



On the social and conceptual structure of the 50-year research landscape in entrepreneurial finance

Minh-Hoang Nguyen^{1,2}  · Thanh-Hang Pham^{3,4} · Manh-Toan Ho¹ · Huyen Thanh T. Nguyen⁵ · Quan-Hoang Vuong^{1,6}

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Abstract

In recent decades, drastic changes in global social-economic situations have led to significant shifts in the financial market for entrepreneurial firms, thus resulting in changes in entrepreneurial finance discipline. The current body of literature, despite its significant growth, has not provided an overview landscape of this research area. Consequently, this study aims to fill this gap by employing the bibliometric analysis of 6902 articles from 1970 to 2019 extracted from the Web of Science database. By doing so, this paper attempts to provide an overview of the discipline's research output, social and conceptual structure, and offer strategies facilitating the scientific development within the field. The findings indicate that entrepreneurial finance is a young and growing field with an exponential increase in the number of publications (approx. 19.75 percent per year) and rising collaboration tendency among authors. The 1991–2000 period is a crucial milestone of the field thanks to the remarkable growth and impact of studies during this period as well as simultaneously occurring historical events. We also notice a sign of Western ideological homogeneity from the collaboration networks and lists of most productive authors, institutions, and countries. Additionally, using thematic mapping, five major research domains are identified: “venture capital”, “crowdfunding”, “SMEs finance”, “social entrepreneurship finance”, “IPO and corporate governance”. Based on these findings, we raise the concern of lacking diversity in entrepreneurial finance research and propose strategies for authors, journals, and policymakers to diversify the literature.

Keywords Entrepreneurial finance · Venture capital · Crowdfunding · Social entrepreneurship · Ideological homogeneity · Bibliometrics

JEL Classification G20 · G24 · L31 · M13

✉ Minh-Hoang Nguyen
hoang.nguyenminh@phenikaa-uni.edu.vn; ng19m6tk@apu.ac.jp

Extended author information available on the last page of the article

Introduction

Entrepreneurial firms play a crucial role in economic, social, and environmental sustainability globally. According to the statistics of the Organization for Economic Cooperation and Development (OECD), firm start-ups and small and medium enterprises (SMEs) contribute to 99 percent of all businesses and around 50–60 percent of added value (OECD 2017, 2019). Regarding developed countries, for example, in the United States of America (U.S.) job market, start-ups are among major job creators, even though their impact on net job creation is not sustainable as more than half of them fail in the first 5 years (Dilger 2013; Gompers and Josh 1994). Also, small start-ups play a significant role in fostering innovation, which is one of the crucial factors that lead to economic growth and structural transformation, by reducing bureaucratic inertia and resistance to new R&D (Dent et al. 2016; Megginson 2002; Scherer 1991). Most recently, when the world is suffering from the COVID-19 outbreak, entrepreneurs are racing to find a vaccine for the virus. One of the front-runners in the race is Robert Langer, a scientist-entrepreneur from the Massachusetts Institute of Technology (Dayton 2020). As for developing nations, newly established businesses are expected to drive economic development without compromising the future of social and environmental aspects in both the short and long term (Dean and McMullen 2007; Dhahri and Omri 2018; McMullen 2011; Vuong et al. 2019).

Entrepreneurship, being an indispensable part of economies, has also undergone various phases of development along with the socio-economic changes all over the world. Since the 1920s, Ludwig von Mises, an Austrian-school economist, had predicted the collapse of the Soviet Union due to the problems of central economic planning (Von Mises 1953). He claimed that knowledge and information could be utilized fully only in a decentralized market system with free competition and pricing. When the Soviet hammer and sickle flag lowered for the last time over the Kremlin in 1991, the dissolution of the Soviet Union marked a milestone in the changes of socio-economic structures not only in the post-communist countries but also in capitalist nations.

The third Industrial Revolution, which is an era of rapid technological progress associated with the development of information technologies, has also marked the introduction of computers and the Internet. This revolution has created enormous opportunities for entrepreneurs and venture capital firms worldwide. However, it also leads to the so-called Internet bubble, a.k.a. The “dotcom bubble” in 2001. The combination of several factors, including speculative or fad-based investing, an abundance of venture capital funding for start-ups, and the failure of dotcoms to turn a profit, resulted in a loss of 77% in the NASDAQ index, as well as the burst of several internet companies. Then, the global financial crisis of 2007–2008 was caused by excessive risk-taking by banks and a downturn in the subprime lending market in the U.S. This crisis was then spread to Europe and the rest of the world. The International Monetary Fund estimated that large U.S. and European banks lost more than \$1 trillion on bad loans and toxic assets.

Such drastic socio-economic changes in the last several decades have considerably affected the emergence and growth of entrepreneurship and entrepreneurial finance research. Therefore, it is imperative for researchers to conduct a review that can present a general picture of entrepreneurial finance literature and offer future research directions.

Several scientists have recently examined the state of the art of entrepreneurial finance; to mention a few, studies of Bellavitis et al. (2017) and Cumming et al. (2019a) are great examples. Bellavitis et al. (2017) provide knowledge of current emerging sources of entrepreneurial finance and generally forgotten sources as well as the insufficiencies of mainstream theories in the entrepreneurial context. They also suggest that future attention should be paid to new sources of entrepreneurial funding (e.g., crowdfunding), usually ignored conventional financing sources (e.g., bank debt), and the globalization of entrepreneurial finance markets. Cumming et al. (2019a) summarize recent advances in the literature regarding the financing of entrepreneurial firms during their lifecycle, the effect of business angels on newly established firms' economic performance, and how entrepreneurs finance from venture capital. Based on the summary, the authors recommend future research to examine the international flows of funding given the development of Internet-based financing platform (like crowdfunding), the interplay between different types of investors given that financing sources (e.g., crowdfunding, business angel, venture capitalists, etc.) as complements or substitutes for each other, and the sustainability as well as social-human capital of board members.

These studies, together with others such as those of Chemmanur and Fulghieri (2014), Cumming and Groh (2018), and Fraser et al. (2015), provide relatively comprehensive and detailed research trends. However, all of them are narrative reviews that are subjective in nature and significantly influenced by prior knowledge of the researchers (Kraus et al. 2020). Moreover, these works merely focus on some facets of entrepreneurial finance research. The current body of literature in this discipline, despite its significant growth over the last few decades, has not provided an overview landscape of this research area. As a result, this study aims to fill this gap by using bibliometrics, which has been widely applied to help researchers to assess the discipline's landscape, and governments/funding organizations to optimize the efficiency and effectiveness of research and funding allocation (Moed 2006; Weingart 2005). The increasing popularity of this statistical method results from its advantages, including large-scale applicability, easy replicability, and perceived objectivity (Haustein and Larivière 2015). In particular, compared to traditional methods to conduct literature reviews, bibliometric analysis can present objective criteria to evaluate the developments in a research field. They can also serve as a useful tool to measure scholarship quality and productivity (Aparicio et al. 2019; Cobo et al. 2015). In addition, the systematization and replication processes offered by this method can enhance understanding of the knowledge dissemination in a field. They can point out research gaps and directions to advance the discipline. Zupic and Čater (2015) further claim that bibliometrics provides "a systematic, transparent and reproducible review process," which helps describe, evaluate, and monitor published research. Therefore, bibliometric analyses can bring new insights into the entrepreneurial finance field as a complement to previous research.

Therefore, given the complexity and dynamics in the entrepreneurial finance field, we aim to provide an overall picture of the discipline by using bibliometrics to answer the following research questions:

1. What are the volume and the most crucial period within the 50-year-period of development of the entrepreneurial finance discipline?
2. What is the social structure (or collaboration patterns) across levels (individual, institution, and country-level) in entrepreneurial finance literature?
3. What is the conceptual structure (or main research domains) in entrepreneurial finance literature?
4. What are future research directions in entrepreneurial finance scholarship?

