

Article

How Do Venture Capital Firms Manage Their Ego Networks for Sustainable Development?

Yuge Gao  and Yongping Xie *

School of Economics and Management, Xidian University, Xi'an 710126, China; gaoyg68@163.com

* Correspondence: xieyop@163.com

Abstract

In the context of rapidly developing emerging industries, shifting investment hotspots, and a turbulent external environment, investment institutions continuously adjust and manage their ego network strategies to ensure survival and promote sustainable development. The long-term development and competitiveness of venture capital (VC) firms largely depend on their ability to generate excess returns and achieve successful exits, such as IPOs and mergers and acquisitions. This study focuses on venture capital ego networks from a dynamic perspective. From both the node and tie dimensions, it systematically examines the effects of ego network dynamics—growth and diversity—on investment performance. It further explores the underlying mechanisms through network stability and information diffusion. Based on empirical analysis using Wind database data from 2013 to 2022, we find that the growth of VC ego networks has a significant negative effect on investment performance, and this effect works through reduced network stability. In contrast, ego network diversity shows a significant positive effect on investment performance, with project information diffusion playing a mediating role. Based on the above findings, we suggest that venture capital firms should shift their ego network management strategy from blind and simple “rapid expansion” to quality-focused “careful cultivation”. While maintaining the stability of their ego networks, firms should also pay attention to the diversity of relationship configurations, so as to better transform network resources into investment performance and promote the growth and sustainable development of venture capital firms.



Academic Editor: Ștefan Cristian Gherghina

Received: 26 September 2025

Revised: 31 October 2025

Accepted: 21 November 2025

Published: 23 November 2025

Citation: Gao, Y.; Xie, Y. How Do Venture Capital Firms Manage Their Ego Networks for Sustainable Development? *Sustainability* **2025**, *17*, 10493. <https://doi.org/10.3390/su172310493>

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Keywords: venture capital; ego network; network dynamics; investment performance; sustainable development

1. Introduction

In the context of the accelerating global innovation economy and the growing emphasis on sustainable development, venture capital has become more than a profit-seeking intermediary. It now serves as a key node that links innovation, industrial upgrading, and efficient capital allocation, and plays an important role in supporting economic growth, social well-being, and ecological resilience. However, in the face of rapid technological change, increasing uncertainty, and growing competitive pressure, the question of how investment institutions achieve long-term sustainable development in a dynamic environment has become a core concern for both scholars and practitioners. In recent years, social network theory has provided an important perspective for understanding the behavior of venture capital institutions. In particular, the ego network, as the core unit for examining micro-level network structures, reflects the strategic choices of investment institutions

in information acquisition, resource integration, and partnership formation [1]. It has a profound impact on how institutions utilize resources and create potential value [2].

In practice, the ego network of a venture capital firm is not static. Over time, changes in the external environment and internal needs drive investment institutions to continuously adjust their ego networks. These dynamic adjustments involve the exit of old partners and the entry of new ones, as well as updates to higher-level patterns of connections among nodes. Together, these changes constitute the dynamic nature of the focal firm's ego network [3]. From the perspective of sustainable development, the sustainability of venture capital institutions essentially involves their continuous evolution through network relationships and the subsequent upgrading of their capabilities to adapt dynamically to the environment. Ego network dynamics precisely form the critical underlying mechanism of this process: by eliminating inefficient existing ties in a timely manner and proactively introducing new members, VC firms can acquire non-redundant knowledge and information resources [4], expand and optimally allocate their resources [5], enhance decision-making efficiency, and maintain resilience in a dynamic environment. For example, to capture the AI wave between 2016 and 2018, Sequoia China significantly strengthened its investments and presence in the artificial intelligence sector, forming syndicates with companies such as SenseTime and the corporate venture arm of iFlytek. Similarly, the surge in the new energy sector required firms to quickly connect to network nodes in battery materials, carbon management, and related areas. These actions essentially represent the optimization of their own network relationships to achieve sustainable development. However, some scholars also argue that, while network dynamism helps firms access new information and explore opportunities, frequent adjustments can undermine established trust and collaboration routines, making it harder to accumulate relational capital and reducing cooperation efficiency [4]. For instance, when partners expect network relationships to be unstable, they may reduce resource contributions and their willingness to collaborate. From the perspective of sustainable development, the growth of investment institutions relies on a stable resource network, continuous knowledge sharing, and a lasting reputation. In this regard, long-term and stable network relationships serve as foundations and key manifestations of trust [6,7], which helps improve cooperation efficiency, reduce transaction costs, and enhance the institutions' value-creation capacity and long-term development [8,9]. Therefore, to achieve sustainable development, one must ask how investment institutions should evaluate and proactively adjust their ego network strategies?

To address the above question, this study reviews research related to the sustainable development of venture capital. Some scholars, aiming to achieve the sustainable development of investment firms, mainly focus on how to build a venture capital ecosystem and examine the factors that influence the formation of connections between venture capital institutions. For example, Ren et al. [10] studied the structural characteristics of partner networks and pointed out that, within the co-investment ecosystem for sustainable projects, venture capital firms tend to form network ties with potential partners who occupy intermediary advantages and appropriate positions. Other scholars have explored the drivers of venture capital network formation from perspectives such as firms' own investment preferences, prior connections, and institutional uncertainty [11,12]. It can be observed that the above studies mainly focus on the static characteristics of networks, emphasizing the question of how to select partners to build a venture capital network, without considering the dynamic development of the network or the impact of network quality. In contrast, an organization's sustainable development is often related to its economic performance [10], and the long-term survival and competitiveness of venture capital firms largely depend on their performance outcomes [13]. To achieve the sustainable development of investment institutions, this study focuses on the economic performance perspective, primarily

examining how the dynamic behaviors of venture capital ego networks affect investment performance. Based on performance feedback, firms actively select, maintain, or remove co-investment partners to optimize and restructure internal network relationships. This behavioral strategy emphasizes how existing network relationships are adjusted and updated, representing a shift from “how networks are formed” to “how networks evolve”, and marking a theoretical upgrade from analyzing static structures to examining dynamic processes. Therefore, the study of venture capital network dynamics not only builds on the theoretical foundation regarding the importance of network relationships from previous research but also further reveals how these relationships evolve over time, providing a new perspective for understanding differences in investment performance and the mechanisms underlying the sustained growth of venture capital firms.

In existing research on network dynamics, many scholars have focused on the evolutionary characteristics of venture capital networks. For example, Gu et al. [14] analyzed the evolutionary patterns of venture capital small-world networks in terms of structural features such as the EI index and degree distribution, and, based on embeddedness theory, revealed the mechanisms driving the dynamic evolution of small-world networks, providing theoretical support for the long-term dynamic development of venture capital firms. These studies primarily focus on the macro level, highlighting the dynamic evolution of the overall network structure and its formation mechanisms. Subsequently, scholars further refined the study of network dynamics by extending it to the meso-level of network communities. They analyzed how these communities evolve and how members’ cross-community movements affect investment performance [15–17]. Although these studies also reflect the dynamic changes of networks, cross-community mobility primarily describes the re-embedding of network members across different network communities. It captures the performance differences of investment institutions resulting from changes in their positions within the macro-structure. This type of dynamism represents flow at the structural level. In contrast, this study extends the research perspective to the micro-level of ego networks, examining the dynamic behavioral changes of venture capital firms at this level. Specifically, ego network dynamics focus on the updating and restructuring of relationships with direct partners, including the formation of new ties, dissolution of existing ties, and the resulting adjustment of relational patterns [18,19]. This type of dynamic reveals how firms manage relationships and integrate resources within their networks, reflecting the balance between maintaining stable collaborations and exploring new opportunities. Overall, compared with previous studies focusing on cross-community mobility, this study extends the level of analysis from meso-level structural evolution to micro-level relational evolution, thereby providing a more fine-grained mechanism to explain differences in investment performance.

However, despite the growing attention to the importance of micro-level ego network dynamics, relevant research in the venture capital field remains limited. Some scholars, such as Luo et al. [1], have examined the relationship between ego network stability and investment performance only from the perspective of node “entry and exit”, but they neglected the role of dynamic configuration of ties between nodes and did not explore the underlying mechanisms linking the two. In fact, network dynamics essentially involve the process by which an organization dissolves prior ties and forms new ones. This process is reflected not only at the node level but also in higher-order dynamic adjustments of ties between nodes [20]. In this context, ego network diversity becomes an important indicator at the relational level, describing the distribution of ties between the organization and its direct partners, and reflecting the ego network’s capacity to access heterogeneous information, knowledge, and other resources [21]. Guan et al. [22] further emphasize that ego network diversity represents the most prominent and important form of network

dynamics, directly influencing the functioning of the ego network and its effectiveness in new knowledge creation. Therefore, compared with previous studies that focus only on node-level dynamics, this study examines ego network diversity from the perspective of relationships between nodes, further exploring its role and underlying mechanisms, thereby addressing the gap in the literature on relational-level network dynamics. In addition, previous studies have also shown that the impact of prior cooperative relationships on investment performance may be moderated by contextual factors, such as geographic concentration, strategic alignment, and the network environment [1,23,24]. However, in contrast to studies focusing on “how contextual factors alter relationship effects”. This study adopts a behavioral perspective, emphasizing how venture capital firms proactively adjust their prior cooperative relationships and the direct impact of these adjustments on investment performance. In other words, we focus on the proactive changes in relationships within the network—such as adding, maintaining, or removing partners and ties—rather than the moderating effects of contextual factors on this process. Future research could build on this work by examining how adjustments prior to co-investment ties affect investment performance under specific contextual conditions.

In summary, this study primarily adopts a dynamic perspective of venture capital ego networks to examine their impact on the sustainable development of investment institutions. Specifically, it explores the effects of ego network growth and diversity on investment performance and further investigates the underlying mechanisms. The aim is to provide strategic guidance for managing ego networks, enabling investment institutions to navigate selection dilemmas and promoting sustainable development amid the rapid evolution of emerging industries and economic turbulence.

2. Literature Review and Research Hypotheses

(1) Venture capital ego network management

This refers to the process in which venture capital firms, guided by the goal of sustainable development and based on feedback from their performance, actively manage their direct co-investment relationships (ego networks) by selecting, maintaining, or removing partners. Through these strategies, they optimize and restructure their internal network relationships to improve resource allocation within the ego network, enhance decision-making efficiency, and strengthen their adaptability to the environment

(2) The sustainable development of venture capital firms

The sustainable development of an organization is often closely related to its economic performance [10]. For venture capital (VC) firms, long-term survival and competitiveness largely depend on their investment performance, specifically their ability to generate excess returns and achieve successful exits (e.g., IPOs or M&As) [13].

