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Who's who in venture capital research

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Abstract

A bibliometric analysis of research papers in venture capital reveals an increasing interest over time by researchers across a broad spectrum of business disciplines. It also reveals the dominance of North American, particularly American researchers who entered the field early. Interestingly, the analysis demonstrates that two schools of entrepreneurial research compete for dominance in the venture capital framework. Much of the core research, the knowledge base, crosses disciplinary lines but is developed, from there-on, in a discipline specific fashion.

Researchers whose primary interest is in finance and economics use quantitative, neo-classical models almost exclusively and publish, with the exception of the most cited authors, solely in economics and finance journals. These researchers tend to be more successful at achieving internal university funding for their projects while the second group, publishing in journals dedicated to management and entrepreneurship research, uses a broader array of theoretical techniques, apply both quantitative and qualitative methodologies and are more often funded externally. The core group of researchers, with reputations supported by large numbers of citations, appear to be able to raise funds both internally (through university bodies) and externally.

Keywords: Venture capital; Bibliometrics; Research front; Knowledge base; Research funding; Citation analysis

1. Introduction

Defining venture capital is relatively easy although disagreements do exist about the boundaries between that and private equity as a whole. Most simply, venture capitalists are financial intermediaries, collecting excess capital from those who have it, and providing it to those who require it for the development of a business venture. They can be distinguished from bankers and other capital providers in that they supply capital as equity or potential equity to unlisted potentially high growth firms and leverage that capital with their own management expertise and that of their networks of associates. Such a definition provides some rationale for the confusion of disciplinary boundaries associated with research in this field. Clearly financial knowledge is a pre-requisite for venture capitalists. It is equally apparent that management expertise is required if a venture fund is to leverage its investments appropriately. Negotiations between venture capitalists and entrepreneurs call upon the specialist skills of contractual lawyers; the start-up and continuation of new ventures require entrepreneurial skills and innovation. The process of innovation has, since Schumpeter (1934), been considered a part of the discipline of economics, as it is an analysis of the economic benefits associated with business development.

Research in venture capital can be considered endogenously, where the process of doing venture capital has been examined or exogenously, considering the impact, for example, of government policy on the availability of venture capital or that availability on various stakeholders. The former area can, again, be broken down into research that focuses on the entry process (setting up venture funds, and selecting ventures in which to invest, structuring the investment), the duration of the investment (adding value to portfolio companies, the relationships between entrepreneurs and investors) or exiting from the investment (the timing of the exit, methods of exit, returns from the investment). The latter set of research consists of exploratory and comparative studies, empirical and

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theoretical models testing assumptions in both finance and management and, of course, a plethora of 'other' studies.

Venture capital does not appear to belong to any single discipline. Research on venture capital has been published in journals targeting entrepreneurship (Journal of Business Venturing, Technovation), in those restricted to the finance discipline (Journal of Corporate Finance, Journal of Banking and Finance), to economics (Journal of Financial Economics, American Economic Review) and management (Omega, European Management Journal) among others (American Journal of Sociology, California Law Review). There are theoretical studies based purely on assumed economic characteristics that attempt to model 'what ought to be' (Bascha and Walz, 2001) while other studies are firmly grounded in an empirical analysis of 'what is' (Lerner and Schoar, 2004). All have made contributions to the knowledge base and the current and future direction of research in this field.

Section 2 summarises some of the research into knowledge development and knowledge acquisition, including developments that have been made in classifying researchers. This section includes a review of the bibliometric approach to analysing a knowledge base and research front in any discipline. From this, we have, in Section 4, developed our research questions based upon the requirements of academics to have their research recognised and to raise funding to support that research. We then, in Section 5, describe our data collection methods and summarise the extent of that data. Our analysis follows in Sections 6 and 7, providing maps and diagrams that have been used to assess the development of venture capital research and to test our hypotheses. Finally, in Section 8, we present our conclusions and suggestions for further research.

