Article

How Does Network Structure Impact Follow-On Financing through Syndication? Evidence from the Renewable Energy Industry

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Abstract: Venture capital (VC) is a critical source of finance for renewable energy ventures. Importantly, VC investments are made in rounds. In higher rounds: (1) the availability of capital drops—we find that less than 50% of renewable energy ventures receive "follow-on" financing—and (2) the rate at which VC firms co-invest increases—we find that 75% of "follow-on" investments are "syndicated", co-investments. We argue that the way in which VC firms co-invest—in terms of how and to whom they are connected—is critical to understanding which projects are financed. Using data on 760 firm-deal observations, we examine how the VC firm's direct ties (ego network) create trust (which we measure using the clustering coefficient) and improve access (structural holes) to important investment information. We consider too how the "small-world" nature of the global VC industry network (small-world quotient) improves "information reachability". Finally, we consider the way in which these features interact with each other—specifically, when they can be substitutes and when they are complements—in explaining which projects do and do not receive follow-on financing through syndication. We conclude by reflecting on the implications of our findings for VC syndication and sustainable entrepreneurship in the renewable energy industry.

Keywords: venture capital; syndication; syndication network; follow-on financing; sustainable entrepreneurship; renewable energy finance; Chinese renewable energy industry

1. Introduction

Venture capital (VC)—a form of private equity financing that is provided by VC firms to start-ups, early-stage, and/or emerging companies [1–3]—is financing the energy transition [4,5]. "Sustainable" entrepreneurial firms—that is, entrepreneurial firms focused on "green energy" and "clean technology" [6]—are driving the transition [7]. Access to capital is the biggest challenge that they face [8–13]. About 70% of their funding comes from VC finance [14]. As a result, it can be suggested that to have and to understand the energy transition, one must first understand the VC industry.

Two features of VC investments in renewable energy projects are noteworthy. First, VC firms invest in rounds, meaning that the investment decision is not once-off. In fact, it is a series of decisions, taken over a period of 5–7 years. Financing after the initial round is known as "follow-on financing". Typically, the size of the investment and, consequently, the levels of risk associated with it, increase across the rounds. The number of projects that receive follow-on financing therefore tends to decline sharply across rounds. In our sample, for example, less than 50% of the ventures that receive first-round financing receive follow-on financing, and only 25% secure follow-on financing in or after the fourth round.

Second, VC firms tend not to invest alone. In fact, as much as 90% of VC firms co-invest, or "syndicate" with other VC firms [15], 50% [16]–70% [17] of all VC investments in

entrepreneurial firms are syndicated and, according to our data, almost 75% of follow-on investments in the renewable energy industry are syndicated. Syndication allows VC firms to share risks and to reduce uncertainty [18,19]. Syndication also allows the firm to build relationships, with their co-investors, to secure access to future deals [1].

For a sustainable entrepreneurial firm, failing to secure follow-on financing can have a profound effect. For example, it sends a negative signal to other would-be investors which makes it even more difficult to obtain financing [20]. Given the importance of the VC industry to the renewable energy industry, and the level of syndication involved in follow-on-financing, we argue, therefore, that it is critical, not only for sustainable entrepreneurial firms but for the energy transition itself, to understand which renewable energy projects receive follow-on financing through syndication, which do not, and why. Relative to the research on initial VC investments [21–24], however, the literature on follow-on financing is rare, and studies on follow-on financing through syndication are rarer still. As a result, there are real gaps in our understanding of the role of VC in this industry.

We build on the research that explains which projects receive first-round VC funding [1,3]. We focus on the role of the VC firm's syndication network in explaining which project receives syndicated follow-on financing. We argue that because so much follow-on financing is syndicated, VC firms are embedded in a syndication circle [6] or network [25]. We argue VC firms obtain several important benefits from this network in the form of "social capital" [26]. We consider three classes of social capital benefits: benefits from the ego network, benefits from the small-world nature of the syndication network and, benefits emanating from the interplay of these two structures.

First, in terms of the "ego-network level" network—that is, in terms of the firm's network of direct ties with its partner firms [27]—research identifies two types of social capital: trust and access to non-redundant information. Trust is built through frequent interaction [28]. It is useful as a way of reducing investment uncertainty. Access, to non-redundant information, comes from having an advantageous network position [29]. It is useful for reducing information asymmetries. We predict that trust and access will positively influence the probability that a renewable project receives syndicated follow-on financing. The first goal of our paper is to empirically establish these relationships.

Second, research suggests that VC syndication networks are "small-world" networks at the global-network level [30,31]. This means that globally, any given VC firm is indirectly tied to any other member, with only a small number of steps between them. The short path linkage among different syndicate clusters improves "information reachability". This creates trust and further reduces information asymmetries, risk, and investment uncertainty. As a result, we predict the small-world nature of the syndication network will positively influence the probability of a project receiving follow-on financing through syndication. The second goal of our paper is to empirically establish this relationship.

Third, and finally, we expect that the interplay between the focal VC firm's ego network and its global network will create additional benefits that are, again, important in understanding which renewable projects receive follow-on investments, and which do not. The firm's ego network creates "trust" and brings "access" to non-redundant information. The global network—which is the full set of actors in the wider VC industry—brings novel information inflow. We predict that these multilevel networks will interact in ways that help us to understand VC firms' behaviors or decisions [32,33]. The third goal of our paper is to empirically establish the ways in which these levels interact in this industry.

We explore the topic using a sample of 760 VC investments—that is, 760 firm-deal dyads—made by 333 VC firms, in the Chinese renewable energy industry in the period 2006–2018. Empirically, we support our hypotheses. We find positive effects for "trust", "access", and the "small-world nature" of the structure in explaining syndicated follow-on financing. We uncover several interesting interaction effects too. For example, we find complementarities between "trust" and "access", which suggests that they strengthen each other in explaining follow-on financing through syndication. At the same time, we find

that "access" and the "small-world structure" can act as substitutes. Such findings are relevant for academics, VC firms, renewable energy ventures, and energy policymakers.

The contributions of this paper are three-fold. First, we extend the literature on VC syndication by considering the factors that influence follow-on financing. Most existing studies tend only to pay attention to the initial co-investment relationships [21–24]. Second, we contribute to the literature on sustainable entrepreneurship by highlighting, empirically, the importance of VC syndication in the renewable energy industry. Also, we offer insights into VC in the renewable energy industry in an emerging economy, and add to the discussion on the Chinese VC industry in particular. Third, we offer a more comprehensive perspective beyond prior VC studies that adopt only one perspective (i.e., ego or global), revealing the complex interplay effects among network constructs.

2. Theoretical Background

2.1. Renewable Energy Industry

The renewable energy industry is a broad industry. It includes "green energy"—that is, technologies aimed at producing energy from renewable energy sources, such as solar and wind—and "clean technology"—that is, technologies aimed at improving sustainability by, for example, reducing existing carbon emissions [6,34].

The renewable energy industry is also huge—it is worth about US$2 trillion—and China is a leader in it. China has, for example, an installed renewable energy generating capacity of 2174 TWh. This figure not only represents 29% of global installed renewable energy capacity, but it is also more than twice the installed capacity of the second-best country—the United States has 1113 TWh—in terms of installed capacity. There is, however, still much work to be done; only 12% of China's energy needs, and only 8% of the United States' energy needs, come from renewable energy sources.

It is widely recognized that entrepreneurial firms will play an important part in making the transition to fully renewable energy sources [7]. This is because, as Hockerts and Wüstenhagen [35] highlight, entrepreneurial firms are more innovative and more likely to pursue renewable energy projects than incumbents. This is, in part, because they are more idealistic and, in part, because they have not had the same sunk costs as the incumbents. The competitive threat that they bring, by offering renewable energy options, also forces incumbents to pursue their own renewable energy projects. As Hockerts and Wüstenhagen put it, "emerging Davids" leads to "greening Goliaths".