The remainder of this paper proceeds as follows. “[Materials and methods](#)” describes the Materials and Methods employed in our study. “[Results](#)” presents the main results. “[Discussion and conclusion](#)” provides a discussion of the results and a conclusion.

Materials and methods

Bibliometric analysis

Science mapping is one of the major components of bibliometrics, together with scientific output and impact evaluation. To study the collaboration patterns across levels (individual, institution, and country), we employ the science mapping workflow suggested by Cobo et al. (2015) and Aria and Cuccurullo (2017): study design, data retrieval, data analysis (descriptive analysis, network matrix creation, and normalization), data visualization (mapping), and interpretation. The current study aims to explore two out of three structures of knowledge (K-structures): conceptual structure (by co-word analysis), and social structure (by co-author analysis).

The co-authorship analysis is performed to study the collaboration patterns among authors, institutions, and countries in various scientific disciplines, such as clinical research, business, and management research, and social research, etc. (Aria et al. 2020; Fonseca et al. 2016; Marzi et al. 2017). Through co-authorship analysis, the social network of authors, institutions, and countries within a scientific discipline can be visualized. A social network consists of two fundamental components: node and edge. Each node represents an author (institution or country), while each edge represents a connection between two authors within a social context. The size of a node is proportionate to the total number of connections the given node has with other nodes (or the degree of the given node). The thickness of an edge illustrates the frequency that two nodes connected by the given edge appear together.

In order to define groups of authors (institutions or countries) that obtain similar collaboration patterns, a similarity analysis is performed using the multilevel approach by Blondel et al. (2008). This approach, known as a multilevel modularity optimization algorithm (or Louvain algorithm), is based on the maximization of a

modularity score Q (Newman 2003). Another algorithm that is used simultaneously with the Louvain algorithm to plot the social network is Kamada-Kawai layout algorithm (Kamada and Kawai 1989).

Thematic mapping, built upon the keyword co-occurrence network and clusters, is performed to study the conceptual structure of entrepreneurial finance. Groups of frequently co-occurring keywords are identified by the simple center algorithm of Coulter et al. (1998). The detected research domains (or clusters) are later plotted on a thematic map. A thematic map is a two-dimensional diagram characterized by two parameters: “density” (x-axis) and “centrality” (y-axis), which help categorize themes into four quadrants (Cobo et al. 2011). The centrality and density are measured by the Callon et al. (1991)-proposed formula.

- The upper-right quadrant: clusters in this area are called motor themes, which are both well developed and essential for the structuring of a research field. They show strong centrality (high degree of external interaction) and high density (high internal strength of the network).
- The upper-left quadrant: clusters in this area are internally well-developed, but lack external interaction with other themes, so they are very specialized and peripheral in character.
- The lower-right quadrant: clusters in this area are important for a research field due to their high centrality, but not developed. The characteristics of these clusters are transversal, general, and essential.
- The lower-left quadrant: clusters in this area are both undeveloped and marginal because of their low centrality and density. They can be emerging themes or vanishing themes.

Search strategy

To conduct a bibliometric analysis, selecting a proper database is very important. The current study examines the landscape of entrepreneurial finance research with data retrieved from the Web of Science (WoS) database of Clarivate. WoS is one of the most reputable and long-standing databases in both Natural Sciences and Engineering and Social Sciences and Humanities.

Entrepreneurial finance is a field encompassing the intersection of two major fields, “entrepreneurship” and “finance”. Studies in entrepreneurial finance do not merely examine how entrepreneurs make a financial decision or allocate financial resources (Paré et al. 2009). In fact, this is a relatively interdisciplinary field, linking various areas such as public policy, psychology, sociology, and geography (Cumming and Johan 2017). Therefore, we define entrepreneurial finance research as any studies that are related to financial issues among entrepreneurs and organizations with entrepreneurial orientation.

Based on prior bibliometric studies about entrepreneurship (Aparicio et al. 2019; Vallaster et al. 2019), we utilize the keyword search with the following words: “entrepreneur*” (entrepreneur, entrepreneurs, entrepreneurial, and entrepreneurship), “start-up*”, “new enterprise*”, and “new firm*”. For finance, we review

studies of Padilla-Ospina et al. (2018), Xu et al. (2018), Zhang et al. (2019), and Cumming and Groh (2018), and determine to use the following search keywords: “financ*” (finance, financing, financial, financier, and financier), “debt*”, “venture capital*” (venture capitalist and venture capitalists), “trade credit*”, “crowdfund*” (crowdfunding, crowdfunded, crowdfunding, and Crowdfunder), “angel invest*”, “private equit*” (private equity and private equities), and “IPO*”.

The search was conducted on the 2nd March 2020 through the field tag “Topic”. The search can be replicated using the following search query:

("entrepreneur*" OR "startup*" OR "start-up*" OR "new enterprise*" OR "new firm*")
AND
("financ*" OR "debt*" OR "venture capital*" OR "trade credit*" OR "crowdfund*" OR "angel invest*" OR "private equit*" OR "IPO*")

When searching the WoS database, we followed prior pieces of literature in the same vein (Ferreira et al. 2019; Marzi et al. 2020; Xu et al. 2018) and extracted documents in the “article” category because papers listed in this category had been through the rigorous peer-review process. Because we perceive entrepreneurial finance as an interdisciplinary field, we did not limit the search query to any research areas. Also, the documents have to be written in English from 1990–2020. Eventually, 7,873 documents are extracted.

After retrieving documents from the online database, we curated and removed unqualified data. In total, 971 documents were excluded from the analysis because (1) they are published in 2020, (2) they obtain no publication year, or (3) they are retracted articles, books, book sections, proceeding papers, or data papers. We did not include any book, proceeding paper, and other types of publications except for research articles because either WoS or Scopus concentrate more on journals and less on other means of scientific knowledge dissemination (Mongeon and Paul-Hus 2016).

Procedure

The data were initially downloaded from the Web of Science (WoS) database based on the keywords mentioned above and inclusion criteria under the.txt format. The data consisted of authors’ names, authors’ affiliations, titles, publication sources, abstracts, keywords, and cited references. The downloaded data were later curated and excluded unqualified publications in Excel after converting from.txt files. The bibliometrix R package (Aria and Cuccurullo 2017) was employed to analyze and extract specific data from the.txt format. The package provides two alternatives to perform the bibliometric analysis; one is for coders, and another one is for ordinary users employing the *biblioshiny* function, which is a web-based application

developed on Shiny environment. In this study, co-authorship analysis is conducted through coding, and thematic mapping is conducted using the *biblioshiny* function for the sake of flexibility and aesthetics. For transparency, the study's anticipated limitations are described in the Discussion following (Vuong 2020).

Results

Scientific output

This section provides an overview of the research landscape of entrepreneurial finance from 1970 to 2019. We record a total of 6,902 research articles by 12,855 different authors in 1,891 journals that meet our criteria.

Publication output

Entrepreneurial finance is a relatively young field of science with the first paper published in 1970 (Jordan 1970) and has been growing dramatically in the last 30 years. Figure 1 shows the annual number of publications related to the financing issues of entrepreneurs from 1970 to 2019 with exponential and linear estimations. It can be seen that the exponential estimate ($R^2=0.93$) can explain the research output growth in this field better than the linear one ($R^2=0.61$). Overall, the annual growth rate of research articles is 19.75 percent (the calculation does not include the period 1970–1990 due to sensitivity).