2. Literature review

Section 3 summarises some of the research into knowledge development and knowledge acquisition, including some of the developments that have been made in classifying researchers. This section includes a review of the bibliometric approach to analysing a knowledge base and research front in any discipline. Bibliometrics uses statistical models to assess discipline specific research based upon key word analysis, citations, affiliations and other information available in library databases. The use of this technique alone is limited, given that it is based on archival analysis (Eom, 1996, 328). As a consequence, the technique is complimented by informed interpretation (He and Hui, 2002, 491).

Bibliometrics is based on a number of premises, primarily those which assume that authors who are co-cited often are intellectually related in some way and that those who are cited more frequently are more important to the development of the discipline than those who are cited less frequently. Authors to be selected as at the core of disciplinary research, then, are determined by the number of times they are cited. The decision on the number of citations required to make the cut-off who is to be included is, according to Eom (1996, 318) ad hoc, and subject to the design of intelligible maps (White and MacCain, 1998; Persson, 1994).

After the selection of authors to be included in the study, co-cited pairs are submitted to a multi-dimensional scaling (MDS) program that makes a two-dimensional representation of the co-citation matrix. The resulting coordinates form the basis for drawing author cluster maps that can be interpreted intuitively by those who know the field of research. On the map, the closer two authors are, the more often they are co-cited. The more commonly cited authors, that is, those with many linkages to other cited authors, are centrally located on maps while those who are less cited, less central to the discipline's development, are on the periphery (He and Hui, 2002, 493). The circle area or size is proportional to the number of citations.

There are many other studies that have utilised this approach to increase researcher's understanding about the knowledge and research front in their own area. Some of the more interesting general findings that apply to the current analysis are those suggesting that there are differences between those using quantitative and qualitative research (Beattie, in press; Swygart-Hobaugh, 2004), those suggesting differences between the European and the American researchers (the former preferring qualitative research, the latter quantitative) (Beattie, in press, 5), those focussed on the development of discipline specific characteristics that suggest a convergence of research paradigms over time in knowledge acquisition as well as the importance of first movers in a new research field (Landström and Johannisson, 2001; Rinia et al., 2001).

One final area of interest herein, where citation analysis has been used and is becoming more common, is in the allocation of research funds to institutions and, often, to individual academics to further pursue their own research agendas. Citation analysis has not, so far, been used exclusively in this process as inputs; particularly, research income has also become a measure of academic success for those who determine the further allocation of funds (Thomas and Watkins, 1998).

3. Research questions

A bibliometric approach to the literature in venture capital provides us with information on the interests and aspirations of academic researchers in our selected field, venture capital. We wish to sort out the research that is undertaken and determine what complementarities and differences there may be in an area of interest to so many different business disciplines. This approach is based upon an assumption that research is undertaken to create a knowledge base that is then published in the interests of other stakeholders (Okubo and Sjöberg, 2000,

84). Those stakeholders are often academics, whose interest is piqued due to the emphasis, in promotion criteria, on publication, and citation (Goldfarb and Henrekson, 2003), but also includes industry participants.[2] Thus, what is cited gives us access to the knowledge base of the field and the citing papers provide us with information on the research front.

Given the need for within group peer recognition we would expect the venture capital research undertaken by researchers in each discipline to cite a core body of work related to their discipline. We would, as well, expect the research front to be developing in such a way that each discipline shows a separate trajectory of research interests with a discipline specific convergence of research paradigms. We have formulated our first questions based on these expectations. That is,

Research Question 1. Do venture capital researchers follow a common core of researchers who form the knowledge base or do they, instead, have separate discipline specific core researchers separate and distinct for each discipline?

Research Question 2. Have venture capital researchers developed a dominant paradigm for use in their studies or are there separate discipline specific paradigms?

Past patterns resulting from bibliometric research have indicated that there will be differences between those undertaking quantitative research and those using qualitative methods. Furthermore, we would expect, from previous research, to find the majority of quantitative studies to be undertaken by Americans while the qualitative studies would be undertaken by Europeans. We see no reason for those studying venture capital to be any different and therefore have suggested a further research question.

