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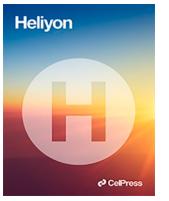

Research article

The component and structure of interpersonal trust

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ABSTRACT

Prior research has identified trust trait, trust expectation, trust risk and trust behavior as integral components of interpersonal trust. However, there still lack an in-depth exploration of the structural relationships among these integral components—how these integral components collectively constitute interpersonal trust. The current study innovatively proposed that interpersonal trust is anchored by individual trust trait, mediated by the dynamic equilibrium between trust risk and trust expectation, and culminates in trust behavior as the outcome. Interpersonal trust results from the synergistic interplay of individual and environmental factors. We called such structural relationships as the pyramid structure model of interpersonal trust, and proved its rationality by empirical evidence.

1. Introduction

Interpersonal trust is a complex social-psychological phenomenon with rich connotations, commonly studied across disciplines such as sociology [1], psychology [2], management [3], economics [4], and other related fields [5]. The sociological perspective suggests that interpersonal trust is a social relationship extending beyond individual connections, it is rooted in the political, economic, cultural and other socio-background. Meanwhile, it represents a universal cultural characteristic derived from shared rules and values [6]. Compared with the sociological perspective, the psychological viewpoint on interpersonal trust is more microscopic. Psychologists emphasize the essential characteristics of trust such as voluntariness, uncertainty, vulnerability and pro-sociality [7,8], and define trust as the willingness of an individual to voluntarily offer personal resources to others based on positive expectations of their reciprocal behavior, thereby putting themselves in a vulnerable position [9–11]. Additionally, economists tend to associate interpersonal trust with risk, and view it as a decision involving risk [12]. For example, Luhmann believes that interpersonal trust is more like a gamble or adventure based on the rational calculation [13], whereas Gambetta views trust as a threshold point on the distribution map of expected probability. When the threshold point is reached, individuals make a trust decision, otherwise, they opt for distrust [14].

Although there are differences in research perspectives among researchers from various disciplines, they still share some common

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understandings of interpersonal trust. Generally, they agree that interpersonal trust is a relatively stable personality trait of the trustor (trust trait) [15–21], and it is the trustor's positive expectation for the goodwill of the trustee (trust expectation) [6,15,16,22–26]. In addition, they also agree that interpersonal trust must be accompanied by uncertain risks (trust risk) [13,14,27,28], and interpersonal trust is not just an implicit belief but an explicit behavior (trust behavior) [29–31]. We think that it is above common understandings from different disciplines that reflect the core component of interpersonal trust. For the sake of clarity in writing, these common understandings were abbreviated as trust trait, trust expectation, trust risk and trust behavior, respectively in this paper.

Although the studies mentioned above have concerned the core components of interpersonal trust, they still lack an in-depth exploration of the structural relationships among these core components—how these core components collectively constitute interpersonal trust. The present study aims to address this gap by exploring the relationships among these core components and proposing a new structural model, referred to as the pyramid structure model of interpersonal trust.

In his theory of psychosocial development, Erikson identified the initial crisis that every individual encounters in infancy as the conflict between basic trust and basic distrust. Adequate care during this stage allows babies to form a foundational sense of trust in their environment. Over an extended period of social learning, this fundamental sense of trust becomes internalized, shaping the individual's trust expectations and trust behaviors [32]. Giddens' theory of ontological security states that the interaction between infants and their mothers plays a crucial role in the acquisition of a sense of ontological security. This sense serves as the foundation for an individual's interpersonal trust and lays the groundwork for other prosocial behaviors [33,34]. Furthermore, according to Rotter, an individual's life experiences and fundamental view of human nature (trust trait) serve as the foundation for trust expectations. This underlying framework is a key determinant of why some individuals are inclined to trust others, while others are predisposed to harbor doubts [15,16]. Building upon the findings of the aforementioned studies, we propose that **an individual's trust trait forms the foundation for both their trust expectations and trust behaviors (Hypothesis 1).**