For this reason, so-called "sustainable entrepreneurship"—that is, entrepreneurship in the discovery, creation, and exploitation of entrepreneurial opportunities that contribute to sustainability by generating social and environmental gains for others in society [36,37]—is becoming an increasingly important topic. In this discussion, it has been recognized that the single biggest problem for sustainable entrepreneurial firms is access to finance [8–10]. Put another way, access to finance may be the biggest hurdle to the energy transition, and therefore understanding entrepreneurial finance is critical.

2.2. Syndicated Venture Capital Investments

VC investment is an important economic and social phenomenon [1]. VC funds innovative, high-growth, and disruptive impact in many industries [38,39] and, because of this, VC accounts for about 70% of entrepreneurial finance [14]. Since the risk of investing in sustainable projects is higher than it is in traditional investments [6], VC is critical in the renewable energy industry. VC is, therefore, being increasingly recognized as a topic of interest in this and other journals focused on sustainability [6,40].

Globally, VC firms invest somewhere in the region of US$50 billion per annum [41]. VC firms invest in rounds, meaning that the investment decision is not once-off. In fact, it is a series of decisions, taken over a period of 5–7 years [6]. Typically, the size of the investment and the levels of risk associated with it increase across the rounds.

When VC firms invest they tend to co-invest, or "syndicate" with other VC firms [1,42] to reduce this risk. Research suggests, in fact, that as much as 90% of VC firms co-invest, or

"syndicate" with other VC firms [15] and that 50% [16]–70% [17] of all VC investments in entrepreneurial firms are syndicated. Research suggests too that syndication is especially common in later, higher-risk investment rounds [43–45].

VC firms syndicate, however, for reasons beyond risk reduction. In fact, they do so for at least five more reasons [1]. First, syndication often helps the firm to make better selection decisions and, post-investment, better outcomes [46]. This is because syndication enables VC firms to pool diverse and at least partially complementary judgments and capabilities [17] and in so doing, reduce uncertainty [47]. Second, syndication can provide the VC firm with access to a larger pool of opportunities [48]. VC firms invest in projects that are brought to them by their syndicate partners [49]. Third, syndication enables VC firms to increase their (geographic) reach or (industrial) spread, by investing in nonlocal projects. VC firms often invest in nonlocal projects with partners for whom they would be a local investment [50]. Forth, syndication enables the VC to build legitimacy or advertise its experience, the size of its portfolio, its industrial spread or geographic reach, by allowing VC firms to showcase their investing partners [44]. Finally, syndication can create barriers to entry for new VCs, leading to better investment terms and higher yields [51].

2.3. Social Capital Benefits of Networks

VC firms are embedded in a "syndication network" [1,6]; that is, the network of firms with whom it co-invests [25]. Network theory suggests that networks offer their members benefits [3], and since as early as the 1920s [52], network scholars have shown that the way in which the firm is embedded in its network affects the share of the benefits that it reaps [27]. Granovetter (1973), for example, studied job seekers and reported that individuals with many weak ties to remote others were more successful in finding a job than those with a few strong ties, because while strong ties lead to "redundant information", weak-tie contacts provide jobseekers with "useful, non-redundant information" [53].

Scholars developed the concept of social capital to describe the benefit of network embeddedness [3]. Social capital facilitates certain actions of individuals who are within the social structure [54]. It is a social asset which provides access to resources in the network [55]. In addition, as with all capitals, such as physical capital or human capital, social capital requires deliberate investment by individuals and calculates acts to recoup those investments by mobilizing those resources embedded in the social networks [3,55].

Research on VC firms suggests that syndication networks offer different types of social capitals [26,56], at the level of the ego network—that is, at the level of the firms' direct ties—and at the level of the global network—that is, at the global industry level.

At the level of the ego network, the literature identifies two important sources of social capital. The first is trust. Trust is brought by network closure and built by frequent interaction and dense small groups. Trust reduces uncertainty regarding high-risk projects. The second is "access". Access means access to non-redundant information. Access often means the firm is the first to access information [3] and access reduces information asymmetries. Such social capitals underlie syndication networks' structure and have a significant impact on ventures' financing [57]. However, the extant research on the effects of ego-network social capitals in ventures' financing has been largely neglected.

At the global-network level, previous research has demonstrated that in the VC industry, the syndication network is one kind of small-world network [58]. This means that every VC firm is only a few handshakes away from every other firm. This is likely to be particularly important in the Chinese context, where "guanxi" is emphasized. Guanxi is a Chinese Confucian concept, which does not have a single direct translation, which encourages social reciprocity, mutual benefit, and a long-term orientation. It plays an important role in both social and professional relationships in China [6,30]. It means that VC firms will not only care about their self-interests but will also focus on "friendship", will build long-term cooperation, and will form guanxi circles [59]. The small-world nature of the network also means that there are many shortcuts between clusters, which increases

"information reachability" [60,61]. This is attractive to existing and prospective partners due to the fast information transitivity and resource sharing.

2.4. Research Gaps

In this paper, we consider the effects of the social capital advantages, discussed in the previous section, on the probability of securing follow-on financing through syndication. We argue that we should not merely view the ego- and global-level network structures as parallel mechanisms but, given that two kinds of network structures exist simultaneously, we suggest that we must consider the interaction effects between them too. Doing so, we argue, can provide new insights to help us to better understand the VC industry, and to better understand which renewable energy projects receive follow-on financing through syndication in the renewable energy industry. Doing so will also allow us to answer research calls to consider multilevel interaction among network characteristics [33].

3. Hypotheses

3.1. Hypothesized Direct Effects

3.1.1. Trust and Follow-On Financing through Syndication

The clustering coefficient is used to measure the degree of actors which are tending to cluster together within a network [58]. In the VC context, clustering coefficient refers to the fraction that a focal VC firm's two randomly selected syndicate partners know each other, and they are syndicate partners too. For example, if the focal VC firm A whose syndicate partners are all directly connected, then we will know A's clustering coefficient equals 1; on the contrary, if A's syndicate partners never syndicate with each other, then A's clustering coefficient is 0 [62]. The greater the clustering coefficient of a VC firm, the higher the likelihood of small groups will be formed within syndication networks.

Prior research has demonstrated that clustering promotes trust, social identification, risk-sharing, and information transmission for actors within the network [63–65]. Given the high uncertainty of renewable energy projects, VC firms tend to select familiar partners to reduce risks and information asymmetry [66]. A focal VC firm with a high clustering coefficient who has finished the first-round investment is more likely to signal that it has formed a good relationship and high trust with its syndicate partners, and thus is more likely to involve in ventures' follow-on financing. Thus, we hypothesize:

Hypothesis 1. *A VC firm's clustering coefficient in VC syndication networks has a positive effect on follow-on financing through syndication.*

3.1.2. Access and Follow-On Financing through Syndication

A structural hole in a network indicates that the firm is the sole link between at least other one pair of firms [67]. Spanning structural holes enables the firm to act as a broker or intermediary [68]. Accordingly, the focal VC firm filling the structural holes in VC syndication networks is tied to disconnected clusters of its syndicate partners. For instance, VC firm A occupies three structural holes if VC firm A co-invest with VC firm B, C, and D respectively while VC firm B, C, and D disconnect with each other.

