

PATH ANALYSIS ON ESCALATION OF COMMITMENT OF INVESTORS IN DIFFERENT PROJECT SCENARIOS OF PPPs

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Abstract. In public-private partnerships (PPPs), escalation of commitment (EOC) of investors often occurs when receiving negative feedback, leading to a great waste of resources and not conducive to the sustainable development of PPPs. The degree of project completion and decision-making responsibilities of investors with different conscientiousness and neuroticism may affect subsequent resource allocation and further influence their escalation behaviour. Thus, through scenario simulation, this paper constructs path analysis to illustrate the formation mechanism of EOC by investors with diverse conscientiousness and neuroticism in different degrees of decision-making responsibilities and project completion, in which confidence in completing the projects may present a mediating effect. The empirical results show that completion degree and decision-making responsibilities both positively affect investors' EOC and that the interaction is significant. The impact mechanism of conscientiousness and neuroticism on EOC varies in different project scenarios. Then, some targeted recommendations are proposed to curb EOC. The findings provide scientific evidence for governments to conduct effective governance of EOC in PPPs.

Keywords: public-private partnerships (PPPs), escalation of commitment (EOC), path analysis, conscientiousness, neuroticism.

Introduction

In practice, investors' performance is an acritical guarantee for sustainable development and the success of public-private partnerships (PPPs) (Hueskes et al., 2017; Wang & Gao, 2020; Yuan et al., 2019; Zhou & Liu, 2021). However, investors often receive some negative feedback that is inconsistent with their initial expectations, such as low market payoffs, schedule delays, an escalation of capital costs and budget overruns (Portugal-Pereira et al., 2018; Zhang et al., 2003). The effect of such negative feedback means the possibility of project failure, which can be represented by the evidentiary weight (Hogarth & Einhorn, 1992). More negative feedback results in a higher possibility of project failure and also the stronger evidentiary weight. The evidentiary weight can be evaluated by simulating a specific project (Gao & Liu, 2020). Even when negative feedback signifies that these projects are likely to fail in the implementation of PPPs, investors usually behave irrationally and choose to continue to invest in troubled projects, which means that an escalation of commitment (EOC) occurs (Cui et al., 2018; Schultze & Schulz-Hardt, 2015; Staw & Ross, 1989; Staw, 1976). For example, the

overall budget escalation at constant prices was up to 69%, the schedule escalation was 14.2% in the Channel Fixed Link project, and the traffic volume was much lower than predicted because of competitive projects in Quanzhou Citong Bridge (Song et al., 2018; Winch, 2013). Even when these projects encountered operational difficulties, investors escalated the commitment on schedule and on budget, only to find themselves trapped. Investors' escalation behaviour not only results in an increase in project risks but also may lead to the failure of projects in severe cases (Feldman & Wong, 2018). Therefore, for the sustainable development of PPPs, understanding the formation mechanism of investors' escalation behaviour is very important, yielding some recommendations of de-escalations for governments.

Generally, investors need to make a series of decisions rather than just one about a specific event (Whyte, 1986), and always demonstrate a significant preference for selling winners and holding losers (Odean, 1998). Thus, when receiving negative feedback in PPPs, they tend to continue to invest resources in a likely failing project because of a tremendous amount of labour, material, and financial

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resources invested, implying that the sunk-cost effect occurs (Brockner, 1992; Chung & Cheng, 2018; Staw, 1976, 1981). Arkes and Blumer (1985) found that those who had incurred a sunk cost inflated their estimate of how likely a project was to succeed compared with that of the same project by those who had not incurred a sunk cost. After escalation theory was proposed by Staw (1976), Conlon and Parks (1987) provided the first direct test of this theory of retrospective rationality. The EOC of investors is subject to a variety of factors, including project, psychological, social, and organizational factors (Ross & Staw, 1993; Staw & Ross, 1989). The influence of each factor is usually different in different project stages (Ross & Staw, 1993). Specifically, the construction and operation stages are the core of successful PPPs (Xu et al., 2019). Morer et al. (2018) highlighted the effect of the degree of project completion on decisions. The effect of decision risk is even moderated by project stage (He & Mittal, 2007); that is, the joint effects of decision risk and the stage of project completion on EOC exist exactly. On the other hand, many researchers have focused on the impacts of some characteristics of investors themselves. Moon et al. (2003) contended neuroticism as a broad construct and addressed the organizational implications of measuring more narrowly the broad trait of neuroticism. Investors with more conscientiousness usually have professional competence and responsibility and exhibit strong tendencies to be locked into losing courses of action (Goldberg, 1990). Considering that prior research has paid scant attention to the role of emotion on EOC, Wong et al. (2006) examined the effect of negative affect with in an EOC dilemma and noted that it was negatively correlated with the tendency to escalate when investors were personally responsible for a prior decision, regardless of whether the negative affect was measured as a dispositional trait (neuroticism) or as a transient mood state. In brief, the existing literature has analysed the impact of conscientiousness (denoted as *C*) and neuroticism (recorded as *N*), the degree of project completion, the decision-making responsibilities, and the confidence about completing the project on EOC respectively. However, the analysis has mostly focused on the direct influence of a certain factor, ignoring the path relationship among these factors in different project scenarios.

In PPPs with a long duration, the degree of project completion is a certain guarantee for investors to some extent and might affect the subsequent resource allocation to further influence decision making (Liu et al., 2019a). In view of the long-life cycles of such projects, decision makers might be replaced, resulting in different initial decision-making responsibilities. Additionally, PPPs are typically involved in many investors with different conscientiousness and neuroticism. In the decision-making process of PPPs, investors with different conscientiousness and neuroticism might present different perceptions about the same project scenario and thus might have different degrees of confidence in completing projects, thereby deciding to escalate the commitment or abandon them.

Therefore, the objective of this paper is to illustrate the paths of investors' EOC with different conscientiousness and neuroticism, influenced by confidence in project completion at different degrees of project completion and decision-making responsibilities through scenario simulation. Different from the existing literature, investors' escalation behaviour, one kind of subjective behaviour, will be considered in PPPs. The study will further illustrate the formation mechanism of their conscientiousness and neuroticism to escalation behaviour, serving as a reference framework to contribute to the de-escalation of irrational commitment for both governments and investors in PPPs.