Interpersonal trust itself is a paradoxical phenomenon encompassing both lofty aspirations, such as seeking profit, and deep fears, notably avoiding loss [35]. On the one hand, expected benefits (including material benefits and spiritual benefits) serve as the driving force behind interpersonal trust. Without foreseeable benefits, interpersonal trust becomes like water without a source and woods without roots. On the other hand, interpersonal trust is inevitably accompanied by risks and uncertainties, without such uncertainties, an individual's decision-making in a given situation cannot be labeled as trust [36]. Thus, rational choice theory even directly regards trust as a risk decision, suggesting that trust behavior hinges on an individual's expectation and calculation of potential risks and benefits [12]. These studies have prompted us to recognize that benefits and risks invariably coexist in interpersonal trust. Individuals are consistently navigating the tension between trust and distrust, requiring them to strike a trade-off between potential risks and possible benefits. The conflicting nature of benefits and risks in trust decision-making contributes to the intricate nature of trust behavior. This intricacy is also the reason why trust is often characterized as a "social dilemma" [37] and "trust dilemma" [38]. **In light of this, we propose that interpersonal trust must be accompanied by a trade-off between trust expectation and trust risk (Hypothesis 2). Trust behavior, consequently, emerges as the outcome of this trade-off, further influenced by an individual's trust trait (Hypothesis 3).** For ease of understanding, we use Fig. 1 to illustrate above relationships, referring to it as the pyramid structure model of interpersonal trust. In the following sections, an empirical test will be conducted to validate the rationality of this model.

2. Materials and methods

To empirically assess the pyramid structure model of interpersonal trust, the current study initially developed a four-dimensional interpersonal trust structure questionnaire. Subsequently, exploratory factor analysis and confirmatory factor analysis were employed to evaluate the rationality of questionnaire. Finally, utilizing Mplus software [39], a structural equation model was constructed to scrutinize the proposed pyramid structure model of interpersonal trust. The research protocol was approved by the Ethics Committee

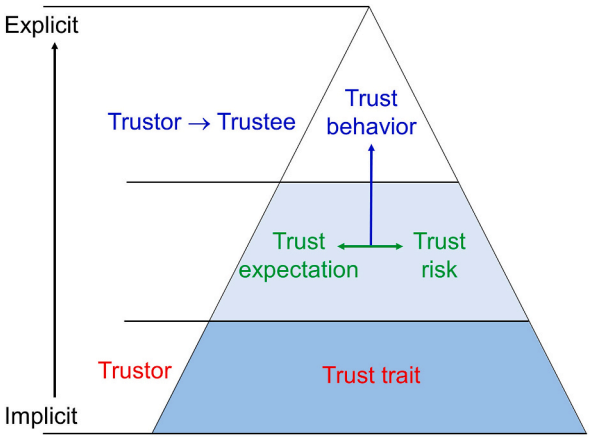

Fig. 1. Pyramid structure model of interpersonal trust.

of Qinghai Normal University (QHNU2022LS-06 and April 7, 2022). Verbal informed consent was obtained from all the participants prior to the enrollment of this study.

2.1. Exploratory factor analysis and control of common method deviation

After conducting semi-structured interviews and refining the questionnaire items, a 40-item interpersonal trust structure questionnaire was developed. In the initial exploratory factor analysis, we excluded samples that did not pass the polygraph test and those with obvious response patterns, resulting in a total of 270 valid samples from college students (females: 134; males: 136; age: 18–24 years old). In the subsequent retest two weeks later, 241 valid samples (females: 113; males: 128; age: 18–24 years old) were matched. After exploratory factor analysis, 20 items were retained in the interpersonal trust structure questionnaire. The results of the Kaiser-Meyer-Olkin test (KMO = 0.84) and Bartlett sphericity test ($\chi^2 = 1746.56^{***}$, $df = 190$, $p < 0.001$) illustrated the suitability of these items for factor analysis. It's worth noting that, to ensure data quality, we first trained the counselors before data collection and then allocated about 30 min in the activity class for students to answer questionnaires. Additionally, during the measurement process, we implemented some necessary measures, such as ensuring all survey items in this study were filled in anonymously and balancing the order of items, to control for possible common method deviation. Statistically, Harman's single factor test was used to quantitatively assess common method deviation [40].