The most important period

We split the annual research articles into four periods: 1970–1990, 1991–2000, 2001–2010, and 2011–2019 (see Table 1). The period 1970–1990 can be considered the “takeoff roll” period for the field, with both the numbers of publications and authors being modest. Meanwhile, the increase in the number of documents, sources, and authors during the period 2011–2019 is impressive; solely the proportion of materials, sources, and authors during this period account for 75.22, 86.15, and 81.86 percent of the field, respectively. Notably, the number of publications in 2015 almost doubled the number of publications in the previous year. This unexpected surge might be the consequence of the emergence of ‘crowdfunding’ as a new method of financing among entrepreneurs. The term ‘crowdfunding’ barely appears before 2010 (Cumming and Groh 2018). However, it has now become one of the most attractive research topics within the discipline (Belleflamme et al. 2014; Mollick 2014).

Among the four periods, the 1991–2000 one marked the most crucial milestone in the history of entrepreneurial finance in terms of productivity and impactfulness. For productivity, this period obtained the highest average annual growth rate in the number of studies at 24.46%, and the impact of publications during this period was also the highest at 77.46 citations per document. The prominence of this period

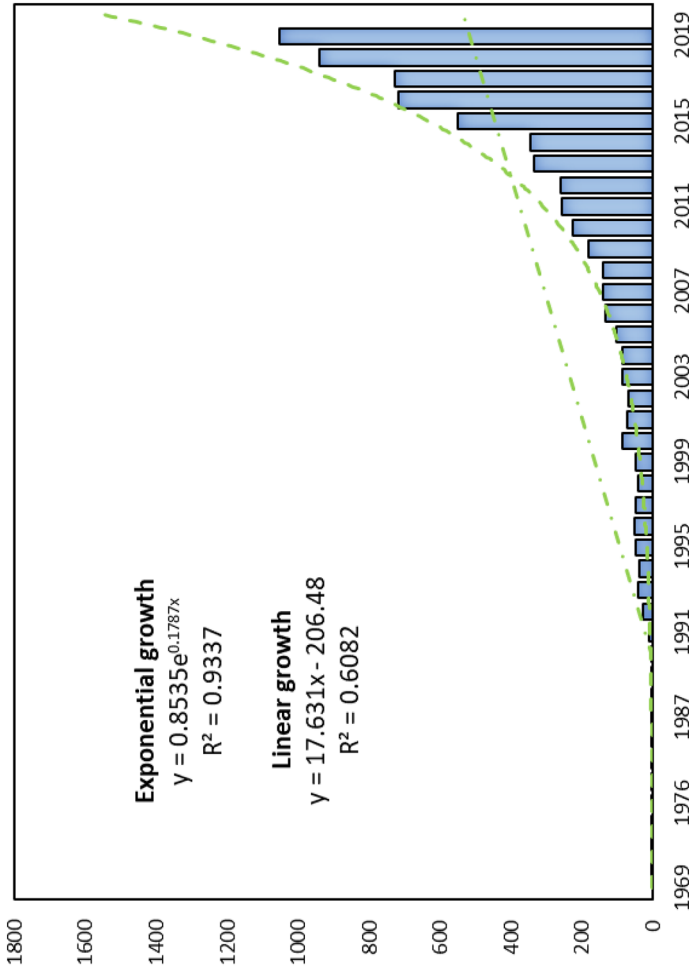


Fig. 1 The annual number of publications in entrepreneurial finance from 1970–2019

Table 1 Scientific performance during four specific periods

	1970–1900	1991–2000	2001–2010	2011–2019
Documents	23	448	1239	5192
Sources	19	200	474	1628
Authors	31	736	2203	10,521
Citations per document	8.09	77.46	54.54	9.32
Authors per document	1.35	1.64	1.78	2.03
The average annual growth rate	N/A	30.97%	11.33%	19.81%
Single-authored documents (%)	16 (69.57%)	214 (47.77%)	385 (31.07%)	1150 (22.15%)
Collaboration Index	2.5	2.32	2.17	2.34

Citations per document = Total citations (of documents published in specific period) until the extracted date / Total number of documents published in that period

Collaboration Index = Total Authors of Multi-Authored Articles / Total Multi-Authored Articles

might result from the dissolution of the Soviet Union (USSR) and the Internet revolution, as well as other historical events prior to it.

In addition, the increasing number of authors per document over time and the decreasing share of single-authored papers hint at the rising collaboration trend among researchers in the discipline of entrepreneurial finance. The group size measured by the collaboration index also slightly decreased from 2.5 during 1970–1990 to 2.34 during 2011–2019, which hints at the fact that researchers in this field tend to collaborate in a smaller group.

Social structure

In this section, we examine the scientific performance and collaboration patterns across three levels: author, institution, and country. The results from the national, institutional, and individual levels suggest the dominance of Western ideologies in the discipline, demonstrated by the strong presence of influential authors and institutions from the U.S. In contrast, the lack of authors, institutions, and countries in continents other than Europe and North America is noticeable (Crew 2019). Unfortunately, those left-out countries include the Asia–Pacific area, which is currently the home of four out of the ten most productive countries in terms of research productivity, namely China, Japan, Korea, and Australia. Even though China exposes a sharp rise in scientific production that ranks 4th among the ten most productive countries, China’s scientific impact is the lowest in terms of both citation per paper and average JIF.

Most productive authors and their social structure

Among the top ten authors in entrepreneurial finance research based on full counting and fractional counting methods, the number of authors affiliated with institutes in Europe and North America is overwhelming (see Table 2). Wonglimpiyarat J is the only author whose affiliation was outside Europe and

Table 2 Top ten most productive authors by full and fractional counting in entrepreneurial finance discipline

Rank	Authors	Counts	First publication year	Institution	Country
Full counting					
1	Wright M	51	1992	Ghent University	Belgium
2	Cumming D	48	2005	Florida Atlantic University/University of Birmingham	U.S./U.K
3	Shepherd DA	25	1999	University of Notre Dame	U.S
4	Schwiebacher A	24	2005	SKEMA Business School	France
5	Colombo MG	22	2005	Polytechnic University of Milan	Italy
6	Zahra SA	21	1991	University of Minnesota	U.S
7	Vanacker T	20	2006	Ghent University	Belgium
8	Grilli L	18	2005	Polytechnic University of Milan	Italy
9	Vismara S	18	2010	University of Bergamo	Italy
10	Clarysse B	16	2005	Swiss Federal Institute of Technology	Switzerland
10	Manigart S	16	1994	Ghent University	Belgium
Fractional counting					
1	Cumming D	21.87	2005	Florida Atlantic University/University of Birmingham	U.S./U.K
2	Wright M	17.75	1992	Ghent University	Belgium
3	Schwiebacher A	12.58	2005	SKEMA Business School	France
4	Zahra SA	11.58	1991	University of Minnesota	U.S
5	Shepherd DA	10.00	1999	University of Notre Dame	U.S
6	Wonglimpiyarat J	10.00	2006	Thammasat University	Thailand
7	Bates T	9.67	1975	Wayne State University	U.S
8	Grilli L	8.75	2005	Polytechnic University of Milan	Italy
9	Vismara S	8.42	2010	University of Bergamo	Italy
10	Colombo MG	7.58	2005	Polytechnic University of Milan	Italy

The first publication year shows the first year the author started to publish in this field, while the information about the country and institution of an author is drawn from the author's last publication in 2019

North America. Still, the total number of citations received by the researcher from Thailand is not in line with his/her production. It is also notable that European authors tend to collaborate to achieve higher scientific output than authors from other territories. In detail, 9 out of 11 most prolific authors (including Cumming D) based on full counting are affiliated with institutions in Europe, whereas with fractional counting, 5 out of 10 most prolific authors (including Cumming D) are from North America and Thailand.

Another observation is that Vismara S from the University of Bergamo, Italy, started his career in the topic of entrepreneurial finance in 2010, which is comparatively later than other researchers on the list. His success might be in touch with the recently rising topic of 'crowdfunding' (Rossi and Vismara 2018; Signori and Vismara 2018; Vismara 2016, 2019).