This paper is organized as follows. First, an overview of the literature review and hypothesis development is presented. This section is followed by the research design, sample data, and analytical techniques. Then, the data analysis is discussed. Finally, the paper closes with conclusions and recommendations accordingly.

1. Literature review and hypothesis development

1.1. Literature review and research gap

As a type of opportunistic behaviour, EOC typically refers to a common investment trap that might cause sizable losses (Gao & Liu, 2020). This phenomenon is often considered to be a self-justification process in which investors attempt to rationalize their previous decision making or psychologically defend themselves against negative consequences (Staw, 1976). EOC occurs in multiple fields, such as information system development projects (Mobekk et al., 2018; Montealegre & Keil, 2000; Pan et al., 2006), research and development projects (Schmidt & Calantone, 2002), stock markets (Odean, 1998), and investment decision-making (Bazerman et al., 1984; Devigne et al., 2016). Many studies have been conducted on the impacts of different factors on EOC. Some of these studies have focused on project factors, such as sunk cost (Chung & Cheng, 2018; Moon, 2001a) and opportunity cost (Sleesman et al., 2012). However, the research results of decision-making responsibilities are different. Some studies have shown that investors held responsible for project losses tend to seriously escalate commitment (Conlon & Parks, 1987; Liu & Liu, 2004; Whyte, 1993), whereas Leatherwood and Conlon (1988) believed that EOC was not related to decision-making responsibilities. In contrast, Boulding et al. (2017) have suggested that retaining the same decision maker who is likely to escalate commitment in the case of real option contexts is beneficial.

Meanwhile, psychological factors also play an important role in escalation, including regret (Ku, 2008; Wong & Kwong, 2007), anger and fear (Tsai & Young, 2010), self-efficacy (Jani, 2008, 2011; Whyte et al., 1997), risk appetite (Wong, 2005), rational thinking styles (Bazerman & Moore, 2008; Wong et al., 2008), ego depletion (Lee et al., 2018), and cognitive biases such as overconfidence (Ronay et al., 2017), conscientiousness (Moon, 2001b), and neuroticism (Wong et al., 2006). Specifically, Moon (2001b)

explained two effects of conscientiousness on EOC: escalation behaviour is positively related to achievement striving and negatively related to dutifulness. Moon et al. (2003) held that neuroticism could be divided into two facets (anxiety and depression) but that its impact on EOC was not significant when constructed as a whole concept. Subsequently, Wong et al. (2006) illustrated that neuroticism had significant negative predictive power for the EOC of investors with higher initial decision responsibility.

In terms of objective conditions in PPPs, both separate ownership and management rights and information asymmetry provide conditions for the EOC. Sometimes, investors might maintain or restore the appearance of rationality to a previously chosen course of action attributable to performance appraisal (Xu & Song, 2010). Therefore, almost all investors have an escalation tendency, and the escalation behaviour is determined by investors' tendency toward EOC directly in PPPs; however, the degree to which the escalation tendency will be transformed into actual escalation behaviour might be different (Liu et al., 2017). That is, EOC has two related facets: the escalation tendency (expressed as *W*) and the capital degree of the continued investment (i.e., the degree of escalation behaviour, recorded as *L*). The degree of escalation behaviour is positively correlated with the degree of the escalation tendency.

To conclude, the existing literature has focused on the impact mechanism of a single project or psychological factor on EOC; however, these factors affect escalation synchronously. As the main body of finance, construction, operation and maintenance of PPPs, investors' initial decision-making responsibilities are very important beyond all doubt. For investors, the completion degree of these PPPs is a certain guarantee, to some extent. Only when projects are completed can investors recover their investments through user charges and government subsidies. Typically, the two factors might present interaction effects in PPPs, which have been ignored. And the results of previous studies regarding the impacts of conscientiousness and neuroticism on EOC are inconsistent. More importantly, the studies performed on PPPs have mainly been devoted to objective risks, and few studies analyse the formation paths in different project scenarios of PPPs.

To bridge the gap in the extant literature, this paper aims to study the impact mechanism of investors' conscientiousness and neuroticism on EOC under different degrees of project completion and initial decision-making responsibilities and explore the potential influence path of confidence in project completion (expressed as *R*) driving EOC. Specifically, the research questions include two parts:

- 1) to investigate whether there are significant differences in investors' EOC in different project scenarios and to clearly determine the situation in which the degree of investors' EOC is the strongest; and,
- 2) to examine the mediating effect of confidence in project completion during the process of conscientiousness and neuroticism that promotes EOC and to formulate paths for investors' such behaviour in each project scenario of PPPs.

1.2. Four project scenarios identified in PPPs

Governments usually authorise investors to finance, build, operate, and maintain PPPs through a concession agreement (Liu et al., 2017). To ensure that public goods or services are delivered efficiently, a performance appraisal mechanism for investors is often designed. Investors, as a core party of this cooperation, are held responsible for their initial decisions (Liu et al., 2019a). When faced with continuous negative feedback (e.g., lower traffic flow than expected) that signifies that maintaining project performance is difficult and that the project should thus be abandoned, they are unwilling to admit that their previous decisions are wrong. Instead of changing their behaviours, investors cognitively distort the negative consequences to more positively valuable outcomes (Brockner, 1992; Staw, 1976). As a result, to maintain their internal and external justification and improve assessment performance, they will attempt to rationalize their previous behaviours and psychologically defend themselves, thereby persisting in their commitments to those decisions. When the other conditions are certain, the escalation behaviour of investors with different decision-making responsibilities (recorded as Condition 1) is different. Thus, the following hypothesis can be proposed.

H1. Investors' EOC is positively associated with their decision-making responsibilities in PPPs.