2.2. Confirmatory factor analysis

Following the same screening rules as exploratory factor analysis, an additional 380 valid samples (females: 105; males: 275; age: 18–29 years old) were collected for confirmatory factor analysis through the Questionnaire-Star (a professional online platform for questionnaire survey, examination, evaluation and voting). Specifically, using Mplus software [39], we employed three model estimation methods (ML: maximum likelihood estimation; MLR: robust maximum likelihood estimation; MLM: maximum likelihood estimation with standard error and mean correction) to conduct confirmatory factor analysis on the four-dimensional structure questionnaire of interpersonal trust.

2.3. The empirically test to the pyramid structure model of interpersonal trust

AS all concepts of this study were latent variables, and our primary focus on the structural relationships among these variables (as depicted in Fig. 2), we utilized Mplus software [39] to construct a structural equation model for testing the proposed pyramid structure model of interpersonal trust. According to Hypothesis 1 (positing that individuals' trust trait forms the basis for their trust expectation and trust behavior), we hypothesized the existence of paths from trust trait to both trust expectation and trust behavior (paths 1 and 2 in Fig. 2) in the path map of the pyramid structure model of interpersonal trust. Likewise, following the premise of Hypothesis 2 (suggesting that interpersonal trust must be accompanied by a trade-off between trust expectation and trust risk), we posit the presence of a bidirectional path (paths 4 and 5 in Fig. 2) between trust expectation and trust risk in the path map of the pyramid structure model of interpersonal trust. Lastly, adhering to Hypothesis 3 (which suggests that interpersonal trust behavior is the outcome of the trade-off between trust expectation and trust risk, and is also influenced by trust trait), we assume the existence of paths from trust trait, trust expectation, and trust risk to trust behavior (paths 2, 6, and 7 in Fig. 2) in the path map of the pyramid structure model of interpersonal trust.

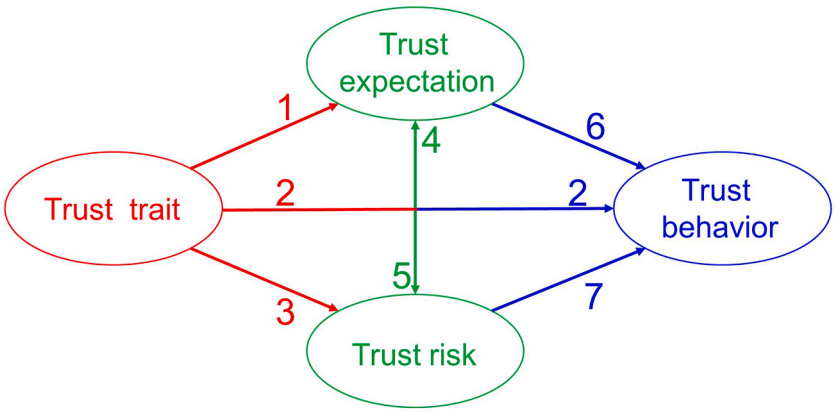

Fig. 2. The path map of pyramid structure model.

3. Results

3.1. Results of common method deviation test

The Harman single-factor test [40] showed that the variance explained by the first common factor was 30 %, indicating that there was no serious common method deviation in this study.