In this study, the sustainable development of venture capital firms is defined as the level of investment performance that continuously secure high-quality investment opportunities and achieve successful exits (e.g., IPOs and M&As). This not only ensures steady financial growth but also maintains competitive advantages in the market, including reputation building and accumulation of capital and resources, thereby supporting their long-term survival and development. The level of sustainable development can be measured by the proportion of portfolio companies through which a venture capital firm successfully exits via IPOs or M&A. This indicator not only reflects the firm’s financial soundness but also its ability to maintain competitiveness and long-term survival in the market. Moreover, based on the widely observed phenomenon of ‘performance persistence’ in venture capital [13], consistently strong investment performance can create a virtuous cycle, reinforcing the firm’s market position and long-term development capabilities

(3) Ego network dynamics

Network dynamics refer to the process through which an organization dissolves existing ties and establishes new ones, manifested in changes in network nodes, the relationships between nodes, and overall network structure [20]. From the perspective of network elements, a network is composed of nodes and the relationships among them. Therefore, based on the studies of Guan et al. [22] and Gao et al. [25], this paper considers that the dynamics of venture capitalists' ego networks involve not only changes at the node level but also changes in the relationships between nodes. First, at the node level, the focus is on ego network growth, reflected in the increase in the number of new partners directly connected to the venture capital firm. Second, at the level of relationships between nodes, the focus is on ego network diversity, reflected in the topological distribution of connections with partners. The reasons are mainly twofold. First, new entrants to the network and the topological distribution of network connections can affect the functionality of the ego network and the resulting access to new resources and heterogeneous knowledge [21,26]. Second, ego network growth and diversity represent the most direct and important changes in network dynamics [27].

2.1. Venture Capital Ego Network Dynamics and Investment Performance

2.1.1. Venture Capital Ego Network Diversity and Investment Performance

Higher ego network diversity in venture capital indicates that the focal firm does not repeatedly collaborate with a single partner, but actively establishes a wide range of diverse connections with other participants in the network [25]. According to social network theory, in the context of increasing uncertainty in the external investment environment, it is difficult for venture capital firms to sustain their development solely through their own social resources, experience, and capabilities. As a result, they often establish broad cooperative relationships with external investors who possess complementary advantages, in order to acquire and integrate diverse information, knowledge, and other resources [28].

Ego network diversity aligns closely with this need of venture capital firms. To some extent, the diversification of ego network relationships implies richer resources [29], and diverse connections provide the external conditions necessary for accessing information, knowledge, and other resources [30]. This not only helps firms broaden project information sources before investment but also enables effective post-investment monitoring and management, thereby enhancing investment performance and promoting the long-term sustainable development of venture capital firms.

Specifically, from the perspective of accessing resources such as information and knowledge, the richness of relationships among network members directly affects the efficiency of resource acquisition. When the level of network member diversity is low, long-term single connections can lead to increasingly similar knowledge structures and cognitive patterns among network members, resulting in fixed thinking and path dependence [31]. Such homogeneity limits the acquisition of diverse information and knowledge, narrows investment perspectives, reduces opportunities for high-potential projects, and ultimately negatively impacts the investment performance and long-term sustainable development of venture capital firms. Conversely, as the diversity of ego network connections increases, an organization's opportunities to access heterogeneous information and knowledge are significantly enhanced [30,32]. On one hand, rich connections can enhance the radar effect of the network [33], broadening channels for acquiring project information and expanding the scope for selecting high-quality projects. On the other hand, according to organizational learning theory, network diversity can effectively facilitate knowledge flow and learning among organizations, promoting the sharing of diverse knowledge and information and enhancing the breadth and mobility of information within the network [34].

Network diversity improves the accuracy of investment judgments, strengthens project selection, evaluation, and management capabilities, minimizes investment mistakes, and thus enhances the quality and efficiency of investment decisions, contributing to long-term sustainability.

In summary, this paper proposes the following hypothesis:

Hypothesis H1: *The diversity of a venture capital ego network has a positive effect on investment performance.*

2.1.2. Venture Capital Ego Network Growth and Investment Performance

In the same vein, as the external investment environment and as projects each become increasingly uncertain and complex, venture capital firms seek external resources and support. They adjust their cooperative relationships with network partners to sustain their dynamic development needs. Ego network growth is thus an investment strategy through which focal venture capital firms search for new partners in line with their strategic development needs.

Specifically, ego network growth in venture capital refers to the new partners that a focal firm seeks for its own development. A higher level of ego network growth indicates a larger number of new partners entering the ego network [25]. From the perspective of searching for and acquiring resources such as information and knowledge, an increase in new members can, through network spillover effects, provide organizations with novel and heterogeneous resources [35]. This helps renew the existing project resource pool. In addition, new members bring different behavioral patterns, which can reduce conformity pressure, to some extent [36], and help focal venture capital firms mitigate the homogeneity of their ego network. In addition, Katila et al. [37] argue that the dynamic changes of ego network nodes are an external manifestation of organizational search behavior. By establishing relationships with new network partners, organizations can expand the scope of their information and knowledge search [4]. Thus, as new entrants expand the scope of the ego network, the focal organization can further broaden its cognitive horizon through the enlarged network boundaries [21]. This increases the likelihood of obtaining more extensive information and diverse knowledge, which helps venture capital firms strengthen their access to high-quality project information and expand their project pool. Finally, the long-term stability of networks allows members to build strong trust and form network routines. However, it may also lead to cognitive inertia, asymmetric dependence, and a lack of resource diversity [19]. The entry of new members can break this stability and inertia, bringing novel ideas and differentiated strategic agendas [38]. This helps venture capital firms handle complex and unconventional problems in the investment process, strengthens their ability to adapt to turbulent environments, and ultimately improves investment performance and supporting venture capital firms' long-term sustainable development.

In summary, this study proposes the following hypothesis:

Hypothesis H2: *The growth of a venture capital ego network has a positive effect on investment performance.*

3. Research Design

3.1. Data Sources and Processing

Data Collection: This study selects Chinese investment institutions as the sample and uses data from the Wind database spanning ten years, from 2013 to 2022, as the data source.

Data Screening and Processing: This study adopts a 3-year rolling time window and first constructs four periods of venture capital ego networks (2013–2015, 2014–2016, 2015–2017, and 2016–2018). To capture ego network dynamics, we examine ego network changes in venture capital firms between period s (years $t - 2$ to t) and period $s - 1$ (years $t - 3$ to $t - 1$). We then reserve a four-year subsequent period to measure investment performance [17], using a rolling 4-year time window (years $t + 1$ to $t + 4$) to observe whether VC firms from period s exit (specifically covering 2017–2020, 2018–2021, and 2019–2022).

Sample Selection Criteria: Using this 3-year rolling time window, we select firms with at least one co-investment and complete information per period to create four network periods (2013–2015, 2014–2016, 2015–2017, 2016–2018). Then, to accurately compare the dynamic changes in each institution's ego network across periods, we further screened and matched only those institutions that continuously appeared in all four networks as the final sample. This resulted in a dataset comprising 920 investment institutions and a total of 22,921 investment events.

Network Construction: For each of the 920 investment institutions, we constructed ego networks in each period, resulting in a total of 3680 ego networks. Based on these networks, the relevant network measures were calculated.

3.2. Variable Measurement

Dependent Variable:

Investment Performance: Profits from IPO and M&A exits are the main sources of returns for venture capital firms and are also commonly used to measure investment performance. Therefore, following previous studies [39], investment performance is measured by the proportion of portfolio companies exiting through IPOs or M&As. Considering the lag of exit events and the average exit cycle in the Chinese investment industry, this study, following related research [40], measures investment performance by the cumulative exit ratio of a venture capital firm over the next four years. Specifically, the exit ratio in period s is the number of IPO and M&A exits during years $t + 1$ to $t + 4$ divided by the total investments made in years $t - 2$ to t .

Independent Variables:

Following the studies of Guan et al. [22] and Gao et al. [25], the dynamics of venture capital ego networks include ego network growth and diversity. These represent the most direct and important changes in network dynamics [36]. In addition, new entrants to the network and the topological diversity of network connections can affect the functions of the ego network, as well as the new resources and heterogeneous knowledge it provides [8,35], which in turn have a significant impact on investment performance.

Venture Capital Ego Network Growth: Following previous studies [22,25], ego network growth refers to the dynamic process of a venture capital firm which adds new partners, reflecting the extent to which the firm gains access to new and heterogeneous resources. This indicator is measured by the number of new members entering the ego network. Specifically, for a given venture capital firm, the partners in periods s and $s + 1$ are identified. By matching the partners across the two periods, the number of new partners added in period $s + 1$ compared with period s is counted.

Venture Capital Ego Network Diversity: Following previous studies [22,25], this refers to the topological diversity in the distribution of a venture capital firm's partnerships among its partners. It reflects the firm's ability to obtain heterogeneous information from a

diverse set of partners. This indicator is calculated using Shannon entropy. The specific calculation formula is as follows:

$$Diver = - \sum_{j=1}^n P_{ij} \ln P_{ij} \quad (1)$$

where n denotes the total number of partners of focal venture capital firm i ; and P_{ij} is the proportion of investments between venture capital institution i and partner j relative to the total number of investments that institution i has made with all its partners.

Control Variables: Previous studies have shown that both firm-level characteristics (such as age, location, and background) and network-level characteristics (such as network density, centrality, and clustering) have a significant impact on investment performance [26,40–43]. Therefore, these factors are included as control variables in this study. The specific details are as follows:

- A. **Venture Capital Firm Age:** Liu et al. [7] argue that age reflects experience, and older venture capital firms are more likely to achieve rapid IPO exits, thereby enhancing their reputation within the industry. Therefore, the age of a venture capital firm can also influence its likelihood of successful exits. The age of a venture capital firm is measured by the number of years from its establishment up to period s [41].
- B. **Geographic Location of the Venture Capital Firm:** Core regions in China, such as Beijing–Tianjin–Hebei, the Yangtze River Delta, and the Pearl River Delta, are considered developed areas. Venture capital firms in these regions may have easier access to high-quality project resources, which can affect their likelihood of successful exits. Therefore, following previous studies [42], a value of 1 is assigned if a venture capital firm is located in one of these regions, and 0 otherwise.
- C. **Investment Institution Background:** Venture capital firms with state-owned or foreign backgrounds have distinct characteristics in terms of funding sources, risk preferences, and project selection, which can affect investment performance [7]. Therefore, following previous studies [42], a value of 1 is assigned if a venture capital firm has a state-owned or foreign background, and 0 otherwise.
- D. **Network Density:** This reflects the overall connectivity and cohesion of the relationships among partners in the network; the more connections between nodes, the higher the network density. Wang et al. [41] suggest that this represents network cohesion and can have a significant impact on enhancing investment performance. The calculation formula is as follows

$$Density_i = \frac{2L_i}{g(g-1)} \quad (2)$$

where L_i represents the actual number of connections among the partners of venture capital firm i and g represents the number of nodes in the network.