Given the same decision-making responsibilities, the completion degree of PPPs (denoted as Condition 2) can also affect investors' decision making (Rutten et al., 2014). PPPs cover construction and operation periods, generally lasting 20 to 30 years and even longer (Liu et al., 2017; Zhang et al., 2020). During the operation stage of this process, investors recover costs and achieve reasonable profits through user fees and government subsidies (Carbonara & Pellegrino, 2018; Liu et al., 2019b; Pellegrino et al., 2019; Zapata Quimbayo et al., 2019). When negative feedback occurs during the construction stage of PPPs, only by completing project construction can investors retrieve the costs; if investors receive such negative consequences during the operation stage, they might engage in escalation behaviour in pursuit of their profits (Gao & Liu, 2019). Consequently, the project completion effect in an EOC dilemma should not be ignored in PPPs with a long duration. PPPs are fraught with various risks, such as construction and demand risks. At different stages of PPPs, the status of projects is different, and the probability of project success and the decision risks of investors diverge (He & Mittal, 2007). In summary, a higher degree of project completion results in a higher probability of project success. Thus, facing dissonant feedback, investors prefer to increase resource commitment in the presence of a higher degree of project completion. The following hypothesis on the relationship between EOC and the project completion degree is proposed as follows.

H2. Given the same decision-making responsibilities, investors' EOC is positively correlated with the completion degree of PPPs.

As previously mentioned, the two conditions (i.e., Conditions 1 and 2) affecting investors' EOC have been identified in PPPs. These conditions can be qualitatively divided into two cases, namely, low and high level. Consequently, there are four scenarios in PPPs (i.e., Scenarios I to IV). Scenario I refers to "low completion degree and high decision responsibilities", Scenario II refers to "low completion degree and low decision responsibilities", Scenario III refers to "high completion degree and high decision responsibilities", and Scenario IV refers to "high completion degree and low decision responsibilities".

1.3. Relationships between conscientiousness and neuroticism and EOC in PPPs

Investors with more conscientiousness generally have professional competence and responsibility. They are methodical and disciplined and strive for achievement (Goldberg, 1990), implying that they are more likely to work out plans and follow them. A complex series of contracts exist in PPPs that continue for 20–30 years or even longer. Investors tend to escalate their commitment according to the contracts signed. In addition, these more responsible investors are usually goal-oriented and strive to be efficient, thus preferring to continue to execute projects to pursue success despite interference and dissonant information. During this process, investors always have more confidence in the completion of projects to escalate commitment to PPPs because of professional competence and prior experiences (Staats et al., 2018). Thus, the hypothetical relationship between conscientiousness and EOC in PPPs is proposed as follows.

H3. With all other conditions fixed, investors with a higher degree of conscientiousness exhibit more escalation behaviour. During the formation process of EOC, investors' conscientiousness directly and indirectly affects decision making, in which confidence in project completion has a moderating effect.

The measure of neuroticism in broad terms is defined as "the general tendency to experience negative effects such as fear, sadness, embarrassment, anger, guilt and disgust" (Costa & McCrea, 1992). Investors high in neuroticism are prone to have more unrealistic ideas and excessive

demands. When receiving negative feedback about PPPs, they will have more anxiety, be less able to control their impulses, and cope more poorly than others with stress. More importantly, they are afraid of punishment from superiors and even governments and care more about what others think of them. To avoid ridicule and punishment and to maintain their internal and external justifications, investors are unwilling to admit that their previous decisions are incorrect and thus sometimes persist in their commitments to those decisions (Bobocel & Meyer, 1994; Staw, 1981). For those investors, only by continuing PPPs can they be likely to succeed. That is, investors with more neuroticism are also more inclined to escalate commitment, and EOC will prevail in PPPs. On the other hand, these neurotic investors are more pessimistic, leading to less confidence in completing these projects and less escalation behaviour. The hypotheses between neuroticism and EOC are assumed as follows.

H4a. When all other conditions are constant, the higher degree of investors' neuroticism, the stronger the escalation tendency and thereby the higher the degree of escalation behaviour.

H4b. Confidence in project completion mediates the relationship between neuroticism and escalation tendency and is negatively associated with neuroticism.

To summarise, the conceptual research framework in a certain project scenario can be derived based on the hypotheses 3 and 4 (shown in Figure 1). An arrow from one variable to another represents a causal link between the former (the cause) and the latter (the effect) variables. In this paper, path analysis examines whether causal links between these variables exist and illustrates the path coefficients if the hypotheses hold. In each scenario, the model for the paths of investors' EOC in PPPs is assumed to be as follows:

$$x_{iL} = P_{ijL} \cdot x_{ij} + P_{iRL} \cdot x_{iR} + P_{iWL} \cdot x_{iW} + P_{ie_1} \cdot x_{ie_1} + P_{ie_2} \cdot x_{ie_2} + P_{ie_3} \cdot x_{ie_3}, \tag{1}$$

where: *i* represents the project scenario in PPPs and *i* = I, II, III, IV; x_{iL} is the capital degree of the continued investment in Scenario *i*; x_{ij} is the value of variable *j* in Scenario *i* and *j* = C, N; x_{iR} is the confidence in project completion of investors in Scenario *i*; x_{iW} is the escalation tendency in

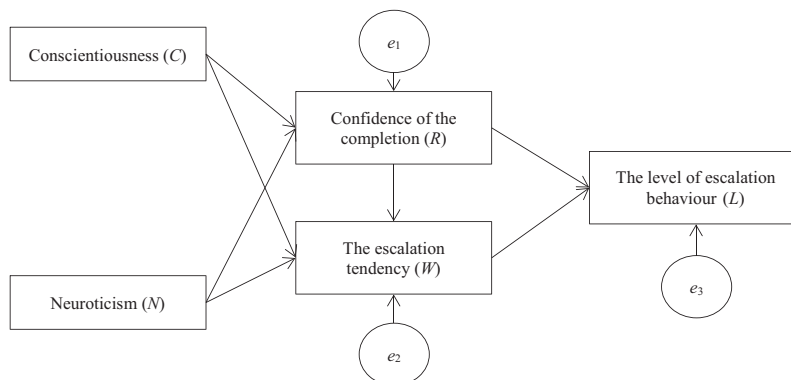


Figure 1. Conceptual model for the paths of investors' EOC in PPPs

Scenario i ; x_{ie_1} , x_{ie_2} , x_{ie_3} are the residuals in Scenario i respectively; p_{ijL} is the path coefficient (i.e., the strength of causality) from j to L in Scenario i ; p_{iRL} is the path coefficient from R to L in Scenario i ; p_{iWL} is the path coefficient from W to L in Scenario i , and p_{ie_1} , p_{ie_2} , and p_{ie_3} are the path coefficients of the residuals.

