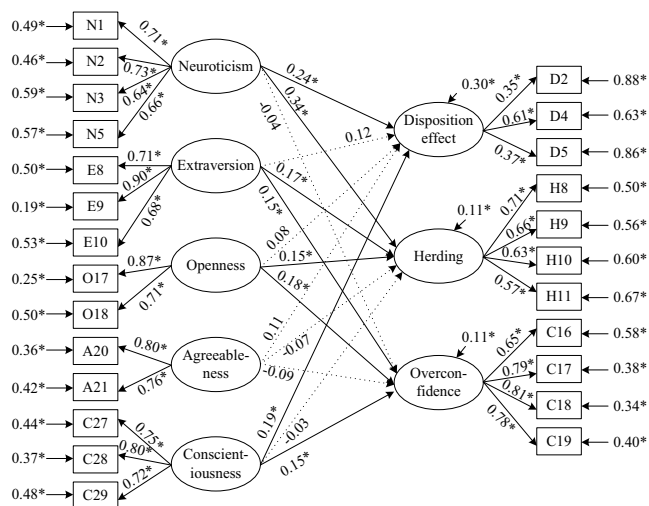International Journal of Economics and Management Engineering
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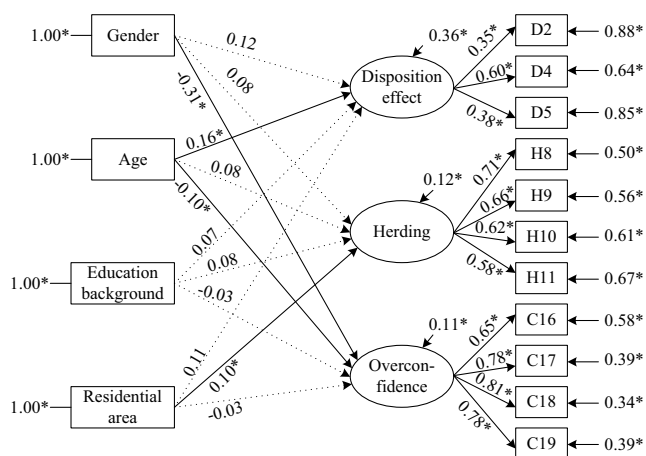Fig. 1 The structure relationship of personality traits and investment biases

Fig. 2 The relationship between investors' demographics and investment biases

B. Goodness-of-Fit Test

According to the criteria of goodness of fit suggested by [15], our model has good model fit (χ^2/df = 1.59, CFI= .98, GFI= .95, AGFI= .93, NFI= .94, NNFI= .97, RMSEA= .031, SRMR= .038 and IFI= .98). In addition, we examine goodness of fit between demographic variables and investment biases (χ^2/df = 1.59, CFI= .99, GFI= .97, AGFI= .96, NFI= .97, NNFI= .99, RMSEA= .033, SRMR= .033 and IFI= .99). It means that the structural equation models can fit will with the data.

C. Estimation of Path Parameters

In Table III, neuroticism has a positively significant relationship with disposition effect (t = 2.90, $p<.01$) and herding (t = 5.87, $p<.001$). It means that the investors with the trait of neuroticism would make profits by selling their holding stocks in advance because they are more worry about their loss of investment. This finding is also corresponding to [35]. In

addition, the type of investors will rely on the suggestions of reference group or other institutional investors because they lack of confidence on their investments.

TABLE II
THE DESCRIPTIVE STATISTICS FOR LATENT VARIABLES

Variables	Item	Mean	SD	Skewness	Kurtosis
Neuroticism	N1	2.76	0.96	0.358	-1.035
	N2	3.17	1.00	-0.241	-1.294
	N3	3.03	1.05	-0.027	-1.278
	N5	3.20	1.02	-0.313	-1.117
Extraversion	E8	3.83	0.72	-0.771	1.220
	E9	3.68	0.77	-0.703	0.158
	E10	3.45	0.84	-0.386	-0.430
Openness	O17	3.70	0.76	-0.707	0.268
	O18	3.68	0.78	-0.721	0.398
Agreeableness	A20	4.00	0.59	-0.757	2.899
	A21	4.04	0.60	-0.620	2.311
Conscientious-ness	C27	4.03	0.56	-0.940	4.881
	C28	4.05	0.54	-0.235	1.653
	C29	4.00	0.57	-0.469	1.758
Disposition effect	D2	3.32	1.04	-0.394	-1.085
	D4	3.69	0.85	-0.981	0.590
	D5	3.78	0.89	-0.917	0.490
Herding	H8	2.81	0.99	0.267	-1.166
	H9	2.92	0.99	-0.010	-1.189
	H10	3.36	0.93	-0.585	-0.754
	H11	3.27	0.97	-0.372	-0.982
Over-confidence	O16	3.24	0.83	-0.175	-0.755
	O17	3.49	0.86	-0.579	-0.421
	O18	3.48	0.90	-0.461	-0.469
	O19	3.51	0.88	-0.371	-0.531