Research suggests that the focal VC firm with structural holes attains an advantageous and strategic position that possesses the information and resources benefits [69]. On the one hand, such VC firms have access to pools of non-redundant resources and information and are more likely to signal their abilities to derive benefits from information arbitrage [26] and thus can provide ventures with superior value-added service. On the other hand, it also conveys the important signals that these VC firms are inclined to exchange cross-network novel and diverse information which are more attractive to existing syndicate partners. Taken together, we argue that the focal VC firm with structural holes is popular with existing syndicate partners and ventures in the renewable energy industry and thus is more likely to enter the subsequent investment rounds. This leads to Hypothesis 2:

Hypothesis 2. *A VC firm's structural holes in VC syndication networks are positively related to follow-on financing through syndication.*

3.1.3. Small-World Structure and Follow-On Financing through Syndication

The small-world structure is defined as the combination of dense local high clustering and short path length among actors in a larger network [58]. In addition, small-world quotient is a comprehensive indicator that is often used to gauge such small-world property [70]. The higher the small-world quotient is, the more the VC syndication network has a small-world structure. Specifically, the small-world structure of VC syndication networks satisfies two points simultaneously, i.e., clusters where VC firms are densely linked to each other and a few VC firms (usually refers to lead VC firms) who bridge different clusters through short path length [61].

The VC industry is marked by constantly changing, fast-growing trends [30]. In such a highly uncertain environment, VC firms usually tend to form alliances (i.e., co-invest with other VC firms) to hedge against investment risks. In China, for example, people pay more attention to guanxi and thus are inclined to keep a long-term friendship and cooperate with familiar partners frequently. In fact, previous research has demonstrated that lead VC firms usually serve as bridges whereas their followers (i.e., syndicate partners) form an intensively connected cluster in the Chinese VC industry [59]. As the small-world quotient increases, (1) the interplay among syndicate partners within the same cluster becomes more intensively, leading to a higher propensity of high trust and collaboration; (2) information reachability as a result of short path linkages among clusters is likely to convey such important signals that VC firms are able to share resources and spread information efficiently which is more attractive for the existing syndicate partners to participate in the subsequent investments. Taken together, we argue that a higher small-world quotient of the VC syndication network can improve the likelihood of ventures' follow-on financing through syndication. Thus, we posit the following hypothesis:

Hypothesis 3. *The VC syndication network's small-world quotient has a positive effect with follow-on financing through syndication.*

3.2. Hypothesized Interaction Effects

Following prior research [71], the interaction effects exist when the effects of clustering coefficient (CC), structural holes (SH), and the small-world quotient (SWQ) apply simultaneously. Two variables can be considered to be complements if the interaction term between them is positive and significant. In contrast, two variables can form substitutes when there is a negative and significant sign of interaction effects.

3.2.1. Trust × Access and Follow-On Financing through Syndication

With the baseline main effects established, now we theorize clustering coefficient and structural holes cannot be regarded as two separate parallel mechanisms in explaining the likelihood of follow-on financing through syndication. Instead, we argue that the impacts of clustering coefficient and structural holes on the likelihood of follow-on financing through syndication are complementary. Previous studies have demonstrated that VC firms with high clustering relations are beneficial for building up trust [72] and coordination and communications [32,60,73] among partners while VC firms with rich structural holes occupy the brokerage advantage and thus tend to enhance the information transfer efficiency and flexibility [74]. In the high-uncertainty environment, the VC firms are inclined to welcome co-invest partners who have broker advantage to join the syndication due to the non-redundant resources and information these VC firms can provide [6]. Meanwhile, the syndication in dense clustering of relations might be able to build long-term relationships since the trust and guanxi they have formed in such networks [30]. Accordingly, they are willing to welcome VC firms with the above characteristics to invest in the subsequent investment rounds. In other words, if the focal syndicate owns a high clustering coefficient

and spans rich structural holes simultaneously, this syndicate will be very attractive for the existing syndicate members to enter the subsequent investment rounds. In this sense, alternative strategies exist which means clustering coefficient and structural holes can create a synergistic effect for the maximization of the likelihood of follow-on financing through syndication. Therefore, this leads us to the following hypothesis:

Hypothesis 4. *Clustering coefficient has a positive interaction effect with structural holes on the likelihood of follow-on financing through syndication.*

3.2.2. Trust × Small-World Structure and Follow-On Financing through Syndication

We expect that the relative importance role of the small-world quotient in follow-on financing through syndication can be partially substituted by mutual trust yields from the high clustering coefficient of VC firms. Considering that previous research has investigated the function of clustering coefficient in increasing mutual trust among actors and therefore facilitating innovation performance [63], we predict clustering coefficient among VC firms might be able to play a significant role in building trust and thus reducing the perceived uncertainty in a similar vein. In doing so, the mutual trust built by high clustering coefficient among VC firms substitutes part of the benefits small-world structure can offer, leading to small-world quotient less important for follow-on financing through syndication. Consequently, we can conclude that the greater the high clustering coefficient improving trust among VC firms, ceteris paribus, the smaller the function of the small-world quotient for increasing the necessary trust for follow-on financing through syndication. Therefore, we propose the following hypothesis:

Hypothesis 5. *Clustering coefficient has a negative interaction effect with small-world quotient on the likelihood of follow-on financing through syndication.*

3.2.3. Access × Small-World Structure and Follow-On Financing through Syndication

We predict a negative interaction effect between structural holes and small-world quotient in follow-on financing through syndication. We argue that structural holes might be able to partially substitute for the information and resource reachability that yields from the small-world structure. Such reachability renders VC firms to connect frequently and efficiently and thus result in the building up of good relationships among them [6]. However, with a low small-world quotient, the focal VC firm can leverage structural holes to bridge non-redundant resources and information together which is attractive to both existing and prospective syndicate partners. It is obvious that the small-world property will become less important when information and resource reachability among VC firms is partially achieved by the brokerage role of structural holes. As a result, the impact of small-world quotient on follow-on financing through syndication will be diminished when the focal VC firm occupies more structural holes (and strengthened when the focal VC firm occupies less structural holes), leading to the slope change of linear relationship between small-world quotient and follow-on financing through syndication. Based on the above argument, we posit the following hypothesis:

Hypothesis 6. *Structural holes have a negative interaction effect with small-world quotient on the likelihood of follow-on financing through syndication.*

4. Methodology
4.1. Empirical Setting

We test our hypotheses using a sample from the Chinese renewable energy industry. This is an appropriate setting because China is: (1) the largest renewable energy industry [75]; and (2) the second-largest VC market [22,24]. China is, therefore, a data-rich and commonly used context to observe VC firms [76–78]. Focusing on one country and one industry also allows us to control for country and industry heterogeneities [27].

4.2. Data and Sample

We collected data from the Thomson Reuters Eikon database, also/formally known as VentureXpert, Venture Economics, or Thomson One [56]. Eikon offers comprehensive VC investment data, on the global VC market, going back as far as 1961 [79]. It is the industry standard and has been used extensively by VC scholars [22,23,50].

We collected data in the period 2006–2018. We chose 2006 as the starting year because pre-2006 syndicated VC investments in the Chinese renewable energy industry are rare [80]. Following prior research [22], we used firm-deal as the unit of our sample. Doing so means that we are more likely to control for the characteristics of the deal level and we can more easily observe VC syndication decisions across the different rounds [24].

We excluded: (1) VC firms with undisclosed names; (2) observations with missing values; (3) the observations in which the variable term "Firm status = defunct". Given that we only focus on syndication partnerships, we restricted our sample to VC firms which involved in syndication made by institutional investors. Thus, non-syndicated deals and deals made by angel investors and individuals were excluded from our sample.