- E. **Network Centrality:** This variable is measured using closeness centrality. A higher closeness centrality indicates a higher network position, reflecting a venture capital firm's more central role in the network and faster access to information, which can significantly affect investment performance [41]. Closeness centrality is calculated based on the sum of the shortest distances from a specific node to all other nodes in the network. The calculation formula is as follows:

$$ClosenessCentrality = \frac{n-1}{\sum_j distance_{ij}} \quad (3)$$

where $distance_{ij}$ refers to the number of edges in the shortest path between venture capital firms i and j and n denotes the total number of members in the ego network.

- F. Network Clustering: This reflects the local closure of collaborative relationships. Higher clustering indicates more frequent connections and a more closed internal network structure. Shi et al. [43] suggest that high clustering can lead to redundancy in the information shared among members, which may inhibit investment performance. Following previous studies [26,43], this is measured by the ratio of the number of closed triads to the total number of triads.

$$\text{Clustering} = 3 \times N_{\Delta}(i) / N_3(i) \quad (4)$$

$$N_{\Delta}(i) = \sum_{k>j} a_{ij}a_{jk}a_{ik} \quad (5)$$

$$N_3(i) = \sum_{k>j} a_{ij}a_{ik} \quad (6)$$

where $N_{\Delta}(i) = \sum_{k>j} a_{ij}a_{jk}a_{ik}$ represents the total number of triangles that include node i in the ego network. $N_3(i) = \sum_{k>j} a_{ij}a_{ik}$ represents the total number of “triplets” that include node i in the network. The numerator is multiplied by 3 to ensure that the clustering coefficient ranges between 0 and 1.

To clearly illustrate the research variables, this study summarizes their definitions and measurements in Table 1.

Table 1. Definitions and measurements of variables.

Variable Type	Notation	Variable Name	Measurement Approach
Dependent variable	IP	Investment performance	Proportion of IPO or M&A exits of venture capital firms.
Independent variables	Diver	Ego network diversity	The topological distribution of investment institutions' cooperative relationships among their partners.
	Gro	Ego network growth	The number of new partners added in period $t + 1$ compared with period t .
Control variables	VCage	Venture capital firm age	The number of years since the venture capital firm was established up to period s .
	VCre	Geographic location of the venture capital firm	Assigned a value of 1 if the investment institution is located in the Beijing–Tianjin region, the Yangtze River Delta, or the Pearl River Delta; otherwise, 0.
	VCbg	Venture capital firm background	This takes a value of 1 if the institution has a state-owned or foreign background, otherwise 0.
	Density	Network density	This refers to the degree of connectedness within the ego network.
	Loc	Network centrality	This is measured using closeness centrality.
	Clus	Network clustering	This is the ratio of the number of closed triads to the total number of triads.

3.3. Model Construction

We test the relationship between the dynamics of venture capital ego networks and investment performance by establishing the following model:

$$Y = \beta_0 + \beta_1 \text{Dynamic}_i + \beta_2 \text{VCage} + \beta_3 \text{VCre} + \beta_4 \text{VCbg} + \beta_5 \text{Density} + \beta_6 \text{Loc} + \beta_7 \text{Clus} + \varepsilon \quad (7)$$

Equation (7) presents the model used to test the effect of ego network dynamics on investment performance. In this model, Y denotes the dependent variable, investment performance (IP). Dynamic represents the explanatory variable of ego network dynamics, measured by ego network diversity (Diver) and ego network growth (Gro). β_0 denotes the intercept term, $\beta_i \neq 0$ indicates the estimated coefficient of the corresponding variable, and ε denotes the random error term.

4. Empirical Results and Analysis

4.1. Summary Statistics and Correlation Analysis

Table 2 reports the summary statistics and Pearson correlation coefficients for the relationship between venture capital ego network diversity, ego network growth, and investment performance. It can be observed that venture capital firms' ego networks grow by an average of nine partners, indicating that firms are continuously expanding their networks. The mean value of ego network diversity is 2.307, suggesting that most firms have a certain degree of network diversity, though not at an extreme level. The average exit rate of venture capital firms is only 7%, with relatively few projects exiting through IPO or M&A, which is consistent with real-world conditions and indicates that the selected exit sample is reasonable. In terms of correlations, venture capital ego network diversity is significantly negatively correlated with investment performance, and ego network growth is also negatively correlated with investment performance. However, the correlation matrix only considers the relationships between two variables at a time and does not account for other factors, so is provided for reference only. Furthermore, the correlation coefficients among the independent variables are generally below the critical value of 0.7, indicating no serious autocorrelation issues. To further address potential multicollinearity among independent variables in the regression models, variance inflation factor (VIF) tests were conducted. The variables in each model were standardized before regression. The results show that all VIF values are below 10, suggesting that multicollinearity is not a concern in the regression models.

Table 2. Summary statistics and Pearson correlation table.

	VCre	VCbg_GY	VCbg_WZ	VCage	Density	Loc	Clus	Diver	Gro	IP
VCre	1									
VCbg_GY	0.039 *	1								
VCbg_WZ	−0.386 **	−0.115 **	1							
VCage	−0.307 **	0.107 **	0.368 **	1						
Density	−0.070 **	−0.002	0.026	0.021	1					
Loc	0.045 *	−0.014	0.116 **	0.055 **	−0.360 **	1				
Clus	−0.104 **	−0.042 *	0.119 **	0.063 **	0.700 **	−0.098 **	1			
Diver	0.065 **	0.022 **	0.150 **	0.096 **	−0.535 **	0.660 **	−0.333 **	1		
Gro	0.034	0.001	0.195 **	0.168 **	−0.372 **	0.349 **	−0.250 **	0.702 **	1	
IP	0.089 **	0.004	−0.068 **	−0.091 **	0.106 **	−0.145 **	−0.003	−0.069 **	−0.101 **	1
Mean	0.814	0.074	0.143	9.923	0.468	0.197	0.648	2.307	9.060	0.071
Standard Deviation	0.389	0.262	0.350	10.982	0.304	0.033	0.546	1.175	15.741	0.206
VIF	1.257	1.047	1.389	1.244	2.564	1.763	2.117	3.623	2.296	

Note: * $p < 0.1$, ** $p < 0.05$.

4.2. Regression Results on Ego Network Dynamics and Investment Performance

After controlling for the effects of investment institution age, background, location, network density, network position, and network clustering on investment performance, this study examines the impacts of ego network diversity and ego network growth. The research results are presented in Table 3. Model 1 includes only the control variables. Models 2 and 3 are the main effect models, in which ego network diversity and ego network growth are added, respectively, based on Model 1. The regression results of Model 2 show that the coefficient of venture capital ego network diversity (Diver) is significantly positive ($\beta = 0.081, p < 0.01$). Compared with Model 1, the adjusted R^2 of Model 2 increases, indicating a significant improvement in the model's explanatory power. These results suggest that ego network diversity has a significant positive effect on investment performance. Investment institutions should enhance ego network diversity and establish diverse connections with network members to improve investment performance and promote sustainable development. Therefore, Hypothesis H1 is supported.

Table 3. Test results of the effect of ego network dynamics on investment performance.

Variables	Model 1	Model 2	Model 3
	IP	IP	IP
VCre	0.076 *** (0.021)	0.069 *** (0.055)	0.080 *** (0.055)
VCbg_GY	0.003 (0.019)	−0.001 (0.074)	0.003 (0.074)
VCbg_WZ	0.001 (0.022)	−0.009 (0.022)	0.008 (0.022)
VCage	−0.063 *** (0.021)	−0.068 *** (0.021)	−0.059 (0.021)
Dens	0.132 *** (0.029)	0.157 *** (0.031)	0.123 *** (0.030)
Loc	−0.141 *** (0.026)	−0.179 *** (0.031)	−0.132 *** (0.027)
Clus	−0.097 *** (0.051)	−0.091 *** (0.051)	−0.101 *** (0.051)
Diver		0.081 *** (0.031)	
Gro			−0.038 * (0.021)
R^2	0.052	0.055	0.053
ΔR^2	0.055	0.003	0.001
ΔF	20.025 ***	8.392 ***	2.872 ***

Note: Standard errors in parentheses. * $p < 0.1$, *** $p < 0.01$.

However, the regression results of Model 3 show that the coefficient of venture capital ego network growth (Gro) is significantly negative ($\beta = -0.038, p < 0.1$). This indicates that ego network growth has a significant negative effect on investment performance. As the number of new members added to the ego network increases, investment performance tends to decline, which is unfavorable for the sustainable development of investment institutions. This result is contrary to the expectation of Hypothesis H2, therefore Hypothesis H2 is not supported.

4.3. Analysis of the Impact Mechanism

4.3.1. Testing the Mechanism of the Effect of Venture Capital Ego Network Diversity on Investment Performance

The above results show that ego network diversity can improve investment performance. This effect is likely driven mainly by the information function that ego network diversity provides. It is well known that diversified and heterogeneous industry information resources are particularly important for the investment performance of venture capital institutions [36]. As a prism and channel for information diffusion [40], networks allow diverse linkages among members to deliver novel and heterogeneous information and knowledge resources to focal investment institutions through the carrier of ego network. This process promotes the flow and diffusion of such resources among network members, thereby expanding the sources of high-quality projects for investment institutions and strengthening their ability in project selection, evaluation, and management, which in turn enhances investment performance and supports the firm's sustainable development. Therefore, it can be expected that information dissemination plays an intermediary role between ego network diversity and investment performance. In other words, ego network diversity may affect investment performance by influencing the process of information dissemination.

To explore the role of information transmission in the relationship between ego network diversity and investment performance, this study introduces information transmission as a mediating variable and constructs a mediation model.

Following previous research [44], information dissemination refers to the process in which members within a venture capital network serve as both the senders and receivers of information. The information mainly includes project screening and post-investment management experience. Through continuous interactions among network members, this information is transmitted, and its value can be gradually enhanced.