2. Research design and analytical techniques

2.1. Research design

As previously described, this study aims to explore the differences in the degree to which the same investor escalates in different scenarios and finds the differences in different investors' escalation in the same EOC scenario by analysing the paths from conscientiousness and neuroticism to escalation behaviour through the mediating effect of confidence in completing PPPs. If each subject (the person of an experiment or test) in the design is only tested for one situation (i.e., between-subjects design), the impact of project scenarios cannot be accurately measured. The number of samples required for the experiment will be expanded by a factor of four. In addition, there is no quantitative tool to measure the initial decision responsibility of investors. If it must be added to the regression model, the measurement error will interfere with the establishment of the model to evaluate the degree of investor's EOC. Considering that investors usually make decisions in one specific project scenario, it is more precise and practical to use the project-specific situation as the background to construct regression models to analyse the relationship among EOC and conscientiousness, neuroticism, and confidence in project completion.

The scenario simulation is divided into two parts: one is a test of conscientiousness and neuroticism, and the other is investment decisions in the four project scenarios. Undoubtedly, the test of conscientiousness and neuroticism is the premise of this study and of great importance. Such personality test including a person's relatively stable thought and emotional and reactive patterns, is complicated processes. To improve the accuracy of the research, the questionnaire for conscientiousness and neuroticism is based on a simplified version of the neo five-factor inventory (NEO-FFI), which was proposed by Costa and McCrea (1992) and has been mature and widely used in personality test. From the NEO-FFI version, 24 questions were selected, with 12 questions in each dimension (shown in the Appendix). Conscientiousness focuses on the characteristics of competence, impartiality, logical presentation, achievement, self-discipline, prudence, and restraint. Neuroticism is heavily weighted in emotional traits, including anxiety, hostility, depression, self-awareness, impulsions, and vulnerability. Both conscientiousness and neuroticism are measured on a five-point Likert scale; that is, respondents are asked to rate the consistency of each scenario or character (i.e., "1" = "least consistent" and "5" = "extremely consistent"). The total score of the questions corresponding to the two dimensions is the score for conscientiousness and neu-

roticism. Four scenarios of PPPs (i.e., Scenarios I to IV) are defined, as previously mentioned.

In this study, the mixed design method is adopted. The degree of project completion and decision responsibility are within-subjects variables divided into two levels: the low level is noted as "1" and the high level is noted as "2". Conscientiousness and neuroticism are between-subjects variables belonging to individual attributes. Conscientiousness and neuroticism of the subjects were determined by comparing their scores with standard scores. Each dimension of conscientiousness and neuroticism has two levels: high and low. Both the escalation tendency and the escalation behaviour are scored in a range from 1 to 9. When measuring the degree of the escalation tendency, "1" indicates that investors are reluctant to escalate their commitment, whereas "9" signifies that they have a strong tendency to continue the projects, implying that a higher number indicates a stronger tendency to continue investing. Similarly, the degree of escalation behaviour is also divided into nine intervals, and the larger the number, the more capitals investors are willing to continue to invest. Considering whether to continue the projects as a reference, when the escalation tendency score is more than five points, the project is estimated to be continued. Confidence in project completion is a mediating variable on a nine-point Likert scale (i.e., "1" = "least confident" and "9" = "extremely confident"), reflecting investors' confidence in the successful completion of PPPs in different scenarios.

To ensure the successful control of their initial responsibilities represented by subjects when participating in investment decisions of PPPs, they are tested for initial decision responsibilities for the project after each situation. The degree of project completion, reflecting the objective reality of PPPs, is clearly presented to the subjects. Similar to many previous studies, manipulative testing here is not needed. The subjects are given descriptions of the unrelated variables before the experiment that inform them that they can respond to the questionnaire with ease because it does not involve personal privacy and is used only for academic research. The experimental process was controlled to ensure that the subjects remained quiet without mutual discussion, and they completed the questionnaire alone. The questionnaire was collected on the spot.

2.2. Sample data

This simulation experiment targeted mainly Master of Business Administration (MBA) students at universities with two years of learning PPP knowledge as subjects. The selected respondents were engaged in PPPs and had rich work experience, thus ensuring the reliability of the questionnaire. A total of 135 questionnaires were recovered, and these were screened to remove incomplete ones. Eventually, 94 valid questionnaires—completed by 58 males and 36 females—were retrieved for an efficiency rate of 69.63%. Forty-three subjects majored mainly in project management, 21 engaged in civil engineering, and 30 in public management and other fields.

Table 1. Analysis of investors' decision-making responsibilities under different degrees of project completion

Degree of project completion	(I) With initial responsibilities	(J) Without initial responsibilities	Mean difference (I-J)	Significance
Low degree of project completion	7.479	2.468	5.011*	0.000
High degree of project completion	5.149	4.798	0.351*	0.000

Notes: The mean difference at the *0.05 level is significant and confidence interval is 95%.

The symbol "I" in second column is the mean value of investors' decision-making responsibilities with initial responsibilities under low/high degree of project completion, and the symbol "J" in the third column is the mean value of their decision-making responsibilities without initial responsibilities under low/high degree of project completion accordingly.

A manipulative test was conducted on the variable decision-making responsibilities to ensure that all participants understood the designed scenarios and could make decisions based on their roles in these scenarios. After the questionnaires were collected, the responsibility setting for the project scenario and participants' answers were reviewed. For the scenario with initial responsibilities, a subject scored more than five points in responsibility control, and the manipulation was considered successful (Table 1).

2.3. Analytical techniques

The IBM Statistical Package for Social Sciences (SPSS) 21.0 was used to perform statistical analysis, including a reliability test using Cronbach's alpha model, variance analysis, paired-samples *t*-test, correlation analysis, and path analysis. First, to statistically confirm the internal consistency (i.e., reliability) of the survey responses, Cronbach's alpha was determined, following $0.7 \leq \alpha \leq 0.8$ being acceptable, $0.8 \leq \alpha \leq 0.9$ being good, and $\alpha \geq 0.9$ being excellent (Norusis, 1992; Wang et al., 2013). Next, variance analysis was used to measure investors' tendency to escalate and their level of continued investment with different decision-making responsibilities in PPPs with different completion degrees. Specifically, the main and cross effects between these two scenarios were analysed with a significance test value less than 0.05.