Doing so we create a sample with 760 firm-deal dyads from 333 VC firms. Figure 1 describes the number of VC firms involved in the period of our analysis. In this figure, we have excluded VC firms which are marked as "undisclosed firm" in Thomson Reuters Eikon database.
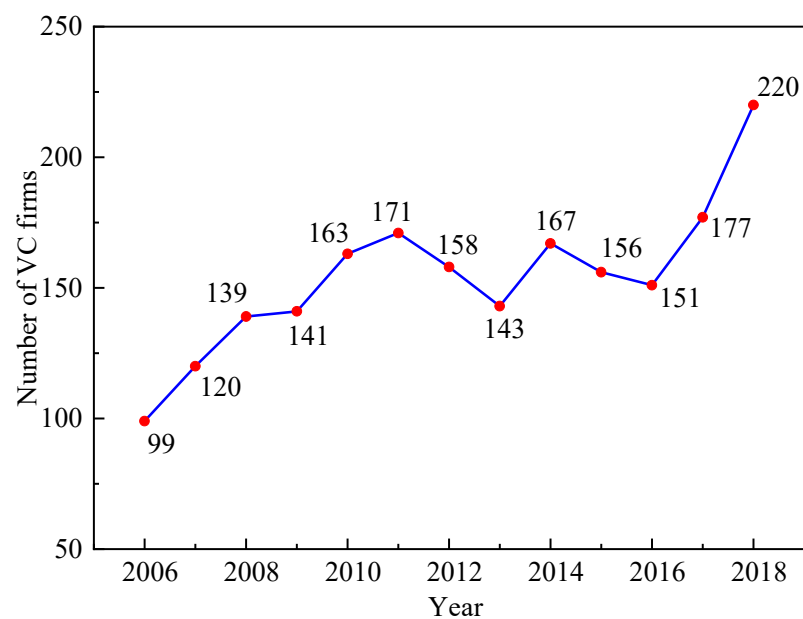

Figure 1. The number of VC firms participated in the Chinese renewable energy industry by year (2006–2018).

Figure 2 describes the investment rounds. It shows that 372 (49%) of the deals in our sample are first-round investments. The remainder (51%) are follow-on investments. It is interesting to note how dramatically the number of deals falls across rounds.

Finally, Figure 3 describes the VC investors in terms of nationality. It shows that the firms in our sample come from 13 countries, but shows too that the vast majority (88%) of VC investments come from Chinese (61%) and US-based (27%) VC firms.
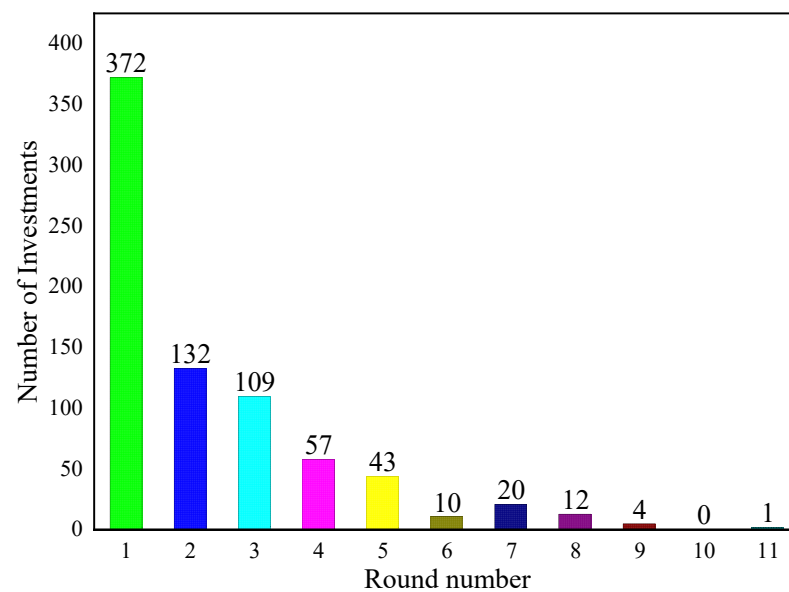
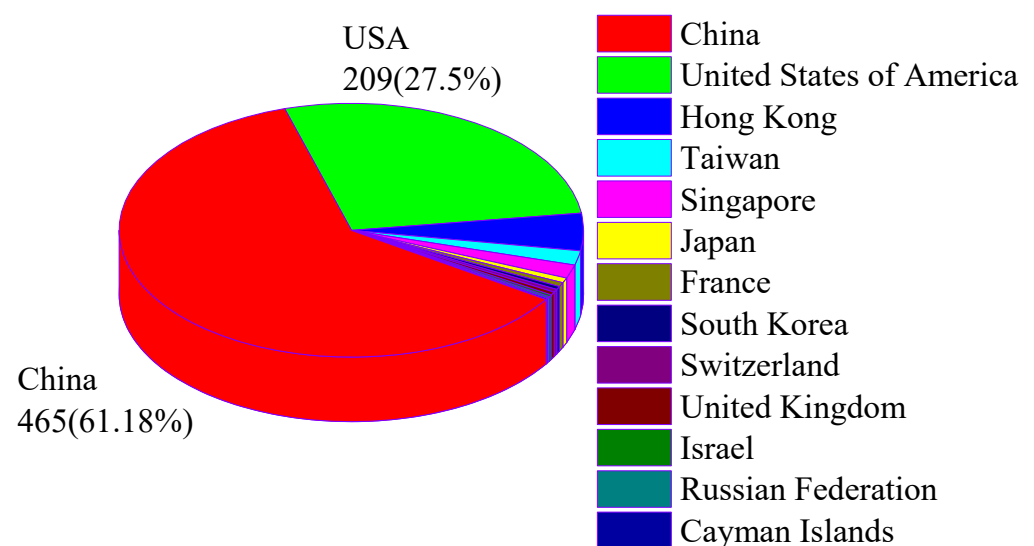**Figure 2.** Investment round distribution.

Figure 3. VC country (region) distribution.

4.3. Variables and Measures

4.3.1. Dependent Variables

Follow-on financing through syndication. For each syndicated investment, we identify the firms involved in them and the investment round. We then create a dummy variable to identify cases in which there is follow-on financing through syndication. We set this dummy variable equal to one if, after an initial co-investment, the syndicate participant backs the venture with follow-on investment, and set it to zero otherwise.

4.3.2. Independent Variables

We constructed the VC syndication networks as follows. First, consistent with prior research [27], we employed a rolling five-year time window (i.e., 2006–2010, 2007–2011, 2014–2018). If two VC firms co-invest in the same portfolio company in a given five-year time window, there is a tie between them. As an example, Figure 4 illustrates the result for the five-year time window (2009–2013). The red nodes represent VC firms that invest in the period. The blue lines indicate the syndication relationships between them.
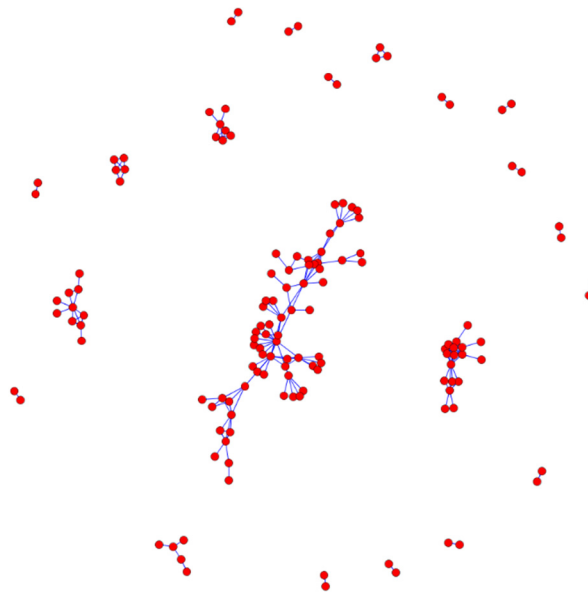
Figure 4. VC syndication network in the Chinese renewable energy industry (2009–2013).