3.2. Results of exploratory factor analysis

The exploratory factor analysis provided preliminary support for our hypothesis regarding the four-dimensional structure of interpersonal trust. As depicted in Table 1, the cumulative variance explanation rate for the four dimensions of the interpersonal trust structure questionnaire reached 55.35 %. Most items demonstrated factor loadings above 0.60, and the correlation between each item score and its dimensional total scores exceeded 0.70. Furthermore, there was a moderate correlation among the four dimensions. Independent samples T-tests, grouped by high and low scores of 30 %, revealed significant differences in item scores between the two groups, indicating a substantial level of discrimination for all items. The reliability test revealed that the internal consistency coefficients (Cronbach's Alpha) for the four dimensions (trust trait, trust risk, trust expectation, and trust behavior) were 0.82, 0.72, 0.81, and 0.73, respectively. The retest reliability of the four dimensions after two weeks was 0.71, 0.67, 0.72, and 0.68, respectively. In terms of validity, the correlations between trust trait and the trust dimension of the Big Five Personality Scale [19], trust risk and the caution scale of Yamagishi [36], trust expectation and the universal trust scale of Yamagishi [36], as well as trust behavior and the trust behavior scale of Peng Siqing [41], were 0.74, 0.62, 0.89 and 0.75, respectively.

3.3. Results of confirmatory factor analysis

As presented in Table 2, confirmatory factor analysis indicated that the fit indices of all three model estimation methods (ML, MLR and MLM) reached an acceptable level. Notably, the MLM method yielded the most favorable fit results.

Table 1
Results of exploratory factor analysis.

I	S	K	DD	Mean	SD	L	Components			
							T	R	E	B
T5	−0.26	−0.01	9.13***	4.53	1.37	0.44	0.77	0.09	−0.03	0.01
T2	−0.46	−0.27	12.87***	4.87	1.50	0.74	0.77	−0.04	−0.05	0.38
T3	−0.44	−0.31	12.80***	4.59	1.56	0.55	0.72	0.06	−0.05	0.16
T4	−0.33	−0.14	10.90***	4.60	1.52	0.57	0.69	0.00	0.08	0.29
T1	−0.70	0.24	12.21***	5.10	1.40	0.60	0.59	−0.11	−0.07	0.26
R2	−0.57	−0.40	−4.81 ***	5.37	1.48	0.46	−0.08	0.73	0.03	0.26
R3	−0.62	−0.43	−3.93 ***	5.15	1.64	0.60	−0.05	0.72	0.05	−0.01
R1	−0.44	−0.62	−4.10 ***	4.76	1.72	0.52	−0.13	0.66	0.06	0.03
R5	−1.39	1.49	−3.65***	6.11	1.27	0.54	−0.19	0.62	0.04	0.48
R4	−0.17	−0.58	−5.68***	4.24	1.60	0.65	−0.12	0.61	−0.02	−0.40
E1	−0.47	−0.34	14.36***	4.99	1.50	0.65	−0.01	0.16	0.79	−0.05
E4	−0.88	0.41	5.76***	5.70	1.28	0.64	0.12	0.15	0.69	−0.23
E3	−0.23	−0.63	10.71***	4.59	1.48	0.53	0.12	0.19	0.68	−0.16
E5	−0.58	−0.36	10.96***	5.50	1.33	0.57	0.14	0.03	0.66	−0.21
E2	−0.62	0.18	8.09***	5.35	1.33	0.50	0.33	0.01	0.55	−0.49
B1	−0.08	−0.69	10.45***	3.87	1.58	0.59	0.02	0.09	−0.08	0.76
B2	−0.23	0.15	12.32***	5.01	1.13	0.56	−0.09	0.04	−0.05	0.74
B4	−0.73	−0.39	8.69***	2.57	1.58	0.40	−0.16	0.10	0.00	0.71
B5	0.03	−0.71	9.44***	3.56	1.54	0.54	−0.26	0.00	−0.07	0.61
B3	−0.45	0.24	11.09***	4.50	1.23	0.44	−0.11	−0.15	−0.04	0.60
Variance explained rate (%)							24.99	12.35	12.11	5.91
Cumulative variance explained rate (%)							24.99	37.34	49.44	55.35
Internal consistency coefficient (Cronbach's Alpha)							0.82	0.72	0.81	0.73
Test-retest reliability after two weeks							0.71	0.67	0.72	0.68
Component correlation matrix (upper right triangle)						T	–	−0.09	−0.10	−0.12
Factor correlation coefficient (lower left triangle)						R	−0.13*	–	−0.01	−0.03
						E	0.69**	−0.01	–	−0.11
						B	0.12*	0.01	0.0.03	–