Then, to further investigate whether there is a certain linear relationship between the degree of the escalation tendency and the escalation behaviour in the same scenario, a paired-samples *t*-test was conducted, followed by correlation analysis to present the correlation coefficients. Finally, path analysis—widely used to reveal the dependencies among variables by regression analysis—was adopted to validate the causal relationships among investors' conscientiousness/neuroticism, confidence in project completion, escalation tendency, and degree of escalation behaviour in the four different Scenarios I to IV (Wang et al., 2016).

3. Data analysis

3.1. Reliability and validity analysis

The results of the data analysis using SPSS show that the consistency coefficients (i.e., Cronbach's alpha) of conscientiousness and neuroticism are 0.920 and 0.900,

respectively, and the whole consistency coefficient is 0.826. With high measurement consistency and good internal structure, the data collected are reliable and meet the requirements (Norusis, 1992). The correlation analysis demonstrates that the dimensions are not significant, signifying that the questionnaire satisfies not only the NEO-FFI theory but also the requirement of further regression for the independent variables that there is no collinearity. In other words, the questionnaire has good reliability.

For the validity of the survey, the result of the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy is 0.874; the approximate Chi-square of Bartlett's test of sphericity is 1260 and $p = 0.000 < 0.001$. Accordingly, questionnaire respondents have a certain degree of knowledge and professional skills, and the questionnaire was deemed to have good content validity, indicating that the items are suitable for factor analysis.

3.2. Variance analysis of investors' EOC in different scenarios of PPPs

The descriptive statistics obtained by SPSS indicate that investors with initial responsibilities and in a situation of a high degree of project completion (Scenario III) have the strongest tendency to continue investing with a mean value of 7.28 points in PPPs. In this scenario, the degree of escalation behaviour is the highest (i.e., mean value = 6.40). That is, the level of capital at which investors continue to invest in the project is significantly higher than that in the other three scenarios. In contrast, when they have lower or even no initial responsibilities and project completion is low (Scenario II), the escalation tendency is the weakest, with a mean value of only 4.64. Thus, investors engage in less escalation behaviour (shown in Table 2).

Then, the main and interaction effects were analysed by clicking "Analyse → General Linear Model → Univariate" in SPSS. The two-way ANOVA results demonstrate that both effects are significant, indicating that these two factors are not mutually independent (Table 3). Therefore, further performing a simple main effect test on the factor's simple main effect is necessary.

The simple main effect analysis of the project completion degree and initial responsibilities can be obtained via the path "Analyse → Compare Means → Paired-Samples Test" (shown in Table 4). The findings demonstrate that, regardless of the degree of project completion, investors with initial responsibilities for PPPs are willing to continue

Table 2. Descriptive statistics of EOC by investors

Indicators	Project scenarios	Mean value	Standard deviation	N
The escalation tendency	Scenario I	5.24	2.179	94
	Scenario II	4.64	1.956	94
	Scenario III	7.28	1.738	94
	Scenario IV	5.78	2.038	94
The level of the escalation behaviour	Scenario I	4.20	2.289	94
	Scenario II	3.51	1.977	94
	Scenario III	6.40	2.137	94
	Scenario IV	4.90	2.185	94

Table 3. Two-way ANOVA of within-subject design of EOC by investors

Indicators	Variation	SS	df	MS	F	P
The escalation tendency	Degree of project completion	236.181	1	236.181	51.102	0.000
	Responsibilities	104.266	1	104.266	37.190	0.000
	Degree of project completion × Decision responsibilities	18.766	1	18.766	13.299	0.000
	Residual (Degree of project completion × Decision responsibilities)	131.234	93	1.411		
The level of the escalation behaviour	Degree of project completion	303.840	1	303.840	65.160	0.000
	Decision responsibilities	112.862	1	112.862	58.429	0.000
	Degree of project completion × Decision responsibilities	15.362	1	15.362	8.447	0.005
	Residual (Degree of project completion × Decision responsibilities)	169.138	93	1.819		

Table 4. EOC of investors in PPP projects: comparison in pairs 1

Types	Degree of completion	(I) Low decision responsibility	(J) High decision responsibility	Mean difference (I-J)	Standard deviation	Significance	95% confidence interval for the difference	
							Lower limit	Upper limit
The escalation tendency	Low degree of completion	4.638	5.245	-0.606*	0.227	0.009	-1.057	-0.156
	High degree of completion	5.777	7.277	-1.500*	0.195	0.000	-1.888	-1.112
The level of the escalation behaviour	Low degree of completion	3.511	4.202	-0.691*	0.215	0.002	-1.118	-0.265
	High degree of completion	4.904	6.404	-1.500*	0.183	0.000	-1.864	-1.136

Notes: The mean difference at the *0.05 level is significant and confidence interval is 95%. The symbol “I” in third column is the mean value of investors’ escalation tendency/behaviour with low decision responsibility under low/high degree of completion; and the symbol “J” in fourth column is the mean value of investors’ escalation tendency/behaviour with high decision responsibility under low/high degree of completion accordingly.

to invest more in these projects, the difference of which is significant. Thus, H1 holds. Likewise, when the degree of investors’ decision-making responsibilities is certain in PPPs, investors faced with a lower project completion degree invest significantly less, and the difference is significant at different degrees of project completion (as shown in Table 5), proving validity for H2. This finding implies that investors generally do not abandon projects with a high degree of completion even if they have received nega-

tive feedback. They deem that a higher degree of project completion results in a higher probability of project success and that the previous losses might be recovered.

In conclusion, both investors’ decision-making responsibilities and the completion degree of PPPs have a significant positive effect on their tendency to escalate commitment. When project completion is certain and investors have high initial decision-making responsibilities, they will have a greater tendency to EOC. The effect of the

Table 5. EOC of investors in PPP projects: comparison in pairs 2

Types	Decision responsibility	(I) Low degree of completion	(J) High degree of completion	Mean difference (I-J)	Standard deviation	Significance	95% confidence interval for the difference	
							Lower limit	Upper limit
The escalation tendency	Low decision responsibility	4.638	5.777	-1.138*	0.260	0.000	-1.654	-0.623
	High decision responsibility	5.245	7.277	-2.032*	0.247	0.000	-2.522	-1.542
The level of the escalation behaviour	Low decision responsibility	3.511	4.904	-1.394*	0.269	0.000	-1.928	-0.859
	High decision responsibility	4.202	6.404	-2.202*	0.256	0.000	-2.711	-1.694

Notes: The mean difference at the *0.05 level is significant and confidence interval is 95%.