Wright M is the most productive author as well as the second most influential author. His works are cited 3,151 times, with the corresponding *h*-index being 27. In terms of scientific impact, Zahra SA is the most influential researcher in the entrepreneurial finance discipline even though he only published 21 papers. His classic works extend our understanding of corporate entrepreneurship and firm performance (Zahra 1991, 1993; Zahra and Covin 1995). Notably, most of the authors (9/10) start in the 1990s and early 2000s, whereas Cumming D is the only author publishing most recently but ranked 5th among the top ten most influential authors with 2,290 citations.

All authors presented in Table 3 are from Western countries. Also, the impact of the U.S. in entrepreneurial finance is again reaffirmed, with eight of the most influential authors being affiliated with institutions in the U.S. The only European representatives in the table are Cumming D and Hellmann T from the U.K., and Wright M from Belgium.

The author's collaboration network is also visualized. Each node (or vertex) on the undirected graph indicates a specific author with his/her name displayed in a label; the size of the node is proportional to the total node degree measuring how many links start from or arrive in the given node. If there exists a co-authoring article between two or more authors, the nodes will be connected by links (or edges); otherwise, the node will obtain no connection link with other authors on the graph. A group of frequently collaborated authors will be clustered in the same color using the Louvain clustering algorithm, and the dotted line shows a cross-group collaboration between two authors in two different clusters.

Table 3 Top ten most influential authors by total citations in entrepreneurial finance discipline

Rank	Authors	Total citations	<i>h</i> -index	First publication year	Institution	Country
1	Zahra SA	4358	19	1991	University of Minnesota	U.S
2	Wright M	3151	27	1992	Ghent University	Belgium
3	Shepherd DA	2890	20	1999	University of Notre Dame	U.S
4	Shane S	2793	8	1994	Case Western Reserve University	U.S
5	Cumming D	2290	27	2005	Florida Atlantic University/University of Birmingham	U.S./U.K
6	Stuart TE	1808	3	1998	University of California	U.S
7	Hellmann T	1796	9	1998	University of Oxford	U.K
8	Carsrud AL	1607	3	2000	Ryerson University	Canada
9	Krueger NF	1480	1	2000	Boise State University	U.S
9	Reilly MD	1480	1	2000	Montana State University	U.S
10	Hoang H	1203	1	1999	Case Western Reserve University	U.S

The first publication year shows the first year the author started to publish in this field, while the country and institution of an author was drawn from the author's last publication in 2019

Initially, we visualized the network with 30 most representative authors, but the result has no clear tendency. Thus, we increased the number to 60 most representative authors (see Fig. 2). Astonishingly, most of the top ten authors in terms of scientific impact and output collaborate heavily with each other and form three main groups, which we may call “supreme groups” in the discipline. Meanwhile, other researchers tend to work alone or in a small group with two to four people. When plotting with a higher number of authors (100 and 200 most representative authors), larger groups of researchers start to emerge, but those groups are relatively peripheral compared to the “supreme groups.” The result, therefore, can be considered unchanged.

Most productive institutions and their social structure

Table 4 shows the top ten institutions for scientific production in the topic of entrepreneurial finance; or, we may say 11 powerhouses. The three most productive institutions are Harvard University and Indiana University in the U.S., and Ghent University in Belgium. Interestingly, all the 11 institutions are in Western countries, eight of which are in North America (the U.S. and Canada), and others are in Europe (United Kingdom, Belgium, and Italy). Contributing more than half of the list, the U.S. is home to most of the powerhouses of entrepreneurial finance research, including Harvard University, Indiana University, University of North Carolina, Stanford University, the University of Minnesota, Babson College, and the University of Pennsylvania. Ghent University in Belgium is the only institution with three researchers in the list of top ten authors for scientific production, who are Wright M, Vanacker T, and Manigart S.

We then visualized the collaboration network of 50 most representative institutions employing the Kamada-Kawai network layout and Louvain clustering algorithm (Fig. 3). The network points out four main clusters: (1) Blue cluster—collaboration dominated by private institutions within the U.S., led by three powerhouses (Harvard University, Stanford University, University of Pennsylvania, and the University of North Carolina); (2) Orange cluster—collaboration group dominated by public institutions within the U.S., led by two powerhouses (Indiana University and the University of Minnesota); (3) Red cluster—collaboration group dominated by institutions in the Europe and Canada, led by powerhouses outside of the U.S. (Ghent University, University of Nottingham, York University, and the Polytechnic University of Milan); (4) Purple cluster—collaboration group that has a connection with all clusters, led by one powerhouse (Babson College); (5) Green cluster—collaboration group that has a close connection with European institutions. Nevertheless, only three institutions from other regions outside Western countries appear in the network (Tsinghua University, Southwestern University of Finance and Economics, and the National University of Singapore). This indicates the weak knowledge exchange of institutions around the world apart from Western countries in the discourse of entrepreneurial finance. The visualization result from 80 and 100 most representative institutions reveals the rising distance between clusters 1 and 3, the higher interconnection of clusters 2, 4, 5, and the marginal appearance of several institutions from China and Hong Kong. Generally looking, there is not much

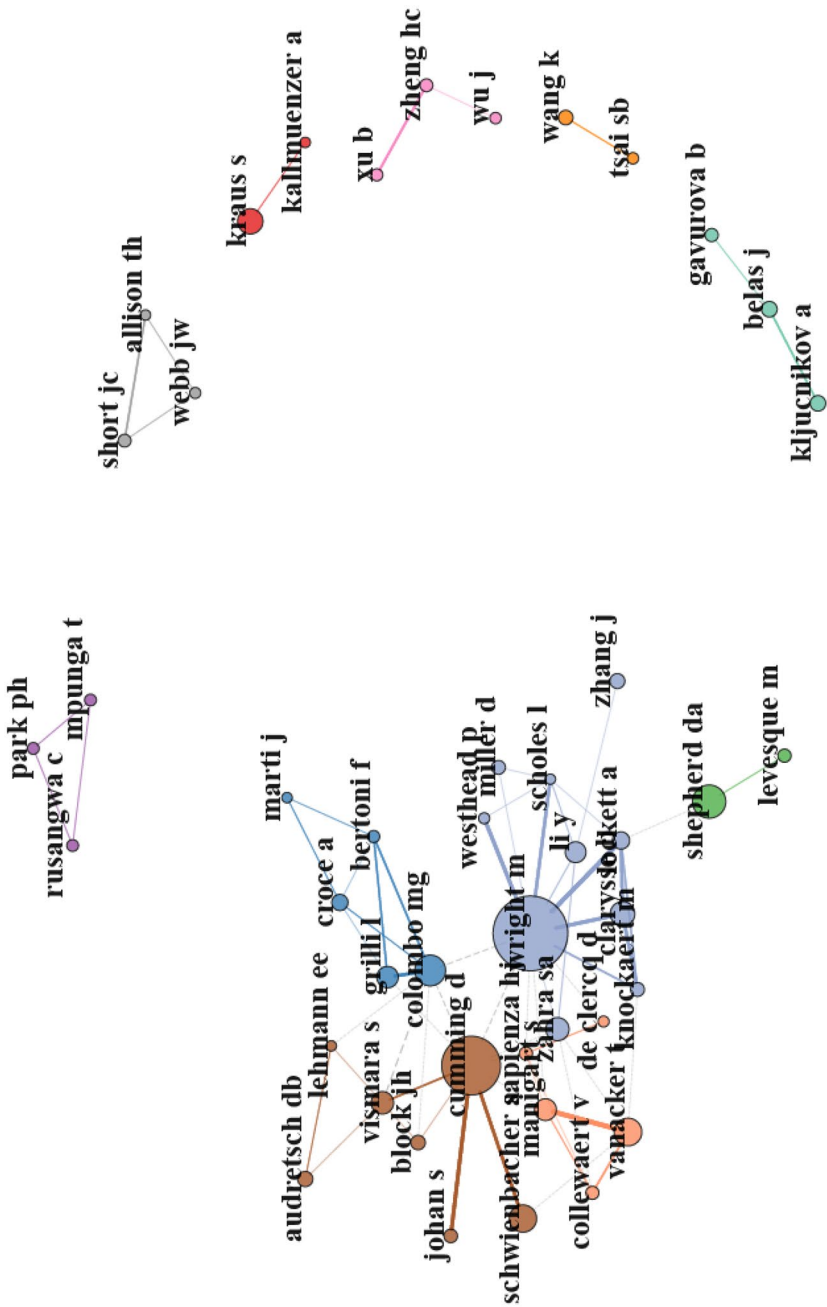


Fig. 2 Collaboration network of 60 most representative authors in entrepreneurial finance discipline