Information dissemination is divided into two types according to its content. The first type is project information dissemination (PID), which mainly functions in the project screening and evaluation stage. This involves the dissemination of information on evaluation indicators, screening criteria, and contract formulation, and is measured by the added number of industry types in period $t + 1$. The second type is experiential information dissemination (EID), which mainly functions in the post-investment value-added stage. This involves the transfer of tacit knowledge related to the management and capital expansion of portfolio companies. It is measured by the number of co-investments.

This study adopts the stepwise testing method proposed by Baron et al. [45] to examine the mediating effect. The stepwise testing method provides richer information on significance and has a lower probability of Type I error. If the results are significant under this method, they are also significant under other approaches. Specifically, four models are constructed to test the mediating effect of information transmission in the relationship between venture capital ego network dynamics and investment performance. Among them, Equations (8) and (9) take information transmission as the dependent variable to examine the direct effects of ego network dynamics on information transmission. Specifically, Equation (8) tests the direct effect of ego network diversity on project information dissemination, while Equation (9) tests the direct effect of ego network diversity on experiential information dissemination. Equations (10) and (11) take investment performance as the dependent variable and include both information transmission and ego network diversity in the full model. Specifically, Equation (10) adds project information dissemination to Model 2, while Equation (11) adds experiential information dissemination to Model 2. The test results are presented in Table 4.

$$PID = \beta_0 + \beta_1 Diver + \beta_2 VCage + \beta_3 VCre + \beta_4 VCbg + \beta_5 Density + \beta_6 Loc + \beta_7 Clus + \varepsilon \quad (8)$$

$$EID = \beta_0 + \beta_1 Diver + \beta_2 VCage + \beta_3 VCre + \beta_4 VCbg + \beta_5 Density + \beta_6 Loc + \beta_7 Clus + \varepsilon \quad (9)$$

$$Y = \beta_0 + \beta_1 Diver + \beta_2 PID + \beta_3 VCage + \beta_4 VCre + \beta_5 VCbg + \beta_6 Density + \beta_7 Loc + \beta_8 Clus + \varepsilon \quad (10)$$

$$Y = \beta_0 + \beta_1 Diver + \beta_2 EID + \beta_3 VCage + \beta_4 VCre + \beta_5 VCbg + \beta_6 Density + \beta_7 Loc + \beta_8 Clus + \varepsilon \quad (11)$$

Table 4. Test of the mediating effect of information diffusion.

Variables	Model 2	Model 4	Model 5	Model 6	Model 7
	IP	EID	PID	IP	IP
VCre	0.069 *** (0.055)	−0.001 (0.049)	−0.003 (0.055)	0.069 *** (0.055)	0.069 *** (0.055)
VCbg_GY	−0.001 (0.074)	−0.003 (0.017)	0.049 ** (0.020)	−0.001 (0.074)	−0.005 (0.074)
VCbg_WZ	−0.009 (0.022)	−0.034 * (0.020)	0.009 (0.022)	−0.009 (0.022)	−0.010 (0.022)
VCage	−0.068 *** (0.021)	−0.001 (0.019)	−0.026 (0.021)	−0.068 *** (0.021)	−0.066 *** (0.021)
Dens	0.157 *** (0.031)	−0.008 (0.027)	−0.159 *** (0.031)	0.157 *** (0.031)	0.173 *** (0.031)
Loc	−0.179 *** (0.031)	0.009 (0.027)	−0.103 *** (0.031)	−0.179 *** (0.031)	−0.169 *** (0.031)
Clus	−0.091 *** (0.051)	0.001 (0.045)	0.007 (0.051)	−0.091 *** (0.051)	−0.092 *** (0.050)
Diver	0.081 *** (0.031)	0.545 *** (0.027)	0.219 *** (0.031)	0.077 ** (0.034)	0.059 ** (0.031)
EID				0.007 (0.022)	
PID					0.100 *** (0.019)
R ²	0.055	0.304	0.083	0.055	0.064
ΔR ²	0.003	0.143	0.023	0.000	0.009
ΔF	8.392 ***	522.302 ***	64.170 ***	0.099	24.798 ***

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 examines the mediating role of information diffusion in the relationship between venture capital ego network diversity and investment performance. Model 2 is the total effect model of the ego network diversity (Diver) on investment performance. The regression results of Model 2 show that the coefficient of ego network diversity (Diver) is significantly positive ($\beta = 0.081$, $p < 0.01$), indicating a significant positive effect on investment performance. This result suggests that higher ego network diversity, which includes more diverse and rich connections, helps improve investment performance and supports the sustainable development of investment firms positively.

Model 4 is the regression model examining the effect of ego network diversity (Diver) on experiential information dissemination (EID). The regression results of Model 4 show that the coefficient of ego network diversity (Diver) on experiential information dissemination (EID) is significantly positive ($\beta = 0.545$, $p < 0.01$), indicating that ego network

diversity positively affects experiential information dissemination. This result suggests that ego networks with higher diversity, characterized by more diverse and rich connections, can effectively broaden the information exposure of network members and promote the diffusion and exchange of experiential information among them.

Model 6, based on Model 2, adds the mediating variable (EID). This full model includes both the independent variable and the mediator. The results of Model 6 show that the coefficient of ego network diversity remains significantly positive ($\beta = 0.077$, $p < 0.05$), while the coefficient of experiential information dissemination (EID) is positive but not significant ($\beta = 0.007$, $p > 0.1$). According to Wen Zhonglin's three-step procedure for testing mediation effects [46], when the coefficient of the mediating variable (EID) is not significant, the mediating role of experiential information dissemination (EID) needs to be further tested using the Bootstrap method. Therefore, this study uses the Bootstrap method with 5000 resamples and a 95% confidence interval to re-test the mediation effect. The results are shown in Table 5.

Table 5. Bootstrap test results for the mediation effect of experiential information dissemination.

Pathway		Effect Value	Standard Error	t-Value	p-Value	95% Confidence Interval	
Diver–EID–IP	Total effect	0.089	0.031	2.896	0.004	0.029	0.149
	Direct effect	0.085	0.034	2.509	0.012	0.018	0.151
	Indirect effect	0.004	0.005			−0.005	0.016

As shown in Table 5, in the Diver–EID–IP path, the total effect of ego network diversity on investment performance is 0.089, with a 95% confidence interval of [0.029, 0.149]. As the confidence interval does not include 0, this result again confirms a significant total effect of self-network diversity on investment performance. The direct effect of ego network diversity on investment performance is 0.085, with a 95% confidence interval of [0.018, 0.151]. As the confidence interval does not include 0, this indicates that the direct effect of ego network diversity on investment performance remains significant even after considering the mediating variable. However, the indirect effect of experiential information dissemination (EID) on investment performance is 0.004, with a 95% confidence interval of [−0.005, 0.016]. As the confidence interval includes 0, this result indicates that the indirect effect of experiential information dissemination is not significant.

In summary, experiential information dissemination (EID) does not play a mediating role between ego network diversity and investment performance. This result indicates that, when the level of ego network diversity is high, the diverse connections can indeed bring in a wide range of experiential information and facilitate the exchange and discussion of investment experiences among network members. However, due to the tacit and non-replicable nature of such experiential information, its value may not directly translate into improved investment performance in the short term and thus may not significantly contribute to the sustainable development of venture capital institutions.

Model 5 is the regression model of the independent variable (Diver) on the mediating variable, project information dissemination (PID). The regression results show that the coefficient of ego network diversity (Diver) on project information dissemination is significantly positive ($\beta = 0.219$, $p < 0.01$), indicating that ego network diversity has a positive effect on PID. This finding suggests that a diverse set of network connections expands the range of project information accessible to network members and facilitates the exchange and diffusion of project-related information among them.

Model 7, based on Model 2, adds the mediating variable (PID). This full model includes both the independent variable and the mediator. The regression results of Model 7 show

that project information dissemination (PID) has a significant positive effect on investment performance ($\beta = 0.100, p < 0.01$). The coefficient of ego network diversity (Diver) is also significantly positive ($\beta = 0.059, p < 0.05$). Compared with Model 2, the coefficient of ego network diversity in Model 7 decreases ($\beta = 0.059 < \beta = 0.081$), suggesting that project information dissemination partially mediates the relationship between ego network diversity and investment performance. This result indicates that diverse ego network connections can effectively promote communication among network members around project information. Such communication not only expands the pool of potential investment opportunities, but also fosters a more comprehensive understanding of potential projects through the integration of multi-source information. On this basis, investment institutions can optimize their investment decisions—such as whether to invest, at what valuation, and to what extent to provide resource support—thereby increasing the likelihood of identifying high-quality projects, enhancing investment performance, and ultimately promoting the sustainable development of investment institutions.

In summary, the above findings indicate that venture capital ego network diversity enhances investment performance primarily through the pathway of project information dissemination, while the mediating effect of experiential information dissemination is not significant. This difference may mainly arise due to the following reasons:

There are significant differences between project information dissemination and experiential information dissemination [47]: On one hand, the two types of information differ in content characteristics. Experiential information dissemination primarily involves summarized knowledge from past investment cases (e.g., insights from post-investment management, lessons from failures, industry insights, and general industry patterns). It is characterized by strong subjectivity and generalizability across projects. In contrast, project information dissemination focuses on project-specific information (such as technical details of the target firm, market size, team background, financial data, and funding needs). This information is more objective and tailored to specific projects. On the other hand, the two types of information differ in actionability. Project information dissemination is more actionable, because high-quality project information can be directly translated into potential investment opportunities. Venture capital firms can quickly decide whether to co-invest or conduct due diligence, thereby improving investment efficiency. However, for experiential information dissemination, even if peers share post-investment management experiences, it is hard to replicate them directly. Its value relies on receivers internalizing and recreating it. In addition, during the dissemination process, experiential information tends to distort or simplify into empty advice, and its practical usefulness largely depends on the firm's ability to transform it.

Given these differences, the two types of information dissemination have distinct transmission effects in their dissemination paths: A diverse ego network allows venture capital firms to access a wide range of information [29]. In the project information dissemination path, because project information is more objective and actionable, when network members exchange information about specific projects, they can directly share objective information closely related to potential investments. This exchange enables a more comprehensive understanding of the projects, allowing firms to quickly make value judgments. This process significantly boosts the chance of identifying high-quality projects, ultimately improving investment performance and supporting the sustainable development of venture capital firms. This pathway is clear and observable, which explains why the mediating effect is significant.