Note: I: items; S: skewness; K: kurtosis; DD: distinction degree; L: loadings; T: trust trait; R: trust risk; E: trust expectation; B: trust behavior; SD: standard deviation; Common factor extraction method: principal components analysis; Rotation method: direct oblimin method (delta = 0); *: significant at 0.05 level; **: significant at 0.01 level; ***: significant at 0.001 level.

Table 2
Model fit indices of confirmatory factor analysis.

Method	χ^2	*df*	CFI	TLI	AIC	BIC	SRMR	RMSEA (95 % CI)
ML	261.35 ***	164	0.94	0.93	11585	11799	0.061	0.056 (0.043–0.068)
MLR	243.18 ***	164	0.94	0.93	11585	11799	0.061	0.050 (0.036–0.063)
MLM	231.77 ***	164	0.95	0.94	11585	11799	0.061	0.047 (0.032–0.060)

Note: ML: maximum likelihood estimation; MLR: robust maximum likelihood estimation; MLM: maximum likelihood estimation with standard errors and mean corrected chi-square test; CFI: comparative fit index; TLI: tucker-lewis index; AIC: alaike information criterion; BIC: bayesian information criterion; SRMR: standardized root mean square residual; RMSEA: root mean square error of approximation; ***: significant at 0.001 level.

3.4. Results of the test to the pyramid structure model of interpersonal trust

3.4.1. Internal correlation analysis of the four components of interpersonal trust

Results Regarding Hypothesis 1: Correlation analysis revealed a significant correlation between trust expectation and trust trait ($r = 0.75$, $p < 0.001$). Similarly, a significant correlation was found between trust behavior and trust trait ($r = 0.41$, $p < 0.001$). In regression analysis, using trust trait as the predictor variable, it was observed that trust trait significantly and positively predicted trust expectation, $\beta = 0.75$, $t = 29.11$, $p < 0.001$, $R^2 = 0.57$. Additionally, the regression analysis for trust behavior as the dependent variable showed that trust trait significantly and positively predicted trust behavior, $\beta = 0.41$, $t = 11.43$, $P < 0.001$, $R^2 = 0.17$.

Results Regarding Hypothesis 2: Correlation analysis indicated a non-significant correlation between trust expectation and trust risk, $r = 0.07$, $p = 0.098$. However, in the structural equation model, where trust expectation, trust risk, and their observed indicators were simultaneously included, the path coefficient from trust expectation to trust risk was found to be significant, $\beta = 0.24$, $P < 0.001$ (Fig. 3).

Results Regarding Hypothesis 3: Correlation analysis revealed a significant positive correlation between trust behavior and trust expectation, $r = 0.28$, $p < 0.001$, as well as a significant negative correlation between trust behavior and trust risk, $r = -0.13$, $p = 0.001$. In regression analysis, with trust behavior as the dependent variable and trust trait, trust expectation, and trust risk as predictive variables, it was found that trust trait significantly and positively predicted trust behavior, $\beta = 0.43$, $t = 7.99$, $p < 0.001$, while trust risk significantly and negatively predicted trust behavior, $\beta = -0.12$, $t = -3.33$, $p = 0.001$. Trust expectation, however, showed no significant predictive effect on trust behavior. Collectively, trust trait and trust risk accounted for 18.00 % of the variation in trust behavior, $R^2 = 0.18$, $F = 48.33$, $p < 0.001$.