Table 4 Top ten institutions for scientific output in entrepreneurial finance discipline

Rank	Institution	Country	Articles	Articles (%)	Total citation	Average citation
1	Harvard University	U.S	75	1.09	5250	70.00
2	Ghent University	Belgium	73	1.06	2375	32.53
3	Indiana University	U.S	73	1.06	2996	41.04
4	University of Nottingham	U.K	68	0.99	3117	45.84
5	University of North Carolina	U.S	63	0.91	1922	30.51
6	Polytechnic University of Milan	Italy	62	0.90	1512	24.39
7	Stanford University	U.S	62	0.90	6143	99.08
8	York University	Canada	58	0.84	2355	40.60
9	University of Minnesota	U.S	56	0.81	3142	56.11
10	Babson College	U.S	47	0.68	3255	69.26
10	University of Pennsylvania	U.S	47	0.68	3616	76.94

difference in the bigger picture, which suggests the Western monocentric in the collaboration network.

Most productive countries and their social structure

With 2,193 articles contributing 31.77 percent of the total publication, the U.S. is the most productive country. The scientific impact of the U.S. (76,894 citations and 35.06 citations per article) is also far ahead of other nations. For some countries, the number of articles does not reflect much of their impact (see Table 5). Netherlands authors have only 243 articles, but each of them is cited 21.17 times. In a list dominated by developed Western countries, China is on the rise with 424 publications, but their impacts are relatively low. The average citation of an article by China is 13.31, making them the least influential country in the top 10.

The collaboration network of 30 most representative countries presents three clusters of international collaboration among countries: (1) North America and Asia, (2) Western Europe, including Italy, (3) South Africa, North Europe, and Central Europe (see Fig. 4). The dominance sign of Western countries in the research topic of financial issues among entrepreneurs is relatively transparent that North American and European countries create three main collaboration networks and significantly contribute to them. The finding provides an additional piece of evidence on the influence of Western countries in the field of entrepreneurial finance.

Conceptual structure

To implement keyword co-occurrence analysis, we use thematic mapping instead of network visualization to examine the current development situation of each area as this method is better in evaluating the current development stage of the research domains than network mapping. We employ 500 most representative words in the Author Keyword field rather than the Keyword Plus field because

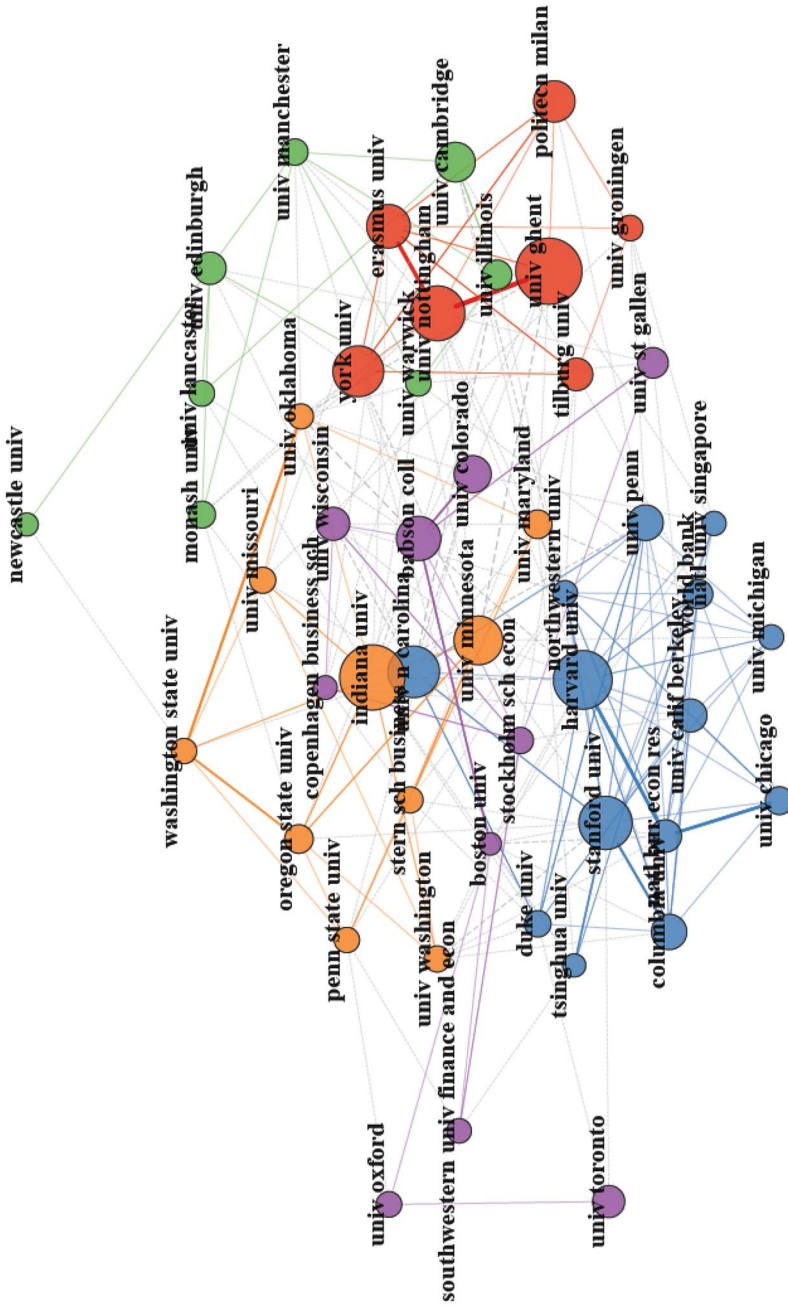


Fig. 3 Collaboration network of 50 most representative institutions in entrepreneurial finance discipline

Table 5 Top ten countries for scientific output in entrepreneurial finance discipline

Rank	Country	Articles	Articles (%)	Total citation	Average citation
1	U.S	2193	31.77	76,894	35.06
2	U.K	936	13.56	21,537	23.01
3	Germany	433	6.27	8084	18.67
4	China	424	6.14	5645	13.31
5	Canada	415	6.01	9740	23.47
6	Italy	315	4.56	4655	14.78
7	France	259	3.75	4981	19.23
8	Spain	277	4.01	4675	16.88
9	Australia	262	3.80	4563	17.42
10	Netherlands	243	3.52	5145	21.17

Author Keyword terms are as useful as Keyword Plus in exploring the knowledge structure of scientific fields and also provide a more comprehensive representation of the article's content (Zhang et al. 2016). A bubble on a bi-dimensional map presents each detected domain. The terms/words in the bubble are terms/words with the highest number of occurrences within a domain. The bubble size is proportional to the word occurrences of the domain, and the bubble position on the map is given based on Callon's centrality and density scores.