However, In the experiential information dissemination path, although a diverse venture capital ego network can also provide a variety of experiential information, this information (such as industry insights, due diligence methods, and post-investment man-

agement strategies) is tacit, subjective, and less actionable. Its value largely depends on the capabilities of the venture capital firm. Moreover, the improvement of investment capabilities and judgment through experiential information is a long-term, subtle process and its value is hard to directly translate into performance outcomes in the short term. In addition, experiential information is generalizable across projects and not closely tied to specific investment decisions, making it hard to quickly apply to particular investment opportunities. These factors together weaken the mediating effect of experiential information dissemination.

4.3.2. Testing the Mechanism of the Effect of Venture Capital Ego Network Growth on Investment Performance

The previous results indicate that ego network growth does not have a positive effect on investment performance. Instead, it has a significant negative effect, which is contrary to our original research hypothesis. This may be because, although adding new members to an ego network can provide access to external heterogeneous information and knowledge to some extent, it also introduces a more direct problem: it disrupts the existing stable network structure. Specifically, due to low levels of trust and coordination as well as limited collaborative experience between new and existing members, frictions arise that reduce the network's ability to absorb external heterogeneous information and knowledge [48]. As a result, the informational benefits cannot be effectively realized among network members, and the interests of existing members may be diluted, which is detrimental to performance improvement. In contrast, in a stable network, the stability reflects the coordination among members' behaviors. Such stability fosters high levels of trust and tacit understanding among partners, while accumulating long-term cooperative experience, norms, and routines [38]. This makes collaboration more familiar, simple, and efficient, thereby facilitating the flow and sharing of information and knowledge and ultimately enhancing investment performance.

If the above hypothesis holds, ego network stability is expected to have a positive effect on investment performance. Therefore, this study examines the impact of ego network stability (Stab) on investment performance to indirectly test the mechanism through which ego network growth negatively affects performance.

Ego network stability refers to the degree of stability of an ego network over its evolution, indicating the persistence and reinforcement of prior relationships, and reflecting trust and long-term connections among network members. Following existing studies [7,21], it is measured by the number of partners who continue to collaborate in period $s + 1$ compared with period s .

The specific procedure is as follows. This study constructs the following model to examine the relationship between venture capital ego network stability and investment performance:

$$Y = \beta_0 + \beta_1 Stab + \beta_2 VCage + \beta_3 VCre + \beta_4 VCbg + \beta_5 Density + \beta_6 Loc + \beta_7 Cluster + \varepsilon \quad (12)$$

Equation (12) represents the model used to test the effect of ego network stability on investment performance, where *Stab* denotes ego network stability. The meanings of the other explanatory variables remain unchanged. The results are presented in Table 6.

Table 6. The impact of venture capital ego network stability on investment performance.

Variables	Model 1	Model 2
VCre	0.076 *** (0.021)	0.069 *** (0.021)
VCbg_GY	0.003 (0.019)	0.002 (0.019)
VCbg_WZ	0.001 (0.022)	−0.012 (0.022)
VCage	−0.063 *** (0.021)	−0.068 *** (0.021)
Dens	0.132 *** (0.029)	0.146 *** (0.030)
Loc	−0.141 *** (0.026)	−0.160 *** (0.027)
Clus	−0.097 *** (0.051)	−0.091 *** (0.028)
Stab		0.069 *** (0.001)
R ²	0.052	0.056
ΔR ²	0.055	0.004
ΔF	20.025 ***	9.465 ***

Notes: Standard errors in parentheses. *** $p < 0.01$.

Table 6 presents the analysis results of the relationship between ego network stability and investment performance. Model 1 is the baseline model including only the control variables. Model 2 builds on Model 1 by adding ego network stability. In Model 2, the coefficient of ego network stability (Stab) is significantly positive ($\beta = 0.069$, $p < 0.01$), and the explanatory power of the model improves compared with Model 1. This indicates that ego network stability has a significant positive effect on investment performance. This finding shows that, in high-stability ego networks, members build trust and rapport through long-term cooperation, which helps reduce transaction costs and opportunistic behavior, improve investment performance, and supports the sustainable development of venture capital firms.

The above result supports our hypothesis that ego network growth negatively affects investment performance. Specifically, when adding many new members to a venture capital firm's ego network, although it may partially reduce information and resource homogeneity, it can weaken the quality of relationships among members. This leads to lower trust and tacit understanding between new and existing members, hindering the transfer and sharing of information, knowledge, and other resources within the network [1]. This dilutes the benefits of ego network growth, thereby negatively affecting investment performance, and long-term sustainable development of the firm. These results align with the findings of Shafi K. et al. [6].

4.4. Robustness Test

4.4.1. Robustness Test for Endogeneity

(1) Endogeneity Arising From Reverse Causality

In venture capital practice, the exit cycle of investment firms is typically long, resulting in a significant time lag. To mitigate endogeneity issues caused by reverse causality, scholars commonly divide the observation periods of variables [47,49] and employ time-lagged effect models that link past explanatory variables to future investment performance. Accordingly, this study adopts the same approach in model specification by dividing the observation periods of variables.

Specifically, to capture ego network dynamics, we examine ego network changes in venture capital firms between period s (years $t - 2$ to t) and period $s - 1$ (years $t - 3$ to $t - 1$). We then reserve a four-year subsequent period to measure investment performance [17], using a rolling 4-year time window (years $t + 1$ to $t + 4$) to observe whether VC firms from period s exit. By this approach, the dynamics of venture capitalists' ego networks serve as a lagged variable, meaning that its value is already determined from the current-period perspective. Therefore, prior-period ego network dynamics can affect subsequent investment performance, though the latter cannot affect the former. This design effectively mitigates endogeneity problems arising from reverse causality.

(2) Endogeneity Arising From Omitted Variables

To mitigate such issues, it is common to include omitted variables as control variables or to employ fixed-effects models. Therefore, first, we employ a panel fixed-effects model to address endogeneity arising from omitted variables. Second, we add network size and macroeconomic characteristics as control variables, and reapply the fixed-effects model to conduct robustness tests.

First, we perform a robustness check using a panel fixed-effects model. The test results are presented in Table 7. As shown, the regression results of Model 1 indicate that the coefficient of ego network diversity is significantly positive ($\beta = 0.121, p < 0.05$), suggesting that ego network diversity has a positive effect on investment performance. In Model 2, the coefficient of ego network growth is negative but not significant ($\beta = -0.035, p > 0.1$), indicating that the negative effect of ego network growth on investment performance is not significant. Considering the regression results of Models 1, 3, and 5, the coefficient of ego network diversity in Model 3 is significantly positive ($\beta = 0.421, p < 0.01$), and in Model 5, the coefficient of ego network diversity remains significantly positive ($\beta = 0.117, p < 0.05$). However, the coefficient of experiential information diffusion is not significant ($\beta = 0.009, p > 0.1$), indicating that experiential information diffusion does not play a mediating role between ego network diversity and investment performance. Considering the regression results of Models 1, 4, and 6, the coefficient of ego network diversity in Model 4 is significantly positive ($\beta = 0.465, p < 0.01$). In Model 6, the coefficient of project information diffusion is significantly positive ($\beta = 0.067, p < 0.05$), and the coefficient of ego network diversity remains positive, and smaller than in Model 1 ($\beta = 0.089 < \beta = 0.121$), indicating that project information diffusion plays a mediating role between ego network diversity and investment performance. The regression results of Model 7 show that the coefficient of ego network stability is significantly positive ($\beta = 0.134, p < 0.01$), suggesting that ego network stability positively affects investment performance. In summary, except for Model 2, which is not significant, the findings of other models remain consistent with the previous conclusions, indicating that the overall results are stable and robust.

Second, this study further minimizes potential biases by including network size and macroeconomic characteristics as control variables and reapplying the fixed-effects model to conduct robustness tests.

Specifically, we use economic policy uncertainty (EPU) as a proxy variable for macro-environmental shocks. Following Baker et al. [50], we process the data as follows: The annual economic policy uncertainty (EPU) data are first averaged. Then, based on the year and number of projects invested by each investment institution, a weighted average is calculated to obtain the mean EPU faced by each institution. Finally, this value is divided by 100 to standardize the scale. Network size refers to the number of network members in an investment institution's ego network. The results are presented in Table 8.

Table 7. Robustness test with a fixed-effects model.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	IP	IP	EID	PID	IP	IP	IP
VCre	−0.132 (0.111)	−0.007 (0.005)	−0.127 (0.081)	−0.108 (0.152)	−0.131 (0.111)	−0.125 (0.122)	0.001 (0.002)
VCbg_GY	−0.088 (0.151)	−0.034 ** (0.024)	−0.026 (0.084)	0.131 ** (0.203)	−0.088 (0.151)	−0.097 (0.150)	0.015 (0.015)
VCbg_WZ	−0.107 (0.122)	−0.002 (0.004)	−0.057 (0.107)	0.318 * (0.166)	−0.107 (0.122)	−0.129 (0.129)	−0.005 * (0.003)
VCage	−0.786 *** (0.228)	−0.510 ** (0.217)	−0.232 (0.175)	−1.072 *** (0.303)	−0.784 *** (0.228)	−0.713 *** (0.230)	−0.758 *** (0.206)
Dens	0.046 (0.046)	0.020 (0.042)	−0.008 (0.027)	−0.284 *** (0.047)	0.047 (0.046)	0.065 (0.048)	0.030 (0.043)
Loc	−0.048 (0.036)	−0.006 (0.034)	0.036 (0.034)	−0.239 *** (0.050)	−0.048 (0.036)	−0.032 (0.038)	−0.027 (0.031)
Clus	−0.012 (0.027)	−0.015 (0.029)	−0.014 (0.011)	0.025 (0.034)	−0.013 (0.028)	−0.014 (0.027)	−0.013 (0.029)
Diver	0.121 ** (0.052)		0.421 *** (0.042)	0.465 *** (0.071)	0.117 ** (0.053)	0.089 (0.054)	
Gro		−0.035 (0.027)					
EID					0.009 (0.008)		
PID						0.067 *** (0.018)	
Stab							0.134 *** (0.039)
R ²	0.013	0.025	0.065	0.080	0.013	0.062	0.024

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

As shown in Table 8, the regression results of Model 1 indicate that the coefficient of ego network diversity is significantly positive ($\beta = 0.135$, $p < 0.05$), indicating that ego network diversity has a positive effect on investment performance. The results of Model 2 show that the coefficient of ego network growth is significantly negative ($\beta = -0.122$, $p < 0.05$), indicating that ego network growth has a negative effect on investment performance. Considering the regression results of Models 1, 3, and 5 together, the coefficient of experiential information diffusion in Model 5 is not significant ($\beta = 0.006$, $p > 0.1$), suggesting that experiential information diffusion does not play a mediating role between ego network diversity and investment performance. Considering the regression results of Models 1, 4, and 6, the coefficient of ego network diversity in Model 4 is significantly positive ($\beta = 0.215$, $p < 0.05$), and in Model 6, it remains significantly positive ($\beta = 0.120$, $p < 0.1$), though lower than in Model 1. The coefficient of project information diffusion is also significantly positive ($\beta = 0.069$, $p < 0.01$). Taken together, these results indicate that project information diffusion plays a mediating role between ego network diversity and investment performance. The regression results of Model 7 show that the coefficient of ego network stability is significantly positive ($\beta = 0.156$, $p < 0.01$), indicating that ego network stability has a positive effect on investment performance. In summary, the robustness tests conducted with the inclusion of omitted variables yield results that are fully consistent with the previous findings, indicating that the study's conclusions are robust.