Research Question 3. Do American and European venture capital researchers differ in terms of their preference for either quantitative or qualitative methods?

Academic involvement with business, including venture capitalists, is growing in part because government and university administrators increasingly rely on these external agencies to bear some of the costs associated with running the institutions (Lawrence and Sharma, 2002, 661). Those who utilise research in the social sciences and apply the prescriptions offered have been shown to perform better than those who do not (Vastag and Whybark, 2003, 124). This, combined with the pressure placed on academics in the social sciences to raise funding for their own research, has resulted in an increasingly large proportion of academic studies in the social sciences and humanities being financed by external agencies. Reputation is important for academics attempting to raise funds internally or externally, and some evidence of reputation can be derived from citation analysis. We would anticipate, then, that those most capable of raising funds to support their research are those who are most cited by their peers. This leads us to our final research question.

Research Question 4. Do high citation rates lead to a higher probability of obtaining research funding from both internal and external providers of capital?

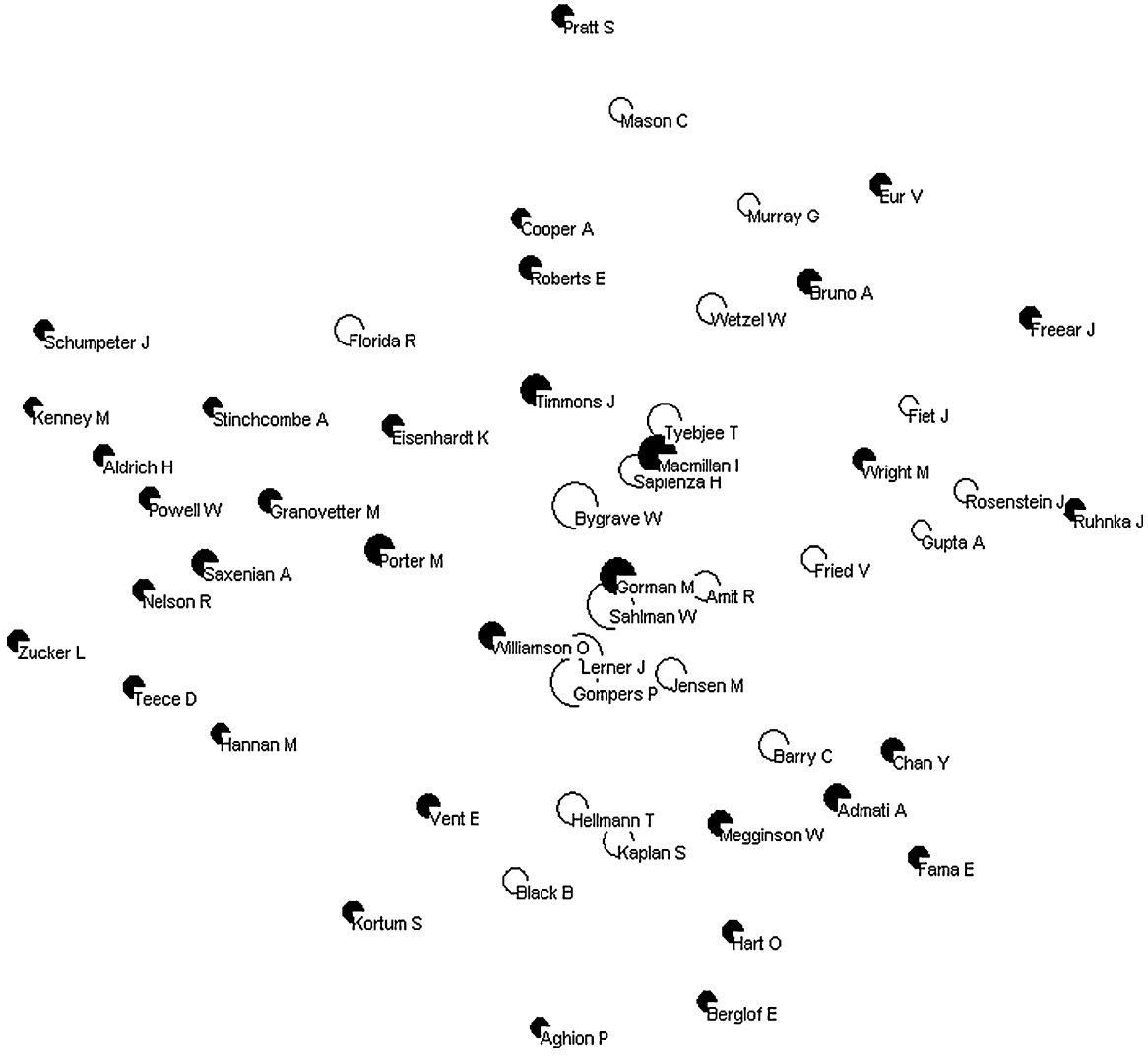
4. Data

The Social Sciences Citation Index—Web of Science, gave a listing of 472 papers when searched under the term ‘venture capital’ in title, abstract or among key words. This database provided not only a listing of authors who used our term but allowed us to determine, among other things the institutional origin and position of authors, the journals in which they published as well as the associated disciplinary field. More importantly, for our assessment of their importance, we could examine the citations and co-citations among the authors in the entire database. Map 1, below, is a diagram of the 54 authors in the database who were cited a minimum of 20 times. Because we could not assess the funding received nor the theoretical approaches used in the articles, we turned to Science Direct where full papers could be downloaded and further assessments about the authors made. This database gave us access to 128 papers, many overlapping those listed in the Web of Science directory.