The symbol "I" in third column is the mean value of investors' escalation tendency/behaviour under low degree of completion with low/high decision responsibility; and the symbol "J" in fourth column is the mean value of investors' escalation tendency/behaviour under high degree of completion with low/high decision responsibility accordingly.

initial decision-making responsibilities is more significant as the project completion degree increases. When the degree of project completion is low, there is also a significant difference in the effect of the initial decision-making responsibilities on investors' tendency to escalate, but the overall tendency is relatively low. Similarly, when investors' initial decision-making responsibilities are certain, a higher degree of project completion results in a stronger tendency to escalate the commitment, and the difference is significant. In addition, the degree of continued investment is consistent with the order of investors' tendency to escalate commitment in the four scenarios.

3.3. Comparison of degree of escalation tendency and escalation behaviour in the same scenario

Similarly, by using the "Analyse → Compare Means → Paired-Samples Test", investors' escalation tendency and their escalation behaviour in four PPP project scenarios can be compared. The results show that the escalation tendency and such behaviour are significantly linearly correlated (shown in Table 6). In a certain project scenario, the degree of investors' escalation tendency is higher than that of their escalation behaviour, and a *t*-test shows that the mean difference is significant. The truth is confirmed through data that demonstrates that the degree of inves-

tors' escalation behaviour is positively correlated with their escalation tendency. Meanwhile, this indicates that investors are willing to continue investing in the original projects when they are in trouble but hesitate and are even unwilling to invest more capital. In practice, regarding investing an enormous amount of capital in PPPs, such irrational escalation behaviour of investors is even weaker; that is, although investors' tendency to continue the projects might be strong, the degree of capital invested is probably much lower than that observed in the experiment.

3.4. Paths for impact of conscientiousness and neuroticism on investors' EOC

A stepwise multiple regression analysis method is used for each project scenario. This method can be subdivided into three submodels. In submodel 1, the independent variables are conscientiousness and neuroticism, and the dependent variable is confidence in project completion; in submodel 2, the independent variables are conscientiousness, neuroticism, and confidence in project completion, and the dependent variable is escalation tendency; gradually in submodel 3, the independent variables are conscientiousness, neuroticism, confidence in project completion, and escalation tendency, and the dependent variable

Table 6. The correlation and a *t*-test of investors' escalation tendency and behaviour

Scenarios	N	Correlation	P	The escalation tendency (<i>W</i>)	The level of the escalation behaviour (<i>L</i>)	Mean difference	Significance (two-tailed)
Scenario I	94	0.501	0.000	5.245	4.202	1.043	0.000
Scenario II	94	0.613	0.000	4.638	3.511	1.128	0.000
Scenario III	94	0.630	0.000	7.277	6.404	0.873	0.000
Scenario IV	94	0.722	0.000	5.777	4.904	0.872	0.000

is the degree of investors' escalation behaviour. The hurdle significance of the path analysis follows the usual significance level of 0.05, with a higher significance level of 0.01. The basic analysis of the questionnaires demonstrates that these two independent variables meet the regression requirement. Thus, four multiple regression analyses need to be performed separately to verify H3 and H4. Based on the multiple regression coefficients and the summary of the SPSS analysis results, the path models with a low degree of project completion are as follows.

Figure 2 shows that when the project completion degree of PPPs is low and investors have high initial responsibilities (Scenario I), confidence in the project completion of investors—not affected by neuroticism—mediates the relationship between conscientiousness and EOC. Specifically, such confidence is mainly impacted by the degree of conscientiousness with a path coefficient of 0.284 and has a significant direct effect on the degree of escalation behaviour with a path coefficient of 0.313. Confidence in project completion can affect escalation tendency with a path coefficient of 0.696, followed by the degree of escalation behaviour with a path coefficient of 0.283. The path coefficients of the three residuals are 0.959, 0.718, and 0.836. Consequently, H3 holds. The various effects are summarized in Table 7. Investors with high conscientiousness have more self-confidence in their abilities, pursue success and excellence, and do their best to complete their work, enabling them to be willing to overcome difficulties and focus on their tasks. When the degree of project completion is low, although the projects presented have received unfavourable feedback, investors with high con-

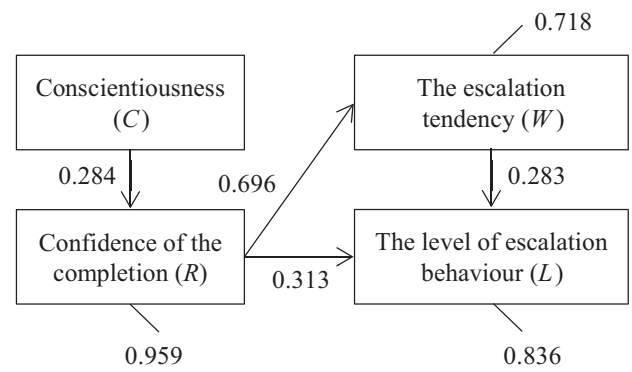


Figure 2. EOC model in Scenario I

scientiousness believe that there is still a long period during which they can overcome the current difficulties and complete their tasks on their own. To sum up, investors' conscientiousness impacts their tendency toward EOC by affecting their confidence in project completion and eventually influencing the capital they continuously invest. The mediating effect of confidence in project completion is significant.