Table 8. Robustness test including omitted variables.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	IP	IP	EID	PID	IP	IP	IP
VCre	−0.129 (0.110)	−0.006 (0.004)	−0.075 (0.076)	−0.104 (0.147)	−0.129 (0.111)	−0.122 (0.111)	0.001 (0.002)
VCbg_GY	−0.089 (0.149)	−0.033 (0.023)	−0.014 (0.090)	0.076 (0.194)	−0.089 (0.149)	−0.094 (0.149)	0.015 (0.015)
VCbg_WZ	−0.104 (0.121)	−0.002 (0.004)	0.017 (0.103)	0.280 * (0.163)	−0.104 (0.121)	−0.124 (0.122)	−0.004 (0.002)
VCage	−0.788 *** (0.296)	−1.02 *** (0.272)	0.652 ** (0.290)	−2.827 *** (0.427)	−0.792 *** (0.297)	−0.592 * (0.317)	−0.947 *** (0.289)
Dens	0.046 (0.046)	0.030 (0.042)	−0.003 (0.018)	−0.279 *** (0.046)	0.047 (0.046)	0.066 (0.047)	0.028 (0.042)
Loc	−0.048 * (0.047)	0.011 (0.042)	−0.080 *** (0.029)	−0.034 (0.057)	−0.047 * (0.047)	−0.046 (0.046)	−0.003 (0.040)
Clus	−0.013 (0.028)	−0.019 (0.029)	−0.011 (0.016)	−0.005 (0.033)	−0.013 (0.028)	−0.012 (0.028)	−0.019 (0.029)
Size	−0.025 (0.029)	0.174 *** (0.064)	−0.639 ** (0.297)	0.253 ** (0.094)	−0.021 (0.033)	−0.043 (0.030)	−0.060 (0.040)
EPU	−0.003 (0.026)	−0.039 * (0.022)	0.052 *** (0.019)	−0.195 *** (0.036)	−0.002 (0.026)	0.010 (0.027)	−0.029 * (0.024)
Diver	0.135 ** (0.066)		0.834 *** (0.166)	0.215 ** (0.086)	0.129 * (0.070)	0.120 * (0.066)	
Gro		−0.122 ** (0.050)					
EID					0.006 (0.010)		
PID						0.069 *** (0.019)	
Stab							0.156 *** (0.050)
R ²	0.012	0.031	0.132	0.083	0.012	0.023	0.025

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.4.2. Robustness Test with Replacement of Core Variables

To verify the robustness of the study's conclusions, we conduct a replacement test for key variables: First, following previous research [51], the independent variable ego network growth is remeasured by the proportion of new partners, defined as the number of new partners entering in period $s + 1$ relative to period s divided by the total number of network members in period $s + 1$. Second, based on prior studies [1,17], the dependent variable investment performance is remeasured by the number of IPO or M&A exits of the investment institutions. The results of the robustness tests are presented in Table 9.

In Table 9, the regression results of Model 1 show that the coefficient of ego network diversity is significantly positive ($\beta = 0.312$, $p < 0.01$), indicating that ego network diversity has a positive effect on investment performance. In Model 2, the coefficient of ego network growth is significantly negative ($\beta = -0.037$, $p < 0.01$), suggesting that ego network growth negatively affects investment performance. Considering the regression results of Models 1, 3, and 5, the coefficient of ego network diversity in Model 3 is significantly positive ($\beta = 0.834$, $p < 0.01$). In Model 5, the coefficient of ego network diversity remains significantly positive ($\beta = 0.176$, $p < 0.05$), lower than in Model 1. The coefficient of experiential information diffusion is also significantly positive ($\beta = 0.162$, $p < 0.05$). Taken together, these results indicate that experiential information diffusion plays a mediating role between ego network diversity and investment performance. Considering the regression results

of Models 1, 4, and 6, the coefficient of ego network diversity in Model 4 is significantly positive ($\beta = 0.215, p < 0.05$). In Model 6, the coefficient of ego network diversity remains significantly positive ($\beta = 0.293, p < 0.01$), lower than in Model 1. The coefficient of project information diffusion is also significantly positive ($\beta = 0.091, p < 0.05$). Taken together, these results indicate that project information diffusion plays a mediating role between ego network diversity and investment performance. The regression results of Model 7 show that the coefficient of ego network stability is significantly positive ($\beta = 0.156, p < 0.01$), indicating that ego network stability has a positive effect on investment performance. In summary, except that the mediating effect of experiential information diffusion becomes significant, other models are consistent with earlier conclusions. Overall, the robustness test with replaced core variables show that the study's conclusions are robust and reliable.

Table 9. Robustness test with replacement variables.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	IP	IP	EID	PID	IP	IP	IP
VCre	0.042 (0.110)	−0.009 (0.126)	−0.075 (0.076)	−0.104 (0.147)	0.054 (0.080)	−0.052 (0.080)	0.001 (0.007)
VCbg_GY	−0.014 (0.149)	−0.088 (0.240)	−0.014 (0.090)	0.076 (0.194)	−0.012 (0.101)	−0.021 (0.107)	0.018 (0.013)
VCbg_WZ	−0.058 (0.107)	−0.104 (0.121)	0.017 (0.103)	0.280 * (0.163)	−0.061 (0.107)	−0.084 (0.107)	−0.016 ** (0.006)
VCage	−1.527 *** (0.389)	−1.781 *** (0.448)	0.652 ** (0.290)	−2.827 *** (0.427)	−1.633 *** (0.386)	−1.271 *** (0.380)	−2.045 *** (0.421)
Dens	−0.054 * (0.029)	−0.096 *** (0.031)	−0.003 (0.018)	−0.279 *** (0.046)	−0.053 (0.029)	−0.029 (0.030)	−0.089 *** (0.028)
Loc	−0.051 (0.042)	0.071 * (0.040)	−0.080 *** (0.029)	−0.034 (0.057)	−0.038 (0.042)	−0.048 (0.041)	0.043 (0.035)
Clus	−0.005 (0.018)	−0.015 (0.019)	−0.011 (0.016)	−0.005 (0.033)	−0.004 (0.017)	−0.006 (0.018)	−0.021 (0.019)
EPU	−0.012 (0.023)	−0.040 (0.027)	0.052 *** (0.019)	−0.195 *** (0.036)	−0.004 (0.023)	0.030 (0.022)	−0.061 ** (0.025)
Size	−0.122 (0.078)	0.041 (0.069)	−0.639 ** (0.297)	0.253 ** (0.094)	−0.018 (0.102)	−0.145 * (0.078)	−0.298 *** (0.084)
Diver	0.312 *** (0.063)		0.834 *** (0.166)	0.215 ** (0.086)	0.176 ** (0.086)	0.293 *** (0.064)	
Gro		−0.037 * (0.020)					
EID					0.162 *** (0.052)		
PID						0.091 *** (0.026)	
Stab							0.543 *** (0.132)
R ²	0.005	0.041	0.132	0.100	0.075	0.064	0.140

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

This study conducted robustness test using fixed-effects models, adding omitted variables, and replacing key variables, statistically confirming the robustness of the findings. At the same time, from the perspective of economic and theoretical consistency, existing studies indicate that a highly diverse ego network means the organization has a wide range of connections, which can provide abundant and varied information, knowledge, and other valuable resources [3]. Pei et al. [39,44] further point out that information spreading helps resources flow and spread among network members, which in turn improves investment performance. This study combines the ego network diversity theory with the in-

formation dissemination theory and builds a model: “ego network diversity—information dissemination—investment performance”. The empirical results align with the expectations of the above theories. They show that network resources affects investment performance through the information dissemination mechanism. This confirms the practical validity of the theoretical pathway and demonstrates the model’s robustness at the theoretical level.

On the other hand, high growth in ego networks often means lots of new members joining in. Although this may partially reduce information and resource homogeneity, it can break the stable structure of the original network to some extent. The lack of trust and understanding between new and old members makes it harder to share and transfer information and knowledge [5], thus weakening the potential benefits brought by ego network growth. In contrast, higher network stability reflects long-term and continuous cooperative relationships among partners. Existing theories suggest that a stable network can promote communication and understanding among partners, gradually building high levels of trust and relationship quality [52]. Slimane Ed-Dafali and Brahim Bouzahir [8,9] further emphasize the importance of trust, which can be seen as a valuable competitive advantage. It can reduce opportunism and transaction costs in cooperation, improve the efficiency of knowledge transfer, and ultimately benefit investment performance. Based on the above theoretical framework, this study confirms the positive relationship between ego network stability and investment performance. This also indirectly suggests that overly rapid network expansion may negatively affect investment performance by disrupting network stability. This finding aligns with the theoretical expectations of trust mechanisms and network stability, showing that the study’s conclusions are robust at the theoretical level.

In summary, both the statistical tests and theoretical validation indicate the reliability and robustness of the core findings of this study.

5. Research Conclusions and Implications

This study adopts a dynamic ego network perspective and examines how venture capital ego network dynamics, in terms of its nodes and their connections, affects investment performance and its underlying mechanisms. The study deepens the understanding of the functional mechanisms of venture capital network dynamics. It not only provides investment institutions with important pathways to strategically manage the dynamic development of their ego networks for long-term sustainable growth, but also offers theoretical foundations and practical guidance for governments and stakeholders to guide and promote the high-quality development of the venture capital industry.