Here, we present five primary research domains with their current development stage (see Fig. 5). The most extensive research domain (blue) is associated with the venture capital financing of entrepreneurs, so the domain is called "venture capital." This research domain has an extensive connection with other research domains, but a relatively weak connection within the domain, which makes it relatively transversal. Researches in this domain usually concern the relationship between venture capital and the innovation ability of new firms (Gu and Qian 2019; Santos and Qin 2019), the role of venture capital financing in China (Cheng et al. 2019), and gender issues in obtaining venture capital (Guzman and Kacperczyk 2019).

The second most substantial research domain is "crowdfunding" (purple). This domain is located on the y-axis, which indicates the growing external links representing connections with other research domains. This domain focuses mainly on the crowdfunding topic; some exemplary studies are Cumming et al. (2019b), Foster (2019), Hervé et al. (2019), Vismara (2019), and Miller et al. (2019). As crowdfunding is a recently developed topic and relatively transversal, the domain's internal links are weak.

The third domain is related to the activities and financial performance of small-medium enterprises, so we call it "SMEs finance" (green) – the motor theme of the entrepreneurial finance field. The domain is not only well developed but also substantially interacted with other domains. Gomezel and Rangus (2018), Adomako (2018), Donkor et al. (2018), and Farrington et al. (2018) are some of the exemplary researches. Also, the SMEs' financial performance and internationalization are often concurrently examined (Gonzalez-Perez et al. 2018; Jin et al. 2018).

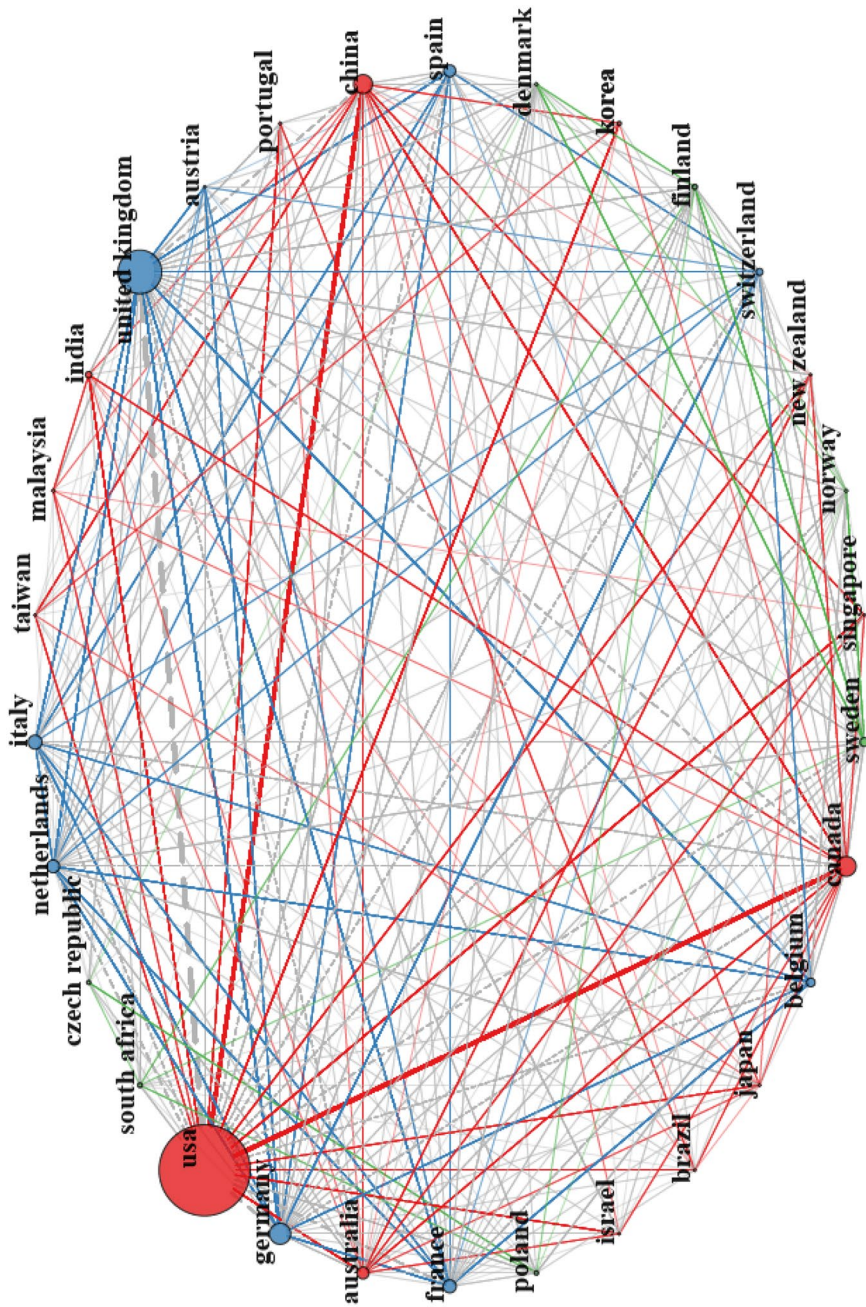


Fig. 4 Collaboration network of 30 most representative countries in entrepreneurial finance discipline

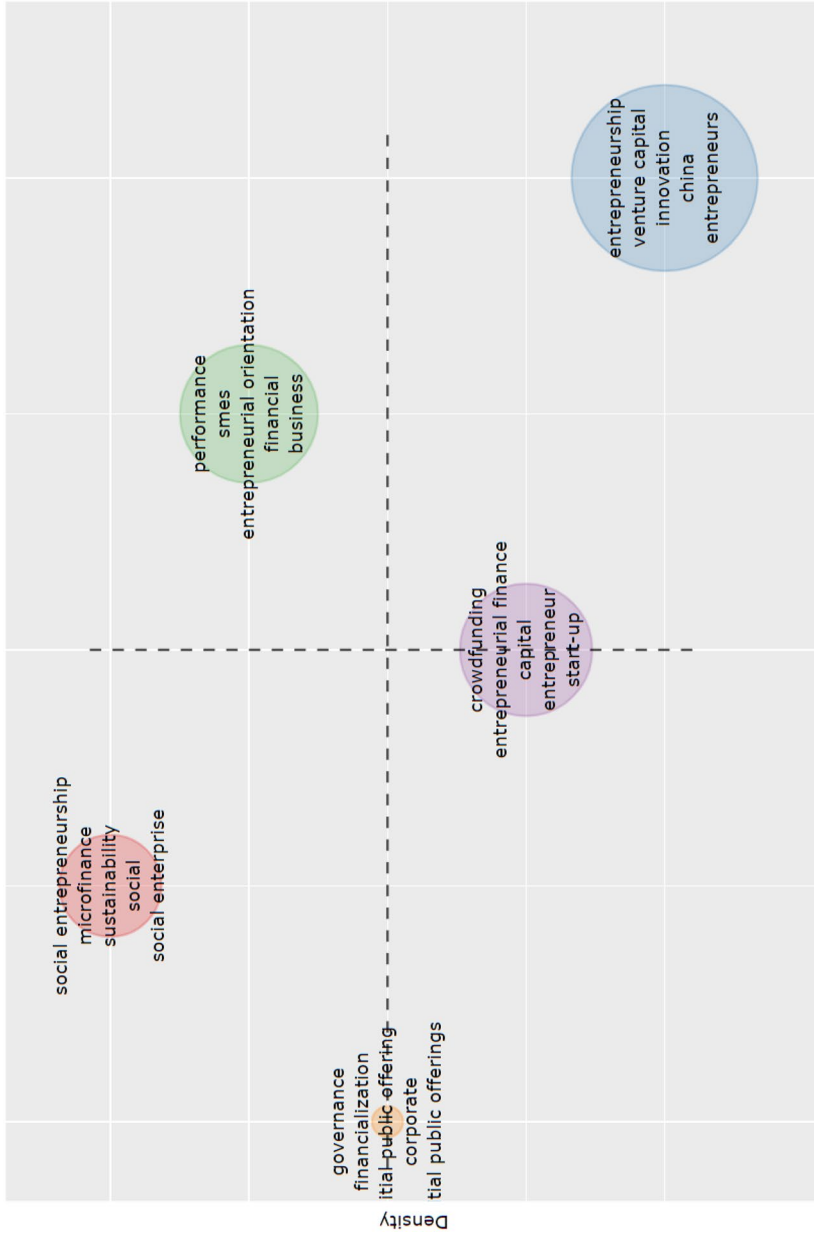


Fig. 5 Thematic mapping of 500 most representative authors' keywords in entrepreneurial finance discipline