3.4.2. Model analysis of the pyramid structure model of interpersonal trust

In this study, we established four competing models to examine the pyramid structure model of interpersonal trust. Model 1 (M1) encompasses all seven paths depicted in Fig. 2; Model 2 (M2) includes paths 1, 2, and 6 from Fig. 2; Model 3 (M3) involves paths 2, 3, and 7 from Fig. 2; and Model 4 (M4) integrates paths 1, 2, 3, 6, and 7 from Fig. 2. The structural equation model demonstrated that the

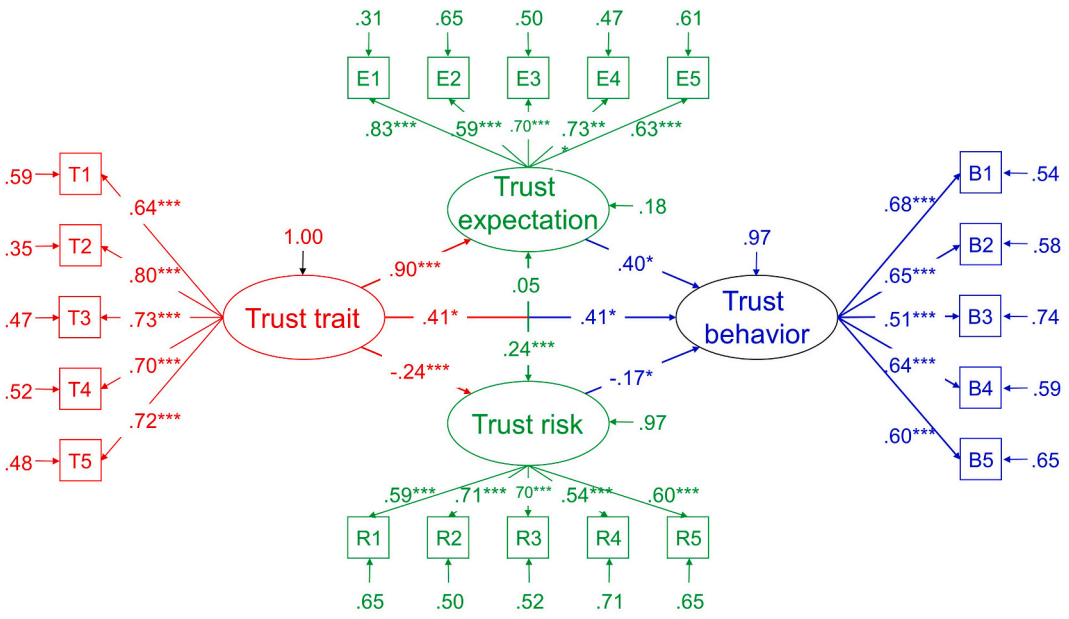

Fig. 3. Roadmap of the interpersonal trust pyramid structure model. Note: *: significant at 0.05 level; **: significant at 0.01 level; ***: Significant at 0.001 level.

fit indices for each model reached acceptable levels (refer to Table 3). Notably, the fitting result of Model 1, which incorporates all seven paths from Fig. 2, was optimal. Consequently, only the path coefficients of Model 1 are presented in Fig. 3. As illustrated in Fig. 3, all path coefficients of the measurement model and the majority of path coefficients in the structural model reached statistical significance at the 0.001 level.

4. Discussion

Although previous studies have concerned the core components of interpersonal trust, there is a paucity of research examining the structural relationships among these components. Drawing on Erikson's psychosocial development theory [32], Giddens' ontological security theory [33,34] and other pertinent studies [36], we posit that interpersonal trust is rooted in individual trust trait, influenced by the interplay between trust risk and trust expectation, and manifested through trust behavior. This dynamic process results from a combination of individual factors (trust trait) and environmental factors (potential gains and losses). We term these relationships among the core components of interpersonal trust as the 'pyramid structure model of interpersonal trust' and substantiate the rationality of this model with empirical data.