"Trust": Clustering coefficient. In VC syndication networks, one node represents one VC firm. The clustering coefficient of node *i* indicates how clustered its neighbors (i.e., syndicate partners) are around it [72]. The clustering coefficient CC_i of the focal VC firm *i* was calculated as the total number of ties between the focal VC firm *i*'s syndicate partners (E_i) divided by the largest number of ties that all the syndicate partners (k_i) can create, in a given five-year time window. This is shown by the following formula.

$$CC_i = \frac{E_i}{k_i(k_i - 1)/2} \tag{1}$$

"Access": Structural holes. The focal VC firm occupies a structural hole if its two syndicate partners are not connected. Structural holes thus measure the degree of disconnections between the focal VC firm's syndicate partners. For example, if VC firm A ties to B and C, but there is no tie between firm B and firm C, then A occupies a structural hole. We identify structural holes using Burt's (1992) dyadic constraint measure (C_{ij}).

$$C_{ij} = \left(p_{ij} + \sum_{k,k \neq i, k \neq j} p_{ik} p_{kj} \right)^2 \tag{2}$$

Here, p_{ij} denotes the ratio of firm *i*'s relations directly invested in contacting *j*. $p_{ik} p_{kj}$ is the ratio at which syndicate partner *j* indirectly accounts for the focal VC firm *i*'s contacts. Since the focal VC firm *i* has more than one syndicate partner, we then derived the aggregate constraint measure (C_i) for the focal VC firm *i*, according to Equation (3) [29].

$$C_i = \sum_{j=1}^{n} C_{ij} \tag{3}$$

where *n* represents the number of the focal VC firm i's syndicate partners.

To render high values indicating higher control advantages, we derived the value of the structural holes (SH_i) by subtracting the constraint measure from 2, as is shown in Equation (4), which is in line with prior research [81,82].

$$SH_i = 2 - C_i \tag{4}$$

"Small-world structure": Small-world quotient. The small-world structure includes two features: (1) high clustering coefficient; (2) low average shortest path length (i.e., the mean value of the number of ties between all pairs of VC firms) [58]. Following previous research [83], we measured this as:

$$SWQ = \frac{\alpha(C/C_R)}{\beta(L/L_R)} \tag{5}$$

Here: $\alpha = \frac{1}{N}, \beta = \ln(N)$ (N denotes the number of VC firms in the VC syndication network). C/C_R is the ratio of the clustering coefficient of the real network to baseline random network values. L/L_R represents the ratio of the average shortest path length of real to random values.

Illustration

Figure 5 provides an illustration. We draw the syndication network at the ego and global-network level. The upper part of Figure 5 displays the focal VC firm A's ego network, and the bottom shows the entire syndication network, which it is embedded within. Firm A has three syndicate partners in total and all of them are co-investors as well. In this case, A can create $\frac{3 \times (3-1)}{2} = 3$ ties at most, and thus A's clustering coefficient (CC) is 3/3 = 1. As for structural holes (SH), A's all partners can directly connect to others outside the ego network, thus the number of A's structural holes is 0. Finally, based on the total number of VC firms in this syndication network (i.e., N = 220), the small-world quotient can be calculated according to formula (5), to obtain the world quotient (SWQ) of 0.297.
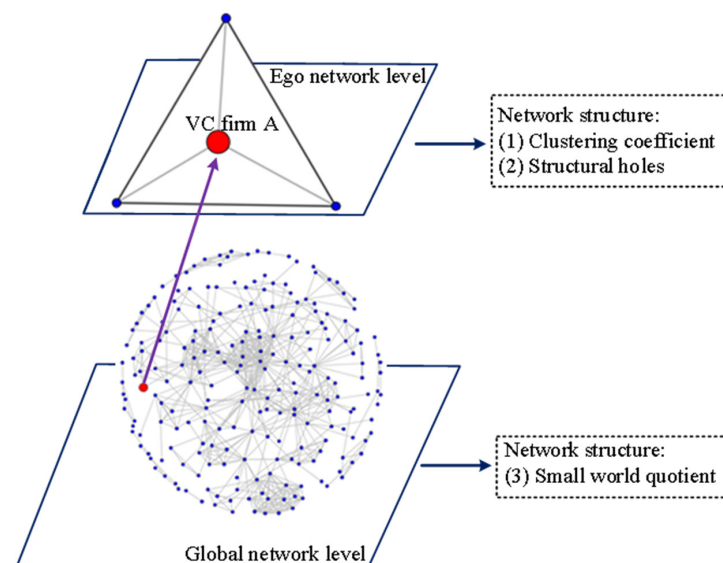
Figure 5. Syndication network at the ego and global-network level (2014–2018).

4.3.3. Control Variables

Following the best practices in the literature, we included the following sets of firm-specific, network-specific, and venture-specific controls in our model.

The first set of controls pertains to the VC firm. Consistent with prior research [84], we controlled for the VC firm's: (1) "age", which was equal to the difference value between the deal year and the focal VC firm's found year; (2) "size", which was measured by the total amount of the focal VC firm's capital under management in the deal year; (3) "reputation", measures by the cumulative number of funds the focal VC firm raised [85]. Different types of investors are more likely to pursue different strategic objectives [86], leading to different syndication propensities [22]. In line with previous studies [22], we created dummy variables to control for: "PVC" (private) and "CVC" (corporate) VC firms. Finally, because

foreign and domestic VC firms use different syndication strategies [24], we constructed a "foreign" dummy, which we set to 1 if the VC firm was non-Chinese and 0 otherwise.

Second, we controlled for other network characteristics that may affect follow-on financing through syndication. Specifically, we control for: (1) "the focal firm" network centrality. Given the possible multicollinearity concern [87], we measure this using betweenness centrality. (2) "Syndication networks density", which is gauged by the count of actual connections divided by their possible maximum connection number [32].

Third, the stage that the VC-backed ventures' project is in is likely to affect the VC firm's syndication decisions [88]. Therefore, we controlled for the project stage. Consistent with prior studies [24], we created and included four-stage dummy variables, namely: "seed", "growth", "expansion", and "mature".

Finally, we included year dummies in all models to control for unobserved effects.

Table 1 provides an overview of the descriptions used for the dependent, independent, and control variables.

Table 1. Descriptions of variables.

Variable Name	Description
Dependent Variable	
Follow-on financing through syndication (FollowSyn)	Dummy that equals one if the syndicate participates in the venture's subsequent financing rounds.
Independent Variables	
Clustering coefficient (CC)	The total number of ties between the focal VC firm's syndicate partners divided by the largest number of ties that all the syndicate partners can create, in a given five-year time window.
Structural holes (SH)	Subtracting Burt's constraint measure from 2, in a given five-year time window.
Small-world quotient (SWQ)	The fraction of clustering coefficient and global average short path length, in a given five-year time window. We scaled this measure by comparing it with the baseline random network.
Control Variables	
VC age	The difference value between the deal year and the focal VC firm's found year.
VC size	The total amount of the focal VC firm's capital under management in the deal year.
VC reputation	The cumulative number of funds the focal VC firm raised.
PVC	Dummy set to one if the VC firm is a private VC firm.
CVC	Dummy set to one if the VC firm is a corporate VC firm.
Foreign	Dummy set to one if the VC firm is non-Chinese.
Centrality	The proportion of shortest paths of syndication between pairs of other VC firms that contain the focal VC firm, in a given five-year time window.
Density	The count of actual syndication ties divided by their possible maximum ties number, in a given five-year time window.
Seed	Dummy equals one if the venture is in the seed stage.
Growth	Dummy equals one if the venture is in the growth stage.
Expansion	Dummy equals one if the venture is in the expansion stage.
Mature	Dummy equals one if the venture is in the mature stage.
Year	Dummy equals one for a particular year (2006–2018).