When the degree of project completion is still relatively low and investors have low or even no initial responsibilities (Scenario II), neither confidence in project completion is correlated with *N*, which is similar to Scenario I (as shown in Figure 3). Both the direct effects of conscientiousness on confidence in project completion (0.225 < 0.284) and such confidence on the degree of escalation behaviour (0.247 < 0.313) are weaker. However,

Table 7. Path effects of investors' EOC in PPPs

Scenarios	Paths	Direct effects	Indirect effects	Total effects
Scenario I	Conscientiousness (C) → Confidence of the completion (R)	0.284	–	0.284
	Confidence of the completion (R) → Escalation tendency (W)	0.696	–	0.696
	Escalation tendency (W) → Level of the escalation behaviour (L)	0.283	–	0.283
	Confidence of the completion (R) → Level of the escalation behaviour (L)	0.313	0.197	0.510
Scenario II	Conscientiousness (C) → Confidence of the completion (R)	0.225	–	0.225
	Confidence of the completion (R) → Escalation tendency (W)	0.742	–	0.742
	Escalation tendency (W) → Level of the escalation behaviour (L)	0.429	–	0.429
	Confidence of the completion (R) → Level of the escalation behaviour (L)	0.247	0.318	0.565
Scenario III	Neuroticism (N) → Escalation tendency (W)	0.242	–	0.242
	Confidence of the completion (R) → Escalation tendency (W)	0.646	–	0.646
	Escalation tendency (W) → Level of the escalation behaviour (L)	0.445	–	0.445
	Neuroticism (N) → Level of the escalation behaviour (L)	–	0.108	0.108
	Confidence of the completion (R) → Level of the escalation behaviour (L)	0.272	0.287	0.559
Scenario IV	Neuroticism (N) → Escalation tendency (W)	0.178	–	0.178
	Confidence of the completion (R) → Escalation tendency (W)	0.632	–	0.632
	Escalation tendency (W) → Level of the escalation behaviour (L)	0.559	–	0.559
	Neuroticism (N) → Level of the escalation behaviour (L)	–	0.100	0.100
	Confidence of the completion (R) → Level of the escalation behaviour (L)	0.259	0.353	0.612

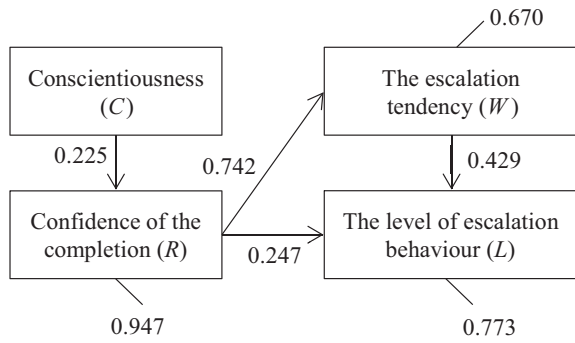


Figure 3. EOC model in Scenario II

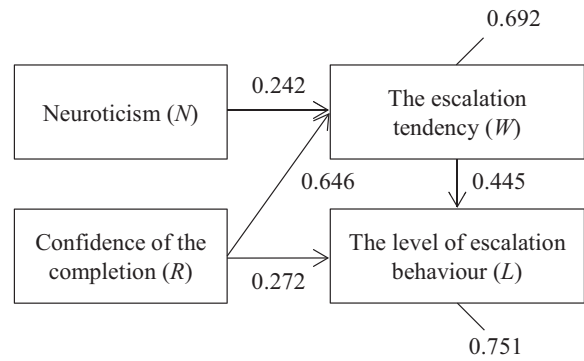


Figure 4. EOC model in Scenario III

the impact of confidence in project completion on the escalation tendency is greater ($0.742 > 0.696$), as is the impact of the escalation tendency on the degree of escalation behaviour ($0.429 > 0.283$). Overall, as far as investors with the same degree of conscientiousness are concerned, when the completion degree of PPPs is low, higher initial responsibilities of investors indicate higher escalation of their commitment, which is consistent with the analysis results in Table 4.

In Scenarios III and IV, in which the project completion degree is high, there is no significant linear relationship between conscientiousness/neuroticism and confidence in project completion; therefore, Hypothesis 4a is not valid. However, neuroticism has a positive impact on investors' tendency to continue the projects (Figures 4 and 5), proving that Hypothesis 4b is not true. A higher degree of investors' neuroticism results in more unstable emotions and greater sensitivity to negative emotions, indicating that these investors will be vulnerable to unfavourable scenarios. If investors abandon projects, they are bound to accept the failure of those projects; however, if they continue, recovering the losses might be possible. Investors with higher neuroticism have a stronger tendency to continue the project to further weaken the impact of the negative outcomes, which is consistent with the characteristics of "loss avoidance" in prospect theory (Kahneman & Tversky, 1979). When the completion degree of a PPP project is high, confidence in project completion is also not affected by conscientiousness and neuroticism. Neurotic investors have a stronger tendency to avoid losses. When investors assume different degrees of decision-making responsibilities, the effects of each path on EOC are still different. In Scenario III, the path coefficients from neuroticism to the escalation tendency and from confidence in project completion to EOC are greater ($0.242 > 0.178$, $0.646 > 0.632$, and $0.272 > 0.259$); nevertheless, for investors with low initial responsibilities (Scenario IV), the causality from the escalation tendency to the degree of escalation behaviour is stronger.

Different from Scenarios I and II, in which the completion degree of PPPs is low, investors' neuroticism has a direct impact on their escalation behaviour when faced with a high degree of project completion (Scenarios III and IV), as displayed in Table 7. Greater responsibility for

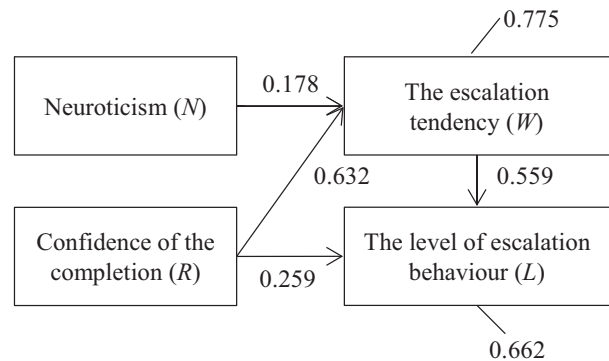


Figure 5. EOC model in Scenario IV

decision making results in a more severe escalation. On the other hand, compared with the other three scenarios, when investors predict a higher degree of project completion and the initial responsibilities are lower (Scenario IV), the total effect of confidence in project completion on the degree of escalation behaviour is the strongest, reaching 0.612, of which the direct effect accounts for 0.259 and the indirect effect accounts for 0.353.