The fourth domain (red), titled “social entrepreneurship finance,” apparently examines how social entrepreneurs finance their businesses. Social entrepreneurship refers to businesses aiming to create social value through recognizing opportunities, employing innovation, tolerating risk, and declining to accept insufficient resources (Peredo and McLean 2006). The financing issues of social entrepreneurs in India attract substantial interest from researchers (Satar and John 2016; Tasavori et al. 2016; Verma 2017). The topic of microfinancing for poverty alleviation is also included in this domain (Alawattage et al. 2019; Hussain et al. 2019; Price 2019). Moreover, the financing issues of social entrepreneurship are frequently studied with sustainability issues (Gray et al. 2018; Laurell et al. 2019), which might require the expansion of external links (or centrality) due to the interdisciplinary nature of sustainability.

The fifth domain—“IPO and corporate governance” (orange), is relatively specific to the connection between Initial Public Offering (IPO) and corporate governance. The knowledge within the domain is developing, but its interaction with other domains is limited, making the domain knowledge narrow. Studies in this domain usually pay attention to IPO underpricing and information asymmetry (Fitza and Dean 2016; Pollock et al. 2015; Wang et al. 2018).

Discussion and conclusion

The historical 1991–2000 period of entrepreneurial finance

From the data of 6,902 research articles between 1970 and 2019, we consider the 1991–2000 as the most important historical period of entrepreneurial finance due to the significant growth rate in the number of articles as well as average citations per document. These may result from the worldwide historical events occurring in the same period. On the 26th December 1991, the Supreme Soviet of the Soviet Union voted itself out of existence, which led to mass migration from USSR countries to others. Notably, around 800,000 immigrants settled down in Israel during 1990–2000, whereas the U.S. welcomed approximately 280,000 immigrants from ex-USSR countries during the first half of the 1990s. The emigration wave to Israel and the U.S. brought with them a large number of scientists and engineers. These scientists and engineers are among the people that contributed and facilitated the Internet Revolution and the surge in hi-tech during the 1990s (Senor and Singer 2011).

According to the U.S. Bureau of Labor Statistics (2016), the number of new business establishments less than 1-year-old increased rapidly from around 569,000 in 1994 to around 674,000 establishments in 2000. Given the tremendous number of new business “born” annually, finance becomes a fundamental need for the survival and performance of start-ups. As a consequence, the amount of venture capital disbursement during 1991–2000 rocketed by approximately 3,000 percent from nearly \$3 to \$90 billion (National Science Board 2002). Despite a much lower amount of investment, the European venture capital industry also invested \$12 billion in 1999

(Hege et al. 2009). With such a massive amount of investment, entrepreneurial finance was a fertile research field for cultivation.

The 1991–2000 period would not have been the most historically important milestone without the contribution of prior scientific and political events that helped entrepreneurship and entrepreneurial finance disciplines take off. The first event that needs to be mentioned is the Nobel prize of Friedrich von Hayek in the 1970s for the business cycle mechanism and the effectiveness of a decentralized market system. After the publication of Schumpeter (Schumpeter 2013), the prize might bring more attention to entrepreneurship, which has long been perceived as the “heart” of the economy by the Austrian School. The idea of a decentralized market system also affected the world’s leaders during the late 1970s and throughout the 1980s. This idea promoted the liberalizing of the economy by reducing state intervention and increase entrepreneurialism. Two exemplary cases are Margaret Thatcher and Ronald Reagan, with their famous “Thatcherism” and “Reaganomics” being associated with supply-side economics. The worldwide economic liberalization, in our opinion, paved the road for not only the rapid growth in entrepreneurship research (Landström and Lohrke 2010) but also the boom in entrepreneurial finance research during 1991–2000.

Then, the dotcom bubble in 2000 affected both the economy and science. In economic terms, while the number of establishments less than 1-year-old slightly declined by around 3 percent (U.S. Bureau of Labor Statistics 2016), the venture capital investment in the U.S. dropped by around 79 percent after 2 years (National Science Board 2008). In science, the average annual growth rate slowed down to 11.33 percent during 2001–2010. After the Great Recession in 2008, another boom is coming due to technological advancement and new players in entrepreneurial finance. In economic terms, the emergence of Industry 4.0 and cryptocurrency marked a coming of a new technology revolution in the 2010s decade. In contrast, the publication growth rate increased to 19.81%, partly thanks to the emergence of crowdfunding – a new web-based financing method.

Western ideological homogeneity and a decade of heterogeneity

There exist some signs of Western ideological homogeneity in entrepreneurial finance research. Ideological homogeneity has been researched extensively, especially in political science. The term often refers to the lack of opinion diversity, as a majority hold a similar opinion. Regarding the disadvantage of this phenomenon, under the influence of ideological homogeneity, the minority might be influenced to adjust their opinions to be in line with the majority, thus narrowing the realm of intellectual inquiry and debate (Atkeson and Taylor 2019; Wojcieszak 2010). The dominance of ideology may also result in the rejection of papers on unpopular subjects or with a different point of view. As a result, scientists with less dominant views may find homogenous environments hostile; thus, they are less willing to share their opinions (Campbell 2019).

The research output and social structure across three levels (authors, institutions, and countries) in our study reveal some characteristics of Western ideological homogeneity

as suggested by Nescolarde-Selva et al. (2017) and Atkeson and Taylor (2019), namely: ideological hegemony and homogenous social circle of top researchers. First, our findings indicate that the ten most productive authors, institutions, and countries are all Western. Only by fractionalizing the count, an author from Thailand is detected. However, his impact within the field is very modest, with only 107 citations compared to thousands of citations of his peers.

Second, the Western monocentric within the discipline seemingly derives from the close collaboration networks among European and North American top authors and institutions. Our social structure analysis reveals a close-knit scientific community formed by institutions within Europe and North America. Meanwhile, the collaboration network among 60 most representative authors illustrates “alliances” of top Western authors, or we may call “supreme groups.” The close connection of Western authors and institutions might amplify their impact on entrepreneurial finance and simultaneously reinforce the influential power of the Western ideology. In contrast, less relevant authors tend to work alone or in a small group; hence their impact is much smaller than the large research groups. In such a Western-centric discipline, China has an impressive performance in terms of publications, but its impact is low compared to Western countries. Given that entrepreneurial finance is becoming a global issue (Boyde 2015; Hruby 2019; Sindakis 2015), we would like to raise the concern of ideological homogeneity in the field of entrepreneurial finance.

We believe that there are no “one size fits all” theories, concepts, and frameworks that can explain the dynamics of entrepreneurial finance. There are always risks in using a “seemingly universal” concept or framework in analyzing the economic realities occurring in another place with different sociocultural, institutional, and financial contexts, which can be reliable predictors of entrepreneurship dynamism (Vuong et al. 2020; Vuong 2016a, b). Another possible risk is that the dominance of Western ideology in entrepreneurial finance may constrain researchers from non-Western countries to share different opinions and direct international research toward Western research orthodox. We believe that the economies around the world will take great benefits from a more ideologically diverse environment. In an ideological heterogeneity environment, a country might find the most appropriate ideology that is not only effective in promoting economic development but also receive less resistance from the institutional and sociocultural filter process of that country. However, ideological diversity is very costly, especially for emerging countries, because it requires a strong scientific foundation and proactive attitudes from researchers, institutions, and governments (Vuong 2018, 2019). Thus, besides the effort to accept heterogenous values from the side of Western communities, we encourage scientists from non-Western countries to propose new ideas that reflect from local sociocultural perspectives bravely, and perhaps established empirical evidence.