4.4. Statistical Analyses

Since our dependent variable—follow-on financing through syndication—is a binary variable, we used a logit regression model to test our hypotheses. Specifically:

$$FollowSyn = \beta_0 + \beta_1 CC_{it} + \beta_2 SH_{it} + \beta_3 SWQ_{it} + \beta_4 CC_{it} \times SH_{it} + \beta_5 CC_{it} \times SWQ_{it} \\ + \beta_6 SH_{it} \times SWQ_{it} + \beta_j controls_{it} + \varepsilon_{it} \tag{6}$$

where: (1) *FollowSyn* is the dependent variable, namely follow-on financing through syndication; (2) $\beta_1 CC_{it}$ is "clustering coefficient" for firm *i* in period *t*; (3) $\beta_2 SH_{it}$ is the "structural holes" measure for firm *i* in period *t*; (4) $\beta_3 SWQ_{it}$ is the "small-world quotient" for firm *i* in period *t*; (5) $\beta_4 CC_{it} \times SH_{it}$ is the interaction between "clustering coefficient" and the "structural holes" measure for firm *i* in period *t*; (6) $\beta_5 CC_{it} \times SWQ_{it}$ is the interaction between the "clustering coefficient" and the "small-world quotient" for firm *i* in period *t*; (7) $\beta_6 SH_{it} \times SWQ_{it}$ is the interaction between the "structural holes" measure and the "small-world quotient" for firm *i* in period *t*; (8) $\beta_j controls_{it}$ is the set of controls described above; and (9) ε_{it} is an error term.

5. Results

Table 2 reports the descriptive statistics on and correlations between our key variables. Most of the correlation coefficients are below 0.5. This suggests that multicollinearity is not likely to be a major concern. We confirm this with the variance inflation factor (VIF) test. Results suggest that all variables are below the cutoff value of 3.50, and the mean VIF value is 1.93. Therefore, we can conclude that multicollinearity is not an issue in our model.

Table 3 reports the results from logit regressions. We centralized the interaction terms to prevent possible collinearity [89]. Model 1 is the baseline model that introduces all control variables. Model 2–6 test hypotheses 1–6. Models 2–4 each consider one of the three independent variables (CC, SH, and SWQ). In Model 5 we test the three independent variables together. Models 6–8 consider each of the interaction effects separately. Finally, Model 9 presents the full model which includes the full set of variables.

From Model 1, we can see that a VC firm's centrality in a syndication network has a positive effect on follow-on financing through syndication. Consistent with prior research [90], this finding reflects that VC firms with high centrality have more access to resources and information and thus are more likely to attract existing and prospective syndicate partners to enter the follow-on financing. In addition, we also find that foreign VC firms are more easily to participate in the follow-on financing of ventures. According to previous research [22,84,91], due to the liability of foreignness, foreign VC firms face higher investment risk than domestic VC firms and thus have a high propensity to co-invest with others.

Table 2. Descriptive statistics and correlation matrix.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 FollowSyn	0.511	0.500															
2 CC	0.513	0.400	**0.299**														
3 SH	1.509	0.320	**−0.204**	**0.124**													
4 SWQ	0.654	0.393	**0.079**	0.031	**−0.193**												
5 VC age	12.82	11.94	**0.244**	−0.059	**0.245**	**0.134**											
6 VC size	4.466	1.011	**−0.124**	0.056	**−0.163**	−0.057	**−0.323**										
7 Reputation	13.59	20.72	**0.099**	**−0.236**	**0.274**	−0.035	**0.546**	**−0.203**									
8 PVC	0.784	0.412	0.030	0.044	−0.041	0.063	**0.079**	0.014	0.067								
9 CVC	0.118	0.323	−0.008	0.034	0.052	0.042	−0.040	**−0.119**	**−0.139**	**−0.699**							
10 Centrality	0.045	0.044	**0.225**	**0.065**	**0.582**	**−0.096**	**0.284**	**−0.207**	**0.189**	0.015	0.079						
11 Density	0.031	0.015	0.036	**0.208**	**−0.183**	**−0.369**	0.003	**−0.109**	−0.051	**0.109**	−0.044	−0.034					
12 Foreign	3.486	0.961	**0.288**	**0.071**	**0.145**	−0.055	**0.596**	**−0.334**	**0.398**	0.037	−0.025	**0.162**	**0.289**				
13 Seed	0.217	0.413	**0.126**	**0.081**	0.071	−0.004	0.004	−0.008	**−0.110**	**0.098**	−0.015	**−0.081**	−0.015	**0.085**			
14 Growth	0.593	0.492	**−0.098**	**−0.093**	−0.002	0.063	−0.027	−0.084	−0.015	−0.037	**0.088**	**0.119**	−0.012	**−0.099**	**−0.636**		
15 Expansion	0.104	0.305	0.066	0.061	0.020	**−0.105**	**0.121**	**0.110**	**0.224**	−0.020	−0.058	−0.067	0.024	**0.100**	**−0.179**	**−0.411**	
16 Mature	0.082	0.274	**−0.074**	−0.017	**−0.120**	0.017	**−0.100**	0.031	−0.053	−0.042	−0.065	−0.009	0.032	−0.060	**−0.157**	**−0.360**	**−0.102**

Note: N = 760, Correlations in bold are significant at $p < 0.05$.