Using the Science Direct database, we downloaded and collected information from all papers that could be fully accessed. It would have been useful, additionally, to add to this list from journals that are known to publish material in the area of research, but that were not included in either database. However, we believe our dual sample is sufficiently large to provide us with significant results to our research questions.

As papers were read, they were categorised relatively simplistically, on an excel spreadsheet. The spreadsheet contains bibliographic information that makes a comparison between the Science Direct database and the Social Sciences Citation Index Web of Science possible. It also contains information on the major theory or theories employed (or where not employed, the driving research question); the type of research (empirical, grounded, case studies, etc.) and the major contribution the author(s) believed they had made to the literature. It also includes information on funding in those cases where the author(s) thanked a source for the assistance provided. We recognise that there may have been unacknowledged funding in some of the papers where funding sources were not credited.

[2] Witness, for example, the recent (2004) participation of J. Lerner as a guest speaker at the Australian Venture Capital Association Annual AVCAL conference.



Map 1. Commonly co-cited authors.

Matching the two databases demonstrates that the Science Direct database provided a reasonable sample of those included in the Web of Science database. From the 76 co-cited authors, we found that over half (44) were included in the science direct articles assessed. The white circles on Map 1 show 20 authors that were among those cited 20 or more times in the Web of Science database and were also included in the Science Direct sample of downloaded papers. Note that they are scattered throughout the map, indicating that they are a representative sub-sample of the larger data set.

5. Analysis of the knowledge base

If authors co-occur in the reference lists, being co-cited, it means that they are intellectually related in some way. Of the 472 papers in the Web of Science database, 60 of the authors were co-cited with at least one of the others. The most common pairs, made up of only seven individuals, with the number of citations given, were:

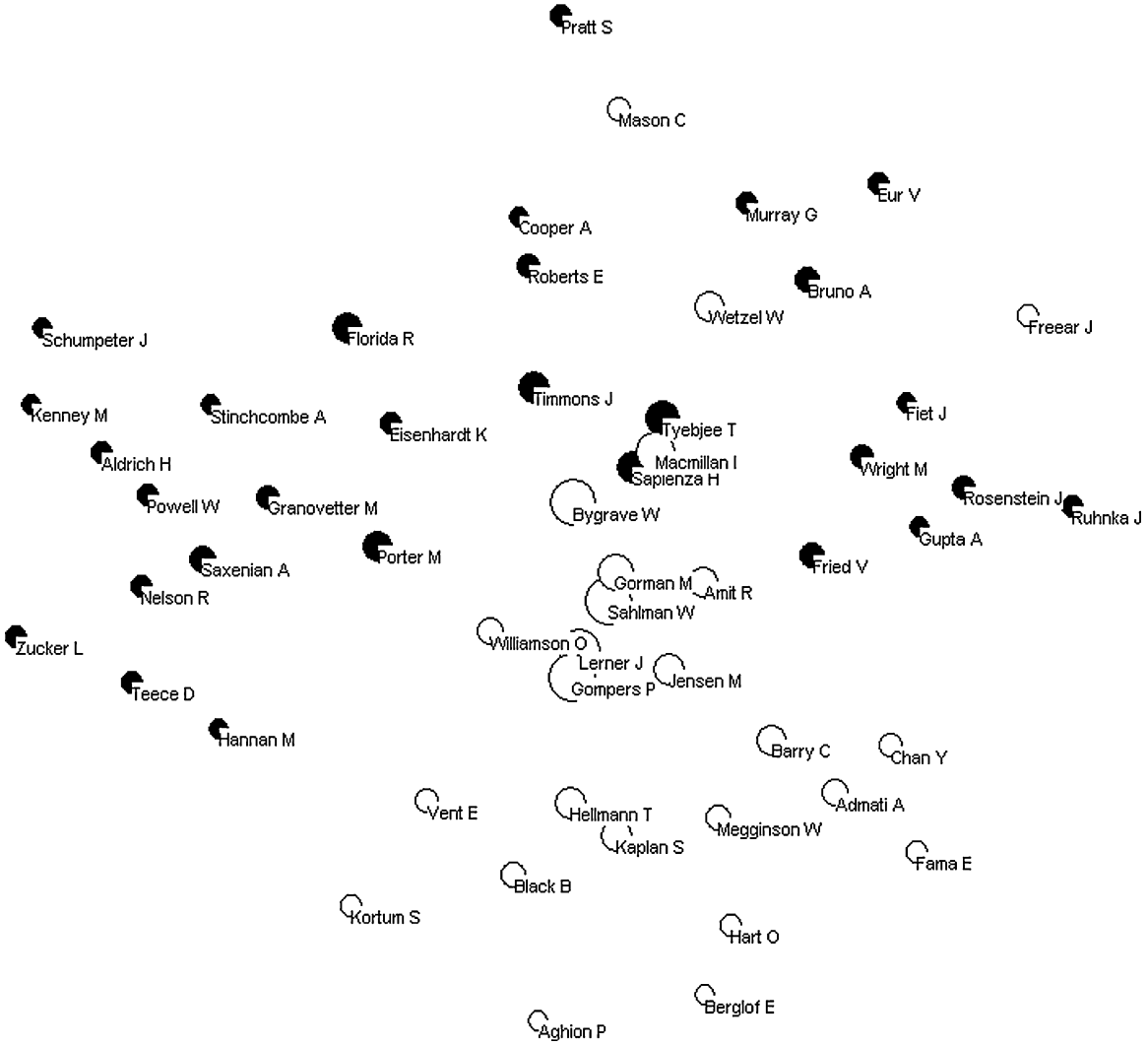
57 GOMPERS P & LERNER J	27 ADMATI A & LERNER J
49 GOMPERS P & SAHLMAN W	27 BYGRAVE W & SAHLMAN W
47 LERNER J & SAHLMAN W	26 ADMATI A & GOMPERS P
29 BARRY C & GOMPERS P	26 ADMATI A & SAHLMAN W
28 BARRY C & LERNER J	24 BARRY C & SAHLMAN W

Of these seven individuals, only three were cited in more than 100 papers (Sahlman, 108; Gompers, 107; Bygrave,102). These individuals, it will be noted, are in the centre of maps. Lerner, cited 90 times, is also quite central while Hellman (47), Barry (43) and Admati (35) are more peripheral. Those on the perimeter of the map still represent important authors with multiple citations (a minimum of 20).