Entrepreneurial finance research themes and future research agenda

Based on the co-occurrence analysis of the most 500 authors’ keywords, we identify five main research domains, including “venture capital,” “crowdfunding,” “SMEs finance,” “social entrepreneurship finance,” and “IPO and corporate governance.”

Among the five domains, there are still many rooms for further research in “venture capital” and “crowdfunding” domains. As these two domains are currently the two most popular financing methods of entrepreneurs, they have a substantive connection with other themes within the field. Still, the internal links have not been fully built up. While “venture capital” has played a significant role in the development of entrepreneurial finance since the 1970s (Fells 1975), “crowdfunding” has only started to emerge since 2010 (Cumming and Groh 2018), so there are still plenty of rooms for research on the relationship between crowdfunding and entrepreneurship.

The finding from the conceptual structure asserts that “social entrepreneurship finance” is an internally well-developed research domain with the highest density score. We learn that the financing sources for social entrepreneurs and enterprises mostly come from familiar sources such as (a) government funds, (b) charitable organizations, (c) personal networks and business angels, and (d) microfinance initiatives. Thus, research on “social entrepreneurship finance” also mainly focuses on these financing sources (Cheah and Ho 2019; Cheung et al. 2019; El Kallab and Salloum 2017). On the other hand, conventional financing channels, such as venture capital and IPO, seems not to have been paid adequate attention. The low centrality score of the research domain, and a limited number of studies found, confirms this issue (Achleitner et al. 2013; Mayer and Scheck 2018). Given the increase in the number and size of social venture capital firms, such as Triodos Investment Management, Vital Capital, Grassroot Business Fund, and Unitus Seed Fund, etc., more researches on how social entrepreneurs and enterprises finance from social venture capitals need to be conducted. Moreover, in regions that lack access to the conventional banking system or obtain a high inequality level, microfinance might be an excellent approach to start with.

The vital contribution of venture capital to the development of start-ups in Western countries from the 1970s has led to intensive research endeavors exploring the relationship between venture capital and entrepreneurial firms’ performance. Crowdfunding has recently emerged as a prominent contributor to the field thanks to the diffusion of the Internet around the globe. However, as the dotcom bubble was influenced mainly by the homogeneity of venture capital as the dominating financing source during the 1990s, overemphasis on one or two financial sources might not help diminish the adverse consequences of the next economic crisis. Therefore, we argue that diversifying viewpoints and financial sources to be studied is an important future research agenda in entrepreneurial finance.

Prior reviews have directed future research to new sources of financing as well as conventional sources that remain underexplored, such as accelerator and incubator, crowdfunding, family offices, university fund, Initial Coin Offerings (ICOs), bank, governmental venture capital, and peer-to-peer lending, etc. (Bellavitis et al. 2017; Fraser et al. 2015; Klein et al. 2020). In supplement to these suggestions, our findings highlight the demand for studying financial sources that are crucial in non-Western contexts. For example, governmental venture capital, peer-to-peer lending, and family/friend loans are common forms of financing in countries with high central government control and collectivism characteristics. Also, a majority of findings in entrepreneurial finance are based on Western data (Cumming and Johan 2017; Mitter and Kraus 2011), so studies employing cross-sectional and non-Western

data might provide valuable discoveries that contribute to theoretical and empirical advancements in the entrepreneurial finance discipline.

Strategies for diversification in entrepreneurial finance

The world economy is currently paralyzed by the COVID-19 pandemic, with already more than 11 million confirmed cases and 500,000 deaths by now (WHO 2020). The need for diversification is more substantial than ever as the likelihood of a post-COVID-19 financial crisis is high. We, therefore, would like to propose strategies for policymakers, editors, reviewers, and authors to diversify the literature of entrepreneurial finance:

- **Authors:** Non-Western authors need to be more proactive in sharing their perspectives and knowledge of local financing methods as well as bravely protect them despite possible criticisms from Western peers due to different core values (Vuong 2019). Besides, not only non-Western authors but also Western peers should have entrepreneurial attitudes to take risks, explore, and challenge counter-intuitive ideas. These actions will eventually result in problem-solving ideas through the mechanism of imaginativeness (Kier and McMullen 2018). For example, “How can social enterprise obtain IPO?” and “How can social enterprise balance between showing investors profit and solving the social-environmental problems?” can be the two questions to start with.
- **Journals:** Editors and reviewers should be more open-minded with new core values or perspectives proposed by non-Western scholars. Given that the majority of members in the editorial boards of entrepreneurial finance journals are Western scholars, the participation of editors and reviewers from non-Western national and cultural backgrounds is necessary. Participation can be promoted through inviting highly influential non-Western scholars to join the editorial board or initiate Special Issues on local and regional knowledge of entrepreneurial finance. The initiative using Special Issues can also be applied to increase scientific output regarding new players in entrepreneurial finance (Block et al. 2018).
- **Policymakers:** Policymakers should implement policies that could promote cross-national knowledge exchange among authors and institutions through research collaboration or conference organizations. Moreover, enhancing the availability and quality of data regarding start-ups’ financial activities also help foster scientific activities in non-Western countries (Cumming and Johan 2017).

Limitations

There are several limitations to acknowledge in our study. Firstly, the WoS search algorithm provides only results searched in most prominent sections of the article, but not the whole article (e.g., title, abstract, keyword, etc.), so it fails to detect articles with deeper layers of meaning. The bibliometrics method helps develop a holistic and objective viewpoint on the studied field; nevertheless, key findings cannot be

explained in detail. This requires the implementation of a qualitative review. Also, in this study, we only use data from the WoS database and do not consider articles not written in English as well as other various forms of publication (e.g., books, book sections, and proceeding papers), so there is a possibility of production bias. The reason is that some countries usually publish social science studies in the form of books, use their language to write research papers, and publish in a local database, such as Japan (Nguyen et al. 2020).

Furthermore, the findings in this study can only show the dominance of Western countries in terms of scientific production and international collaboration within the discipline, but not really an ideological homogeneity. Therefore, studies employing Y-index, historiography, co-citation, and qualitative analyses are recommended to examine the Western ideological homogeneity further.

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Data availability The data that support the findings of this study are available from the Web of Science database of Clarivate Analytics. However, restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission of Clarivate Analytics.

Code availability Not applicable.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Affiliations

Minh-Hoang Nguyen^{1,2}  · Thanh-Hang Pham^{3,4} · Manh-Toan Ho¹ · Huyen Thanh T. Nguyen⁵ · Quan-Hoang Vuong^{1,6}

Thanh-Hang Pham
hangpt@hanu.edu.vn

Huyen Thanh T. Nguyen
huyen.ngtt98@gmail.com

Quan-Hoang Vuong
quvuong@ulb.ac.be

¹ Centre for Interdisciplinary Social Research, Phenikaa University, Yen Nghia Ward, Ha Dong District, Hanoi 100803, Vietnam

- ² Graduate School of Asia Pacific Studies, Ritsumeikan Asia Pacific University, Beppu, Oita 874-8577, Japan
- ³ Faculty of Management and Tourism, Hanoi University, Km9, Nguyen Trai Road, Thanh Xuan, Hanoi 100803, Vietnam
- ⁴ School of Business, RMIT Vietnam University, Hanoi 100000, Vietnam
- ⁵ School of Economics and International Business, Foreign Trade University, 91 Chua Lang, Dong Da, Hanoi 100000, Vietnam
- ⁶ Centre Emile Bernheim, Université Libre de Bruxelles, 1050 Brussels, Belgium