Table 3. Results of logit regression analysis.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
CC		2.007 ***			2.074 ***	1.399 ***	2.183 ***		1.556 **
		(6.433)			(6.099)	(3.834)	(4.103)		(2.456)
SH			1.632 ***		2.420 ***	1.507 ***		4.344 ***	3.873 ***
			(2.899)		(4.269)	(2.745)		(3.852)	(3.300)
SWQ				2.364 ***	2.747 ***		1.986 ***	7.561 ***	6.442 ***
				(3.674)	(4.032)		(3.144)	(3.731)	(2.993)
CC × SH						3.088 ***			2.880 ***
						(3.335)			(3.083)
CC × SWQ							−0.338		−0.219
							(−0.531)		(−0.316)
SH × SWQ								−2.486 **	−2.197 **
								(−2.530)	(−2.096)
VC age	0.016	0.019 *	0.014	0.013	0.012	0.016	0.016	0.012	0.015
	(1.275)	(1.837)	(1.107)	(1.006)	(1.155)	(1.522)	(1.517)	(0.906)	(1.297)
VC size	−0.070	−0.125	−0.028	−0.073	−0.069	−0.050	−0.129	−0.018	−0.042
	(−0.616)	(−1.179)	(−0.234)	(−0.624)	(−0.571)	(−0.454)	(−1.146)	(−0.137)	(−0.347)
Reputation	−0.010	−0.001	−0.011	−0.008	−0.000	0.000	0.000	−0.009	0.002
	(−0.958)	(−0.084)	(−1.035)	(−0.780)	(−0.035)	(0.053)	(0.024)	(−0.789)	(0.180)
PVC	−0.174	−0.251	−0.216	−0.231	−0.375	−0.257	−0.305	−0.259	−0.315
	(−0.499)	(−0.733)	(−0.590)	(−0.652)	(−1.022)	(−0.715)	(−0.885)	(−0.674)	(−0.863)
CVC	−0.371	−0.498	−0.392	−0.390	−0.534	−0.524	−0.517	−0.323	−0.473
	(−0.849)	(−1.193)	(−0.878)	(−0.889)	(−1.241)	(−1.216)	(−1.241)	(−0.714)	(−1.093)
Centrality	11.166 ***	12.073 ***	1.862	10.857 ***	−1.437	−7.946 *	11.800 ***	−5.283	−13.066 ***
	(3.858)	(4.343)	(0.499)	(3.788)	(−0.436)	(−1.914)	(4.298)	(−1.441)	(−3.032)
Density	8.889	−20.535	46.524*	−30.629**	−14.347	19.825	−51.787***	27.554	7.980
	(0.548)	(−1.448)	(1.901)	(−2.470)	(−0.983)	(0.997)	(−3.994)	(1.425)	(0.447)
Foreign	1.261 ***	0.966 ***	1.357 ***	1.305 ***	1.141 ***	1.041 ***	1.017 ***	1.449 ***	1.123 ***
	(4.259)	(3.807)	(4.358)	(4.406)	(3.998)	(3.941)	(3.965)	(4.321)	(3.966)
Growth stage	−0.668 ***	−0.575 **	−0.607 **	−0.697 ***	−0.502 **	−0.461 **	−0.601 **	−0.637 **	−0.486 **
	(−2.722)	(−2.467)	(−2.468)	(−2.794)	(−2.146)	(−1.969)	(−2.537)	(−2.524)	(−2.021)
Expansion stage	0.060	−0.124	0.142	0.047	0.008	−0.029	−0.136	0.170	0.005
	(0.172)	(−0.396)	(0.394)	(0.133)	(0.025)	(−0.088)	(−0.430)	(0.453)	(0.014)
Mature stage	−0.697	−0.623	−0.671	−0.720*	−0.592	−0.505	−0.656	−0.662	−0.499
	(−1.620)	(−1.495)	(−1.508)	(−1.662)	(−1.403)	(−1.186)	(−1.568)	(−1.385)	(−1.115)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.089	−0.377	−3.406 **	−0.055	−5.263 ***	−3.007 **	−0.509	−10.966 ***	−9.806 ***
	(−0.109)	(−0.502)	(−2.238)	(−0.068)	(−3.508)	(−1.968)	(−0.648)	(−3.384)	(−2.777)
Log-likelihood	−453.456	−421.090	−448.350	−447.845	−406.396	−408.145	−417.196	−435.249	−399.125
Wald chi-square	65.65	89.54	72.44	73.67	91.91	94.03	96.83	72.30	89.56
N	760	760	760	760	760	760	760	760	760

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard errors are in parentheses. Dependent variable is follow-on financing through syndication.

5.1. Direct Effects

Model 2 suggests that when tested in isolation, the clustering coefficient (CC) has a positive and significant ($\beta = 2.007, p < 0.01$) effect on follow-on financing through syndication. Model 5 confirms this, when structural holes (SH) and small-world quotient (SWQ) are also added as controls. Together, they allow us to support Hypothesis 1. This result suggests that VC firms with high trust are more easily to enter the follow-on financing, which also supports the prior finding that Chinese VC firms emphasize friendship and long-term relationship given the higher risk stemming from sustainable projects [6].

Hypothesis 2 suggests that structural holes in VC syndication networks are positively related to follow-on financing through syndication. In support of this, Model 3 reports a positive and significant effort for structural holes (SH) ($\beta = 1.632$, $p < 0.01$), when tested in isolation, and Model 5 shows that the effect remains consistent in the full model. This finding reflects the idea that VC firms with access to non-redundant information and resources are more attractive for syndicate partners because of their abilities to exchange cross-network information and resources [6,92] and derive benefits from information arbitrage [26].

Model 4 regresses follow-on financing through syndication on the small-world quotient (SWQ). A positive and significant effect ($\beta = 2.364$, $p < 0.01$) suggests that a small-world structure is beneficial to follow-on financing through syndication. Model 5 shows that these effects remain consistent in the full model. Thus, we support Hypothesis 3. Fitting with previous research [30], Chinese elite VC firms usually form small groups with their followers. In so doing, they collaborate with their followers densely and bridge novel information and resources among elite VC firms simultaneously, which is confirmed to be conductive to follow-on financing through syndication.

5.2. Interaction Effects

Hypothesis 4 predicts that the interaction between the clustering coefficient (CC) and structural holes (SH) has a positive effect on the follow-on financing through syndication. The positive and significant sign of the (CCxSH) interaction term ($\beta = 3.088$, $p < 0.01$) in Model 6, and again in Model 9, provides evidence in support of Hypothesis 4. Such complementary effect may offer us a new insight into a better VC network structure configuration [32,71] for maximizing venture financing performance at the ego-network level. In other words, ventures are more easily to receive follow-on financing through syndication when VC firms successfully combine co-investing with partners who they are familiar with and trust in a close circle with bridging different small groups to seek non-redundant information and knowledge.

Hypothesis 5 predicts a negative interaction effect between the clustering coefficient (CC) and the small-world quotient (SWQ). The insignificant interaction term (CCxSWQ) in Model 7 and again in Model 9 means that we fail to support Hypothesis 5. The possible reason: although both high clustering at the ego-network level and small-world structure at the global-network level can bring mutual trust [58,63], the mechanism that trust creates differs at each level. Thus, it is necessary to study the syndication network structure from the multilevel perspective.

Hypothesis 6 predicts a negative interaction effect between structural holes (SH) and the small-world quotient (SWQ). The negative and significant ($\beta = -2.486$, $p < 0.05$) interaction term (SHxSWQ) in Model 8 and Model 9 allows us to support Hypothesis 6. This finding further highlights the necessity of focusing on global-network structure [83] and policymakers can take action to monitor different small groups maintain distances while still encourage distant VC investors to build relationships in the absence of VC firms' non-redundant information and knowledge to follow-on financing [63].

Finally, in terms of explanatory power, it is interesting to note that Model 9 has more explanatory power than Model 5 ($p < 0.01$). This means that the three interaction terms are important in explaining the likelihood of follow-on financing through syndication.

5.3. Robustness

We conduct three additional robustness tests to explore the sensitivity of our results. First, we add an additional network control. The average path among actors within the network impacts the ease of accessing information and resources [63] and thus may influence the focal VC firm's decision-making. We estimate the average path and re-estimate our models. Second, we use an alternative method of estimation. Specifically, we employed a probit analysis and re-estimated our model. Third, running regression without control variables can provide valuable information for the dependent variable's

uncontrolled variance [93]. Hence, we re-ran our models without all the control variables. Table 4 reports three versions of Model 9; the results on the other models are available upon request. Model 10 adds path length to Model 9, Model 11 estimates Model 9 using a probit specification, and Model 12 estimates Model 9 without controls. In each case, we continue to support our conclusions and thus demonstrate the robustness of our results.

Table 4. Robustness checks.