This analysis shows that when the degree of project completion is low, without reference to the degree of the initial decision-making responsibilities, the levels of neuroticism in heterogeneous investors have no significant effect on confidence in project completion. At this point, the impact path of conscientiousness and neuroticism on EOC is shown as follows: conscientiousness \rightarrow confidence in project completion \rightarrow escalation tendency \rightarrow escalation behaviour. At the same time, confidence in project completion has a significant direct effect on the degree of escalation behaviour. When the completion degree of PPPs is relatively high, regardless of investors' initial responsibilities, the impact paths of personalities on EOC are neuroticism \rightarrow escalation tendency \rightarrow escalation behaviour and confidence in project completion \rightarrow escalation tendency \rightarrow escalation behaviour, in which investors' neuroticism has no direct effect on confidence in project completion. When faced with a high degree of project completion, investors typically have a direct and strong tendency to avoid the unfavourable perception generated by negative emotions.

Conclusions and recommendations

Different from the existing literature on objective risks of PPPs, this paper focuses on the subjective escalation behaviour of investors. At every stage of PPPs, investors might receive negative feedback at any time. Different stages imply different project progress and risk levels. Nevertheless, the degrees of investors' decision-making responsibilities for PPPs vary at the same stage. Consequently, different degrees of project completion or decision-making responsibilities lead to four project scenarios in which negative feedback occurs in PPPs. In such project scenarios, investors' conscientiousness and neuroticism have different effects on their confidence in project completion, followed by different escalation behaviours. Specifically, investors' EOC is measured in two dimensions: the degree of the tendency to continue investments (i.e., the escalation tendency) and continued investments (i.e., escalation behaviour).

First, this paper investigates the differences in investors' EOC in different project scenarios and clearly explains the situation in which the degree of investors' EOC is the strongest. Then, considering confidence in completing the projects as a mediating effect, the paths from conscientiousness and neuroticism to investors' EOC are formulated and tested using survey data in the four project scenarios. The surveys indicate that both the completion degree of PPPs and investors' decision-making responsibilities have a significant positive effect on investors' escalation behaviour, and the interaction is significant. In different project scenarios, the impact mechanism of investors' conscientiousness and neuroticism on EOC varies. When the degree of project completion is low regardless of the level of initial decision-making responsibilities, conscientiousness will significantly increase the confidence of investors and indirectly impact their EOC; however, when the degree of completion is high, neuroticism has no effect on investors' confidence but a significant direct impact on EOC. However, the impact mechanism for investors' confidence on their EOC is the same in the four scenarios, which not only indirectly influences the degree of continued investment through the tendency to escalate commitment but also directly impacts the level of investment. Overall, the level of continued investment is significantly lower than the level of investors' tendency to escalate, which means that investors who encounter the aforementioned decision-making dilemma are still inclined to escalate their commitment to recover their losses. Thus, to curb such escalation behaviour in PPPs, the following recommendations are proposed.

- 1) Governments need to accurately assess investors' conscientiousness and neuroticism in the project procurement or negotiation stages to choose more rational investors with low conscientiousness and neuroticism.
- 2) When there is negative feedback in PPPs, the degree of project completion should be evaluated immediately and accurately. In particular, when the com-

pletion degree of projects is high, the government should conduct a comprehensive assessment of the project and require investors to submit a detailed decision report to judge the reasonableness of investors' decisions, constantly preventing escalation.

- 3) Replacing decision makers is beneficial regardless of the degree of project completion. As described, investors with high initial decision-making responsibilities are more likely to escalate their commitment to PPPs. Thus, when faced with dissonant feedback and re-decision needs to be made, the replaced investors can evaluate the projects more rationally to make subsequent decisions more reasonably and scientifically.
- 4) Governments should reduce the early termination compensation in the EOC scenario of PPPs. Generally, the compensation of the early termination, such as because of force majeure, is specified as agreed on through negotiation in the PPP contract. Thus, to punish investors with such irrational escalation behaviour, the compensation should be reduced relative to that without EOC, of which the mechanism serves as a deterrent to some degree.
- 5) Improving the accuracy of project information feedback, including project income and cost information after additional inputs and the project prediction information, is an effective measure resulting in accurate confidence in the projects generated by investors to efficiently de-escalate the commitment.

In conclusion, the contribution of this paper is to incorporate investors' subjective escalation behaviour into PPPs and formulate paths on the EOC of investors' conscientiousness and neuroticism in four project scenarios. The findings provide scientific evidence through quantitative analysis for the government to conduct effective governance of the escalation in PPPs. Finally, the limitations should be highlighted. On the one hand, the diversity of the sampling is a weakness of the data collection for this paper given that MBA students at universities were selected as respondents. On the other hand, many types of factors affect the escalation behaviour of investors in PPPs, whereas this paper has studied only the impact mechanism of different project scenarios (i.e., decision-making responsibilities and degree of project completion), conscientiousness and neuroticism on investors' EOC. Follow-up studies will focus on the impact mechanism of other factors (such as organizational and social factors) on escalation behaviour.

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Appendix

The questions of conscientiousness test of are as follows:

- (1) In my work, I am efficient and competent;
- (2) I always keep my things clean and tidy;
- (3) I am not an orderly person;
- (4) I cannot seem to keep things in order;
- (5) I always try my best to finish all of the work assigned to me;
- (6) Sometimes I cannot be as reliable or credible as I should be;
- (7) When I make a promise, I usually carry it through;
- (8) I have a clear set of goals and can work toward them in an orderly manner;
- (9) I can achieve my goals;
- (10) I always strive for excellence;
- (11) I am good at arranging everything at my own pace;
- (12) It will take me a long time to settle down.

The questions of neuroticism test are as follows:

- (1) I am not a person full of troubles;
- (2) I rarely feel fear or anxiety;
- (3) I often feel nervous and restless;
- (4) The way others treat me often makes me angry;
- (5) I seldom feel lonely or blue;
- (6) Sometimes I feel completely worthless;
- (7) I rarely feel blue or depressed;
- (8) Many times in our life when things go wrong, I feel frustrated and want to give up;
- (9) Sometimes I feel so shy that I want to hide;
- (10) I usually feel like I am not as good as anyone else;
- (11) I often feel helpless and hope that someone can solve my problems;
- (12) When I am under great pressure, I feel like I am going to breakdown sometimes.