5.1. Research Conclusions

- (1) Venture capital ego network diversity has a positive effect on investment performance. In ego networks with higher diversity, connections among network members are richer, and the flow and diffusion of heterogeneous resources such as knowledge and information are greater. This reduces investment errors and helps firms continuously identify high-quality investment opportunities in dynamic environments, thereby strengthening their competitive advantage and supporting long-term survival and sustainable development.
- (2) Ego network growth has a negative effect on investment performance. As the number of new members joining the ego network increases sharply, the previously stable network structure becomes disrupted. Insufficient trust, low tacit understanding, and limited collaboration experience between new and existing members reduce the quality of relationships within the network. As a result, investment institutions exhibit weaker absorptive capacity for external heterogeneous information and knowledge, diluting and offsetting the potential information advantages brought by new members,

which ultimately hinders the improvement of investment performance and long-term sustainable development.

- (3) Project information dissemination plays a mediating role between ego network diversity and investment performance. The diverse linkages among network members provide the focal investment institution with a wide range of heterogeneous and varied resources, including experience, information, and knowledge. This broadens the sources of high-quality project information, enhances the institution's "radar effect" in acquiring informational resources and its project screening capability, and thereby improves investment performance.
- (4) From the perspective of ego network stability, the study indirectly tests and confirms the mechanism through which network growth negatively affects investment performance. Ego network stability has a positive effect on investment performance. A stable ego network helps build high levels of trust and mutual understanding among network members, establishing consistent cooperative experience, norms, and routines. This makes the flow of information and knowledge easier, thereby enhancing investment performance. Such stability, based on trust and mutual understanding, provides the firm with a sustained competitive advantage and helps ensure its long-term survival and sustainable development.

5.2. Research Contribution

- (1) From the dynamic perspective of a venture capital ego network and by introducing the new dimension of inter-node relationships, this study provides a novel analytical framework for examining the effects of ego network dynamics on the sustainable development of investment institutions. Existing literature has largely focused on changes in the number of nodes, while overlooking the potential opportunities and constraints embedded in inter-node relationships during dynamic evolution. This study integrates the dynamics of both nodes and inter-node relationships into a unified analytical framework. In doing so, it not only addresses the gap in micro-level research on ego network dynamics but also extends the research boundaries on the effects of venture capital network dynamics, enriching the body of knowledge in this field and providing a new perspective for enhancing the sustainable development of investment institutions.
- (2) Building on the debate over whether ego network dynamics should prioritize "stability" or "growth", this study validates the effectiveness of the "stability" approach. It also proposes an integrative perspective: maintaining network stability while ensuring diversity in relationship configurations. This way can more effectively enhance investment performance and support the sustainable development of venture capital firms. This provides new empirical support for the "stability" view and addresses the limitation that stability often leads to network closure. In doing so, it complements existing research and enriches the theoretical understanding of the relationship between ego network growth and investment performance.
- (3) This study extends and deepens research on the effects of ego network diversity on investment performance. From the perspective of information diffusion, it reveals the mediating mechanism between them, thereby enriching the depth of research in this field. Previous studies have mainly focused on the formation mechanisms of ego network diversity, paying relatively little attention to its effects and underlying mechanisms. This study not only extends the analysis to the impact on investment performance but also clarifies their relationship based on information dissemination theory, deepening the understanding of the link between ego network diversity and investment performance.

5.3. Managerial Implications

Venture capital firms should carefully manage the pace of network growth, focusing on the quality rather than the quantity of relationships. The value of a network lies not in the simple accumulation of nodes but in the effectiveness of knowledge exchange and collaboration built on high-quality ties. Firms need to pay close attention to whether overall cooperation efficiency declines or information flows weaken after network expansion, and adjust their network management strategies accordingly. Excessive and rapid addition of new members may erode the foundation of trust and established routines, leading to lower relationship quality. To prevent this, firms should implement a “quality-first” admission mechanism, supported by a systematic evaluation process for potential partners. Moreover, they should set clear limits on both the pace and number of new members, ensuring that integration speed aligns with the network’s capacity to build trust and stable relationships. This helps avoid network fragmentation and the dilution of relational quality caused by an excessive increase in nodes.

When building networks, venture capital firms should not only value relational stability on an emotional level but also emphasize the instrumental role of their ego networks. This means paying attention not only to the maintenance of stable ties but also to the pursuit of diversity. In joint investments, firms should consciously reduce over-reliance on a single or a few partners to avoid lock-in and information homogeneity. By fostering heterogeneity and functional complementarity among network members, firms can access diverse and non-redundant information. Thus, while maintaining stability and relational quality, they should also enhance network diversity, creating an efficient and stable system that effectively transforms network resources into improved investment performance. Venture capital firms should strengthen their capacity for knowledge integration and information flow within their ego networks. As project information dissemination plays a mediating role between network diversity and investment performance, firms need to establish mechanisms that promote the circulation and sharing of relevant knowledge and information. At the same time, they must develop the ability to absorb, filter, and apply heterogeneous information, ensuring that it is effectively transformed into decision-making and post-investment management outcomes.

In addition, we believe that ego network management not only affects the performance of venture capital institutions themselves but also indirectly determines the efficiency, information flow, and sustainability of the entire venture capital ecosystem. Therefore, it holds significant value for governments, enterprises, and other relevant stakeholders. Accordingly, specific practical directions are proposed for policymakers, fund managers, limited partners, and other stakeholders.

For policymakers, the government should rationally guide the expansion of venture capital networks to avoid “superficial prosperity” and focus on cultivating stable, trust-based partnerships. Long-term cooperation mechanisms, such as government-guided funds, joint innovation platforms, or green investment alliances, can help build high-quality and stable investment networks, improve investment decision-making, and support the growth of sustainable enterprises. In addition, public investment information platforms can be established to encourage collaboration among different types of investment institutions. Through policy support and tax incentives, venture capital can be directed toward green industries, low-carbon technologies, and social impact enterprises, thereby enhancing the sustainability and innovation capacity of the venture capital industry.

For fund managers and limited partners, building a diversified network and engaging partners from different backgrounds, industries, regions, and experiences is crucial. This allows them to capture more high-quality investment opportunities and improve investment decision-making, thereby enhancing the long-term performance and sustainability of the

fund. However, when introducing new members, it is important to maintain long-term cooperative relationships. This can be achieved through pilot collaborations, clear cooperation guidelines, and the establishment of formal rules and knowledge-sharing mechanisms.

For other stakeholders, such as start-ups, financial intermediaries, and research institutions, they should actively participate in venture capital networks, leverage the network resources of investment institutions, and use diverse relationships to facilitate information sharing and resource integration, thereby jointly improving project identification efficiency and investment success rates.

Finally, it should be noted that the implications of this study are intended as directional and instructive guidance, rather than as direct causal prescriptions. Managers should carefully consider contextual differences and potential external factors when making practical decisions.

5.4. Limitations and Future Directions

- (1) This study only includes venture capital firms from the Chinese market as the sample; therefore, the findings are applicable only to the specific context of China's venture capital market. Due to differences in market environments, institutional frameworks, and investment cultures across countries or regions, the results may not be directly generalizable to other contexts. Future research could expand the sample to include venture capital firms from other countries or regions for comparison, further revealing the differences in ego network dynamics among venture capital firms across different regions.
- (2) The sample period of this study ends in 2022, lacking the most recent data from 2023–2024, which may weaken the timeliness of the conclusions in reflecting the current market conditions. To address these limitations, future research can be improved by incorporating data from 2023–2024 and subsequent years to verify the applicability of the conclusions in the latest market environment.
- (3) In examining the impact of ego network growth on investment performance, this study focuses only on changes in the number of network members and does not fully consider the potential influence of member quality from a static perspective. In future research, we plan to treat member quality as a moderating variable to further examine how ego network growth influences investment performance under different network quality conditions.
- (4) This study includes only venture capital institutions that continuously participate in syndicated investments as the sample. However, some venture capital firms may engage in syndication only once or for a short period due to short-term objectives. The conclusions of this study may not fully apply to the ego network dynamics of such firms. Future research could specifically examine institutions that participate in syndicated investments only in the short term and compare their network dynamics with those of continuous participants, highlighting their differences.