Extraversion has also a positively significant relationship with herding (t = 2.53, $p<.05$) and overconfidence (t = 2.36, $p<.05$). It means that the investors with the trait of extraversion prefer to access according to the opinions or investment experiences of more other people, and follow other investors' information when they have involved in the stock market. In addition, the types of traits will continue to hold loss stocks because they will believe a rise on those loss stocks that is corresponding to the findings of [26]. Similarly, openness has a positively significant relationship with herding (t = 2.35, $p<.05$) and overconfidence (t = 2.82, $p<.05$). It means that the investors with the trait of openness would prefer to seek new investment information, such like newspaper and institutional investors' suggestions so that would result in herding behavior. In addition, the type of investors is more overconfidence than other investors that is corresponding to the findings of [4].

In addition, conscientiousness have positive relationship with disposition effect (t = 2.15, $p<.05$) and overconfidence (t = 2.43, $p<.05$). It means that the investors with the trait of conscientiousness are careful than other investors on investment and will advance on selling their profit stocks. Thus, with the characteristic of investors are more confident on themselves investments and lead to overconfidence bias.

In Table III, there is a negative relationship between gender and overconfidence (t = -6.51, $p<.001$) that is consistent in the finding of [1]. It implies that males are more overconfidence than females. Age and disposition effect (t = -6.51, $p<.001$) are existed positive associations. This suggested that older people have higher disposition effect than young people. In addition,

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age and overconfidence ($t = -2.02$, $p<.05$) are existed positive associations. This suggested that older peoples are more overconfidence than young peoples. In addition, there is positively significant relationship between residential area and herding ($t = 1.98$, $p<.05$). Thus, it implies that herding bias is attributable to cultural difference.

TABLE III
THE ESTIMATED COEFFICIENTS OF PERSONALITY TRAITS AND DEMOGRAPHICS ON THREE TYPES OF INVESTMENT BIASES

Variables	Disposition effect	Herding	Overconfidence
Neuroticism	0.24[a] (0.083)[b] 2.90**[c]	0.34 (0.058) 5.87***	-0.035 (0.052) -0.69
Extraversion	0.12 (0.085) 1.43	0.17 (0.066) 2.53*	0.15 (0.062) 2.36*
Openness	0.080 (0.084) 0.96	0.15 (0.066) 2.35*	0.18 (0.062) 2.82**
Agreeableness	0.11 (0.099) 1.12	-0.073 (0.077) -0.95	-0.089 (0.072) -1.24
Conscientiousness	0.19 (0.091) 2.15*	-0.033 (0.065) -0.51	0.15 (0.062) 2.43*
Gender	0.24 (0.14) 1.75	0.15 (0.10) 1.50	-0.62 (0.095) -6.51***
Age	0.14 (0.066) 2.04*	0.069 (0.048) 1.44	-0.086 (0.043) -2.02*
Educational background	0.087 (0.094) 0.92	0.11 (0.074) 1.45	-0.035 (0.066) -0.53
Residential area	0.11 (0.069) 1.55	0.10 (0.052) 1.98*	-0.033 (0.046) -0.71

IV. CONCLUSION

In this paper we examine the relationship between Big Five personality traits and investment biases of individual investors through constructing two concrete structure equation models. The results show that four personality traits and three demographics would significantly influence three behavioral biases in investment. Based on the findings, we conclude the following suggestion: First, the investors with stronger neuroticism personality should set up a stop-loss point and a lock-gain point so as to avoid the loss resulted from the biases of disposition effect and herding. Second, the investors with stronger extraversion and openness personality traits should further confirm the market information and make up their minds on investing so as to avoid forming the biases of herding and overconfidence. Third, we suggest that the investors with stronger conscientiousness personality traits should set up a stop-loss point and a lock-gain point because the type of investors seems to be obstinate in making their investment decision, so they would be better to consult other experts in order to avoid forming disposition effect and overconfidence.

In addition, we suggest that male investors should consult other people ideas on investing. For elder investors, they need to set up a stop-loss point and a lock-gain point, but for younger investors, it is better to consult other people ideas on investing as well as the investors living in the south of Taiwan in order to improve their investment performance.

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