4.1. Interpersonal trust structure questionnaire

To empirically test the pyramid structure model of interpersonal trust, the current study devised a four-dimensional interpersonal trust structure questionnaire. Initially, the findings from exploratory factor analysis, reliability testing, and a validity assessment provided preliminary validation of our hypothesis regarding the four-dimensional structure of interpersonal trust. Subsequently, confirmatory factor analysis affirmed that all indicators of the four-dimensional interpersonal trust structure questionnaire met the measurement criteria, establishing its utility as a tool for empirically testing the structural relationships among the core components of interpersonal trust.

4.2. The pyramid structure model of interpersonal trust

4.2.1. Trust trait is the cornerstone of an individual's trust expectation and trust behavior

Correlation analysis revealed significant and positive associations between trust expectation, trust behavior, and trust trait. Further regression analysis demonstrated that trust trait significantly and positively predicted both trust expectation and trust behavior. Specifically, trust trait accounted for 57 % of the variance in trust expectation and 17 % of the variance in trust behavior. The structural equation model corroborated these findings, indicating significant path coefficients from trust trait to both trust expectation and trust behavior. In alignment with Rotter's perspective, which posits that an individual's life experience and fundamental view of human nature (trust trait) serve as the foundation for the emergence of trust expectation, these results highlight trust trait as a pivotal factor influencing why some individuals tend to trust while others tend to doubt [15,16]. In line with prior research, the present findings affirm that trust trait serves as a significant predictor of both trust expectation and trust behavior. This lends empirical support to the perspective that an individual's trust trait acts as the cornerstone influencing their trust expectation and trust behavior. When considered in conjunction with Erikson's psychosocial development theory [32], and Giddens' ontological security theory [33,34], these results provide further justification for the placement of trust trait at the foundation of the pyramid structure model of interpersonal trust.

4.2.2. Interpersonal trust inherently involves a trade-off between trust expectation and trust risk

Correlation analysis indicated that the direct correlation between trust expectation and trust risk was not significant. However, when both trust expectation and trust risk, along with their observed indicators were simultaneously incorporated into the structural equation model, path analysis revealed a significant path coefficient from trust expectation to trust risk. As mentioned earlier, latent variables like trust trait and trust expectation pose challenges for direct measurement and can only be indirectly assessed through explicit observational indicators. Traditional statistical methods, such as correlation and regression analysis, may not effectively handle these latent variables. In contrast, structural equation models offer the advantage of addressing both latent variables and their indicators [42]. The results presented here underscore the efficacy of using a structural equation model in this study, providing

Table 3
Fitting results of pyramid structure model of interpersonal trust.

Model	χ^2	*df*	CFI	TLI	AIC	BIC	SRMR	RMSEA (95 % CI)
M1	375.69 ***	163	0.95	0.94	41549	41849	0.042	0.045 (0.039–0.051)
M2	384.18 ***	166	0.93	0.91	41551	41838	0.044	0.045 (0.039–0.051)
M3	388.17 ***	166	0.92	0.91	41555	41842	0.045	0.045 (0.040–0.051)
M4	383.32***	165	0.95	0.94	41553	41844	0.044	0.045 (0.039–0.051)

Note: CFI: comparative fit index; TLI: tucker-lewis index; AIC: alaike information criterion; BIC: bayesian information criterion; SRMR: standardized root mean square residual; RMSEA: root mean square error of approximation; Models: M1: model 1, incorporating all 7 paths of Fig. 2; M2: model 2, comprising 3 paths (1, 2, 6) of Fig. 2; M3: model 3, including 3 paths (2, 3, 7) of Fig. 2; M4: model 4, involving 5 paths (1, 2, 3, 6, 7) of Fig. 2. ***: Significant at 0.001 level; Estimator: = maximum likelihood estimation; Bootstrap = 1000.

evidence for its utility in verifying the pyramid structure model of interpersonal trust.