Author Contributions: Conceptualization, Y.G. and Y.X.; methodology, Y.G.; software, Y.G.; validation, Y.G. and Y.X.; formal analysis, Y.G.; resources, Y.X.; data curation, Y.G.; Writing—original draft, Y.G. and Y.X.; Writing—review & editing, Y.X. supervision, Y.X.; funding acquisition, Y.X. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the Ministry of Education in China (MOE) Liberal Arts and Social Sciences Foundation (Grant No. 22XJA630007), the Natural Science Basic Research Program of Shaanxi Province (Grant No. 2024JC-YBMS-580) and the Beijing Wuzi University (Grant No.BWUISS09).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Luo, C.L.; Liu, B.; Fu, Z.P. “Maintaining Stability” or “Turning Back to the Past”: The Impact of Venture Capitals’ Ego-network on Their Investment Performance. *J. China Univ. Geosci. Soc. Sci. Ed.* **2023**, *23*, 92–104. [\[CrossRef\]](#)
2. Guan, J.C.; Zhang, J.J.; Yan, Y. A dynamic perspective on diversities and network change: Partner entry, exit and persistence. *Int. J. Technol. Manag.* **2017**, *74*, 221–242. [\[CrossRef\]](#)
3. Zhang, L.; Guler, I. How to join the club: Patterns of embeddedness and the addition of new members to interorganizational collaborations. *Adm. Sci. Q.* **2020**, *65*, 112–150. [\[CrossRef\]](#)
4. Liu, N.; Wu, X.Y.; Mao, Q.J. The impact of inventors’ ego-networks dynamic on knowledge searching. *Stud. Sci. Sci.* **2019**, *37*, 689–700. [\[CrossRef\]](#)
5. Bakker, S.R.; Hendriks, P.H.J.; Korzilius, H.P.L.M. Let it go or let it grow?—Personal network development and the mobilization of intra-organizational social capital. *Soc. Netw.* **2022**, *68*, 179–194. [\[CrossRef\]](#)
6. Shafi, K.; Mohammadi, A.; Johan, S.A. Investment ties gone awry. *Acad. Manag. J.* **2020**, *63*, 295–327. [\[CrossRef\]](#)
7. Liu, Z.; Chen, Z. Venture capital networks and investment performance in China. *Aust. Econ. Pap.* **2014**, *54*, 97–111. [\[CrossRef\]](#)
8. Ed-Dafali, S.; Bouzahir, B.; Omrane, A. Corporate governance and its effects on perceived performance in Morocco: The mediating role of venture capitalists’ strategic and managerial involvement. *Int. J. Bus. Glob.* **2022**, *30*, 166–186. [\[CrossRef\]](#)
9. Ed-Dafali, S.; Bouzahir, B. Trust as a governance mechanism of the relationship between venture capitalists and managers of venture capital-backed firms in Morocco. *Transnatl. Corp. Rev.* **2022**, *14*, 210–226. [\[CrossRef\]](#)
10. Ren, J.; Luo, J.D.; Rong, K. How do venture capitals build up syndication ecosystems for sustainable development? *Sustainability* **2020**, *12*, 4385. [\[CrossRef\]](#)
11. Nirei, M.; Shoji, T.; Yu, F. Formation of Chinese venture capital syndication network. *Jpn. Econ. Rev.* **2021**, *72*, 49–64. [\[CrossRef\]](#)
12. Zheng, L.; Cao, L.; Ren, J.; Li, X.; Yin, X.; Chen, J. How venture capital firms choose syndication partners: The moderating effects of institutional uncertainty and investment preference. *Manag. Organ. Rev.* **2022**, *18*, 463–490. [\[CrossRef\]](#)
13. Kaplan, S.N.; Schoar, A. Private equity performance: Returns, persistence, and capital flows. *J. Financ.* **2005**, *60*, 1791–1823. [\[CrossRef\]](#)
14. Gu, W.; Luo, J.D.; Liu, J. Exploring small-world network with an elite-clique: Bringing embeddedness theory into the dynamic evolution of a venture capital network. *Soc. Netw.* **2019**, *57*, 70–81. [\[CrossRef\]](#)
15. Tan, Y.; Wang, X.; Li, R. Venture capital cross-investment network community movement and investment performance. *Int. J. Financ. Econ.* **2023**, *23*, 55–69. [\[CrossRef\]](#)
16. Luo, J.; Dang, X.H. Study on China’s VC Network Communities: Structure Recognition, Dynamic Evolution and Preference Features. *Manag. Rev.* **2016**, *28*, 61–72. [\[CrossRef\]](#)
17. Xue, C.; Jiang, P.; Dang, X. The dynamics of network communities and venture capital performance: Evidence from China. *Financ. Res. Lett.* **2019**, *28*, 6–10. [\[CrossRef\]](#)
18. Yan, Y.; Guan, J.C. Social capital, exploitative and exploratory innovations: The mediating roles of ego-network dynamics. *Technol. Forecast. Soc. Change* **2018**, *126*, 244–258. [\[CrossRef\]](#)
19. Kumar, P.; Zaheer, A. Ego-network stability and innovation in alliances. *Acad. Manag. J.* **2019**, *62*, 691–716. [\[CrossRef\]](#)
20. Ahuja, G.; Soda, G.; Zaheer, A. The Genesis and Dynamics of Organizational Networks. *Organ. Sci.* **2012**, *23*, 434–448. [\[CrossRef\]](#)
21. Cannella, J.A.; McFadyen, M.A. Changing the exchange: The dynamics of knowledge worker ego networks. *J. Manag.* **2016**, *42*, 1005–1029. [\[CrossRef\]](#)
22. Guan, J.; Liu, N. Dynamic evolution of collaborative networks: Evidence from nano-energy research in China. *Scientometrics* **2015**, *102*, 1895–1919. [\[CrossRef\]](#)
23. Tagliatalata, J.; Barontini, R. Prior co-investments and exits: A study on European venture capital syndicates. *Ventur. Cap.* **2025**, *27*, 271–298. [\[CrossRef\]](#)
24. Bellavitis, C.; Rietveld, J.; Filatotchev, I. The effects of prior co-investments on the performance of venture capitalist syndicates: A relational agency perspective. *Strateg. Entrep. J.* **2020**, *14*, 240–264. [\[CrossRef\]](#)
25. Gao, Y.G.; Xie, Y.P.; Yang, Y.P. The Impact of Relationship Dependence Among Network Members on Ego-Network Dynamics of Venture Capital: The Moderating Effect of Knowledge Attributes. *Sci. Technol. Progr. Policy* **2023**, *40*, 53–64. [\[CrossRef\]](#)
26. Gu, J.; Zhang, F.; Xu, X.; Xue, C. Stay or switch? The impact of venture capitalists’ movement across network communities on enterprises’ innovation performance. *Technovation* **2023**, *125*, 102770. [\[CrossRef\]](#)

27. Demirkan, I.; Deeds, D.L.; Demirkan, S. Exploring the Role of Network Characteristics, Knowledge Quality, and Inertia on the Evolution of Scientific Networks. *J. Manag.* **2013**, *39*, 1462–1489. [\[CrossRef\]](#)
28. Wu, J.; Luo, C.; Liu, L. A social network analysis on venture capital alliance's exit from an emerging market. *Complexity* **2020**, *2020*, 4650160. [\[CrossRef\]](#)
29. Marco, C.; Lin, J. The cost of integrating external technologies: Supply and demand drivers of value creation in the markets for technology. *Strateg. Manag. J.* **2013**, *34*, 404–425. [\[CrossRef\]](#)
30. Oerlemans, L.A.G.; Knobens, J.; Pretorius, M.W. Alliance portfolio diversity, radical and incremental innovation: The moderating role of technology management. *Technovation* **2013**, *33*, 234–246. [\[CrossRef\]](#)
31. Wang, J.; Xue, Y.; Yang, J. Boundary-spanning search and firms' green innovation: The moderating role of resource orchestration capability. *Bus. Strategy Environ.* **2020**, *29*, 361–374. [\[CrossRef\]](#)
32. Wang, Y.D.; Lin, L. The Impact of Diversity of Collaborative Innovation Network Members on Exploratory Innovation: The Mediating Role of Technology Diversification. *Sci. Technol. Prog. Policy* **2021**, *38*, 76–82. [\[CrossRef\]](#)
33. Duysters, G.; Lokshin, B. Determinants of alliance portfolio complexity and its effect on innovative performance of companies. *J. Prod. Innov. Manag.* **2011**, *28*, 570–585. [\[CrossRef\]](#)
34. Yang, Y.; Zhu, C. Could the cooperative network induce innovation of enterprise: Under the perspective of network diversity and innovative chain. *J. Ind. Eng. Eng. Manag.* **2019**, *33*, 28–37. [\[CrossRef\]](#)
35. Guo, J.J.; Xie, F.J.; Wang, H.H.; Wang, M. Research of the Effect of Ego-Network Dynamics, Inter-Regional Collaboration Network on Innovation of Enterprises in Industry-University Collaboration. *China J. Manag.* **2019**, *16*, 1026–1034. [\[CrossRef\]](#)
36. Shi, G.P.; Chen, D.J.; Dang, X.H.; Xue, C. The Impact of Membership Turnover of Network Community on Venture Capital Firms' Investment Performance. *Chin. J. Manag.* **2019**, *16*, 1486–1497+1551. [\[CrossRef\]](#)
37. Katila, R.; Ahuja, G. Something old, something new: A longitudinal study of search behavior and new product introduction. *Acad. Manag. J.* **2002**, *45*, 1183–1194. [\[CrossRef\]](#)
38. Liu, N.; Ji, J.; Mao, J.; Wang, X.; Guan, J. The dynamic configuration of inventors' network community and its influence on innovation capacity. *Sci. Res. Manag.* **2021**, *42*, 44–51. [\[CrossRef\]](#)
39. Pei, X.; Dang, X. Research on investment performance of venture capital network community in the internet industry. *Mob. Inf. Syst.* **2022**, *1*, 7373981. [\[CrossRef\]](#)
40. Yang, S.; Li, Y.; Wang, X. Cohesiveness or competitiveness: Venture capital syndication networks and firms' performance in China. *Br. J. Manag.* **2018**, *91*, 295–303. [\[CrossRef\]](#)
41. Wang, X.; Tan, Y. Network impact on the investment strategy and performance of cross-border venture capital institutions in China. *J. Risk Financ. Manag.* **2024**, *17*, 384. [\[CrossRef\]](#)
42. Yang, Y.P.; Gao, Y.G. The Impact of Network Size and 2Stepreach on Venture Capital Performance: The moderating effects of knowledge attribute. *Manag. Rev.* **2020**, *32*, 114–126. [\[CrossRef\]](#)
43. Lin, S.; Xinghua, D.; Qian, Y.; Xia, R. The Impact of Venture Capital Network Communities Clustering and Reach on Successful Exit. *Sci. Technol. Prog. Policy* **2017**, *34*, 9–15. [\[CrossRef\]](#)
44. Pei, X.; Wang, X. The medical health venture capital network community structure, information dissemination and the cognitive proximity. *Appl. Math. Nonlinear Sci.* **2022**, *7*, 803–824. [\[CrossRef\]](#)
45. Baron, R.M.; Kenny, D.A. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J. Personal. Soc. Psychol.* **1986**, *51*, 1173–1182. [\[CrossRef\]](#)
46. Wen, Z.L.; Ye, B.J. Analyses of Mediating Effects: The Development of Methods and Models. *Adv. Psychol. Sci.* **2014**, *22*, 731–745. [\[CrossRef\]](#)
47. Nahata, R. Venture capital reputation and investment performance. *J. Financ. Econ.* **2008**, *90*, 127–151. [\[CrossRef\]](#)
48. Liu, N.; Ji, J.; Mao, J.; Wei, Y.; Wang, X. System Identification, Structural Dynamics and Impacts on Innovation Performance of Inventors' Network Community—Dual Moderating Effect of Network Locations. *Sci. Technol. Prog. Policy* **2021**, *38*, 11–20. [\[CrossRef\]](#)
49. Dang, X.H.; Dong, J.W.; Chen, R. Study on the impact of Venture Capital Firms' Network Positions on Their Exit Way. *China Soft Sci.* **2011**, 156–166. [\[CrossRef\]](#)
50. Baker, S.R.; Bloom, N.; Davis, S.J. Measuring economic policy uncertainty. *Q. J. Econ.* **2016**, *131*, 1593–1636. [\[CrossRef\]](#)
51. Wang, J.; Yang, N.; Guo, M. Ego-network stability and exploratory innovation: The moderating role of knowledge networks. *Manag. Decis.* **2021**, *59*, 1406–1420. [\[CrossRef\]](#)
52. Soda, G.; Stea, D.; Pedersen, T. Network structure, collaborative context, and individual creativity. *J. Manag.* **2019**, *45*, 1739–1765. [\[CrossRef\]](#)

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.