	Model 10	Model 11	Model 12
	Add Path Length	**Probit Regression**	**Without Controls**
CC	1.552 **	0.893 **	2.024 ***
	(2.448)	(2.554)	(3.075)
SH	3.919 ***	2.242 ***	3.278 ***
	(3.294)	(3.457)	(2.915)
SWQ	5.757 **	3.709 ***	5.319 **
	(2.172)	(3.148)	(2.490)
CC × SH	2.863 ***	1.703 ***	2.286 **
	(3.064)	(3.449)	(2.394)
CC × SWQ	−0.216	−0.108	−0.329
	(−0.313)	(−0.280)	(−0.452)
SH × SWQ	−2.237 **	−1.264 **	−1.796 *
	(−2.111)	(−2.175)	(−1.734)
VC age	0.015	0.009	
	(1.323)	(1.365)	
VC size	−0.043	−0.023	
	(−0.353)	(−0.338)	
Reputation	0.001	0.001	
	(0.152)	(0.191)	
PVC	−0.322	−0.188	
	(−0.882)	(−0.867)	
CVC	−0.482	−0.286	
	(−1.110)	(−1.128)	
Centrality	−13.115 ***	−7.833 ***	
	(−3.034)	(−3.162)	
Density	−6.293	5.701	
	(−0.167)	(0.534)	
Foreign	1.120 ***	0.648 ***	
	(3.952)	(4.065)	
Growth stage	−0.490 **	−0.282 **	
	(−2.044)	(−2.035)	
Expansion stage	0.001	0.010	
	(0.002)	(0.047)	
Mature stage	−0.508	−0.264	
	(−1.138)	(−0.975)	
Average path	0.294		
	(0.383)		
Year dummy	Yes	Yes	Yes
Constant	−10.265 ***	−5.691 ***	−9.285 ***
	(−2.672)	(−2.942)	(−2.924)
Log-likelihood	−396.064	−399.521	−427.527
Wald chi-square	89.76	108.42	52.25
N	760	760	760

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard errors are in parentheses. Dependent variable is follow-on financing through syndication.

6. Discussion and Conclusions

6.1. Key Contributions

Entrepreneurial firms play a critical role in the energy transition [35]. It has been recognized that the single biggest problem for sustainable entrepreneurial firms is access to finance [8–10]. As VC accounts for about 70% of entrepreneurial finance, we argue, in this paper, that understanding entrepreneurial finance is critical.

Research shows that 90% of VC firms syndicate with other VC firms [15] and 50% [16]–70% [17] of all VC investments in entrepreneurial firms are syndicated. VC financing occurs in a round, and research suggests that these occur over a period of 5–7 years [6]. Strangely, the literature on follow-on financing is rare, and studies on follow-on financing through syndication are rarer still, relative to the research on initial VC investments [21–24]. Our departure point in this paper was to add to this discussion.

Our results provide novel insights on the importance of syndicated follow-on financing in the renewable energy industry. Specifically, we show that only 50% of renewable energy projects receive follow-on financing and that 75% of this is syndicated follow-on financing. This is interesting, given Zhang et al.'s (2017) finding that 44% of first-round investments are syndicated [1]; it shows clearly that syndication increases across rounds.

Theoretically and empirically, we then examine the roles played by "trust", "access" to non-redundant information, and the "small-world" nature of the VC industry, in explaining the probability that a specific project will receive syndicated follow-on financing. We operationalize "trust" using the "clustering coefficient", "access" to non-redundant information using "structural holes", and the small-world nature of the industry using the "small-world quotient". We tested their effects separately and jointly. Our empirical results show that these three network attributes directly increase the likelihood of follow-on financing through syndication. Looking at their interactions, we find that the interaction term between clustering coefficient and structural holes has a positive effect, but that structural holes have a negative interaction effect with the small-world quotient. Our results offer several intriguing theoretical contributions and offer important practical insights.

6.2. Theoretical Implications

First, we extend the literature on VC syndication literature by advancing our understanding of the network factors influencing subsequent syndication. Previous studies have tended to pay more attention to the consequences of VC syndication. For instance, research has considered the impact of VC syndication on exit performance [3,74] and innovation [17,94]. Those studies that have examined the antecedents of VC syndication have tended to focus on the first-round investment [21–24]. Few take into account the question of follow-on financing [1,43]. We respond to calls [21] to explore whether the initial syndication can form lasting syndication relationships or not. We also shed light on the positive effects of syndication network characteristics (i.e., clustering coefficient, structural holes, and the small-world quotient) on subsequent syndication.

Second, we add to the burgeoning literature on sustainable entrepreneurship. We do this, on the one hand, by highlighting the role of VC syndication in the renewable energy industry [95], and, on the other, by zooming in on the topic of follow-on finance through syndication [43]. There is, of course, increasing attention being paid to sustainability and environmental problems. Some of this focuses on finance-related issues and some even provide specific insights on China. Ren et al. (2020), for example, describes VC syndication in Chinese sustainable entrepreneurship [6]. That said, empirical research on sustainable entrepreneurship in the renewable energy industry remains scarce. In addition, there is little to no research—that we are aware of—which considers how the features of the VC syndication network affect follow-on financing through syndication, in the renewable energy industry. In this study, however, and by constructing VC syndication networks for the renewable energy industry, we contribute to the sustainable entrepreneurship literature. We provide specific industry evidence on the topic of VC financing. In addition, we highlight the role played by follow-on financing, in particular, for sustainable entrepreneurship.

In so doing, we extend research on sustainable entrepreneurship into an emerging field. By focusing on the Chinese industry, our findings also offer fine-grained, practical insights on sustainable entrepreneurship in one particular renewable industry.

Third, while there are many studies on network and innovation, few have examined the impact of the network on follow-on financing through syndication. There are very few that we are aware of that incorporate the interaction effect of the attributes of ego network and global network. By integrating the ego-network perspective with the global-network perspective to explain the likelihood of follow-on financing through syndication, this paper advances our understanding of sustainable entrepreneurship. Furthermore, we find the substitutes effect between structural holes and small-world quotient and complementary effects between clustering coefficient and structural holes for increasing the likelihood of follow-on financing through syndication. This finding implies that there are alternative strategies in enhancing the likelihood of subsequent financing.

6.3. Managerial Implications

Our paper also yields some important managerial contributions to VC firms, policy-makers, and investee ventures in the Chinese renewable energy industry in particular.

For VC firms, our findings offer insights on the value of trust, access, and small-world networks, and provide insights on how to sustain syndication relationships. For instance, considering the complementary effects between clustering coefficient and structural holes, our finding suggests that they should emphasize brokerage and cluster advantage simultaneously. Similarly, regarding the small-world property, our research suggests that VC firms should put efforts into spanning more structural holes when the small-world structure of syndication networks is not obvious.

For energy policymakers, our results suggest that supportive policies, which encourage VC firms to collaborate, can increase the probability of securing follow-on-finance. Our findings suggest, for example, that policy should encourage VC firms to form clusters—to increase trust—and to enable VC firms to learn from the lead VCs in their clusters. Our findings also suggest that policymakers should look for ways to increase access to information, but creating conduits, within the industry and between the firms, to share information, to share resources, and to share industry insights.

Finally, for the Chinese renewable energy ventures, our results suggest that VC firms with high levels of social capital are key to securing the investment needed for survival and development. Ventures should study and understand the VC market before they seek investments and should identify the social elites among the various VC firms in each of the different clusters, and make use of the small-world nature of the VC network.

6.4. Limitations and Future Research

While offering valuable insights, we recognize that this paper also has its limitations. These, in turn, present interesting avenues for future research. Two are noteworthy:

First, the geographical scope in this paper was limited to only one country. We do so to control for country-specific effects and, most importantly, because we see no reason the mechanisms that we describe should differ in different settings. We recognize, however, that this is an assumption and that it may discount the generalizability of our findings. We hope that future research will test our hypotheses in other settings.

Second, we only focus on the renewable energy industry in this paper. We do so, on the one hand, because it allows us to control for industry-specific effects, and on the other hand, it is the industry that is of most interest to this journal. We recognize, however, that some investors may have formed co-investment relationships outside the renewable energy industry and that this may affect their follow-on financing decisions. We hope that future research will use a broader industry setting to address this issue.

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