Previous studies have characterized trust as a paradoxical phenomenon [35], wherein expected benefits serve as the driving force behind trust behavior, yet trust is inevitably accompanied by risks and uncertainties [36]. This dichotomy places individuals in a perpetual state of tension between trust and distrust, necessitating a delicate balance between potential risks and possible benefits. The results from the current structural equation model align with our daily experiences, where benefits often coexist with risks, and high returns are typically associated with high risks. Furthermore, these findings offer empirical support for the notion that interpersonal trust inherently involves a trade-off between trust expectation and trust risk.

4.2.3. Trust behavior results from the combined influence of trust trait, trust expectation, and trust risk

Correlation analysis revealed a significant and positive association between trust behavior and both trust trait and trust expectation, while indicating a significant and negative correlation with trust risk. Regression analysis further demonstrated that trust trait significantly and positively predicted trust behavior, and trust risk significantly and negatively predicted trust behavior. Specifically, the combined impact of trust trait and trust risk accounted for 18 % of the variation in trust behavior. The structural equation model, encompassing all seven paths from Fig. 2, confirmed the significance of the three path coefficients leading from trust trait, trust expectation, and trust risk to trust behavior. This aligns with findings by Evans et al., who observed that an individual's trust trait can predict their trust behavior in the trust game [43]. Coleman et al.'s research highlighted that risk and reciprocity expectation jointly influence an individual's trust decision [28]. Consistent with these findings, the current results lend support to our perspective that trust behavior is a product of the interplay between individual factors, such as personal trust trait, and environmental factors like trust expectation and trust risk. Furthermore, the regression analysis revealed that when trust trait, trust expectation, and trust risk were simultaneously included as predictive variables, the predictive effect of trust expectation on trust behavior became nonsignificant. These findings suggest that, in comparison with trust expectation, the prediction of trust behavior by trust trait is more stable. It implies that trust behavior is predominantly determined by internal or individual factors rather than external or environmental factors. This finding aligns, to some extent, with the moral norm theory of trust, asserting that trust is a form of behavior driven by internalized moral norms [44,45].

5. Conclusions

Building on previous studies, the present research introduces an innovative structural model—the Pyramid Structure Model of Interpersonal Trust—and substantiates its validity through empirical evidence. This model posits that interpersonal trust centers around individual trust trait as its foundation, with the dynamic equilibrium between trust risk and trust expectation acting as intermediaries, ultimately resulting in trust behavior. It represents the collaborative influence of individual and environmental factors. The Pyramid Structure Model of Interpersonal Trust, proposed in this study, serves as a valuable extension and complement to existing trust theories. It aids in deepening our understanding of the nuanced facets of interpersonal trust.

6. Limitations and future directions

Acknowledging its core aspect as vulnerability to others' actions, researchers in the field of economics often utilize economic exchange games, such as the trust game, to evaluate trust behavior. In this study, aiming to facilitate data collection, a paper version of the trust game task (see Supplementary Material) was employed to measure trust behavior. While this approach partially addresses limitations linked to questionnaire data resembling cheap talk in proposing trust behavior, it is essential to acknowledge a certain degree of difference from the real trust game. Subsequent studies may consider incorporating a binary trust game in real scenarios to alleviate these limitations. Additionally, it's important to note that this study was conducted within the context of Chinese culture, and further research is needed to verify the universality of this structural model in other cultural backgrounds.

Ethics statement

The research protocol was approved by the Ethics Committee of Qinghai Normal University (QHNU2022LS-06 and April 7, 2022).

Informed consent statement

Verbal informed consent was obtained from all the participants prior to the enrollment of this study.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Chao Fu: Writing – review & editing. **Shuai Yang:** Validation, Software. **Mengying Zhai:** Writing – original draft. **Tingjun Yong:** Writing – original draft. **Chun Zheng:** Visualization. **Xueqin Ma:** Validation. **Guangyan Hou:** Writing – original draft, Conceptualization. **Ping Su:** Writing – review & editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Fu Chao reports article publishing charges was provided by National Natural Science Foundation of China. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e30071.

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