Our first research question asked whether there was a single core group of researchers making up the knowledge base in venture capital or whether there were separate, discipline specific core groups. We had anticipated an

element of discipline specificity in the knowledge base. Thus, the most cited authors would be published in and be cited by those researching in their own area of business expertise. Taking names from this central core of most co-cited authors, we find that Sahlman, a Professor of Business Administration with an expertise in entrepreneurship, has been published in the *Journal of Financial Economics* and the majority (nearly 53%) of his citations have, indeed, been in the finance and economics arena. The next largest group of researchers citing Professor Sahlman are those in entrepreneurship journals (20%), while those in the disciplines of management (11%) and law (6%) have referred to his work, they do not do so as often. Other areas where Professor Sahlman has been cited are broadly distributed, in areas such as sociology and geography. The next most commonly cited author on our list, Gompers, has conformed to our expectations well. A Professor of Finance and Entrepreneurship, he has published in six finance or economics journals and no others on our database. He has been cited largely in finance and economics journals as well. In fact, fully 69% of those citing him are in such journals. He has been cited in management, law and other journals relatively evenly, between 8 and 10% of the citations given. Interestingly, despite being a combined Professor of Finance and Entrepreneurship, only 5% of those citing him have published in the entrepreneurship literature. The only other author in our database cited in more than 100 papers, Bygrave, is a Professor of Entrepreneurship. As anticipated, he has published in entrepreneurship journals and the majority of those citing him (49%) have been in these as well. He has been cited outside of this discipline, most commonly in less discipline specific journals (20%), in management (18%), finance and economics (11%) and slightly in law (2%). Thus, the most cited authors, those in the centre of the map, appear to focus their own publications in their own discipline and are cited, most commonly, within that discipline although other researchers from other disciplines find their work relevant as well.

Cluster analysis done on the core authors shown on the map, that is, those cited by other researchers 20 or more times, demonstrates that the majority of these researchers group into



Map 2. Authors most frequently cited in Finance and Economics Journals in white.

Map 3. Authors most frequently cited in Management journals in white.

two discipline specific categories. The top 50 citations in each journal was the cut-off for inclusion within a discipline specific category. Those cited in finance and economics journals are shown in Map 2, below, in white. The following map, Map 3, shows those cited in management journals. There is some overlap in the centre of the map, showing 22% of our authors are cited across disciplines. These inner core authors, cited by those in both disciplines, make up close to 40% of the citations in both finance and management. Thus, the most commonly cited research, the knowledge base, does not appear to be as discipline specific as expected, this inner core group being cited by all. However, the majority of research cited by individual authors is discipline specific. Thus, in answer to our first research question, the knowledge base is made up of a core of commonly cited authors each of whom focuses on their own discipline, but each of whom is widely cited beyond that discipline.

6. Analysis of the research front

The research front appears to be dominated by those in the finance and economics areas given that 62% of the research in venture capital is published in finance and economics journals and given that our inner core of researchers, those cited by researchers in both disciplines, are largely finance academics. Research in venture capital is increasing. Out of the past 15 years, the past five account for more than half (55.5%) of venture capital related research. The research front is also shifting away from North America. In the decade of the 1990s, only 29% of the research in venture capital was undertaken outside of North America while in the past 5 years, fully 58% of the research has taken place in the rest of the world, largely in the EU but including representatives from every continent.

To understand the research front more fully, we turned to our second database, that which provided information on the type of research undertaken by each author, the methods and theories used, sources of funding and the contribution made. This data was collected from 1988 on and can be used to track changes in the research front. We have already seen who cites whom but we are now interested, additionally, in the research trajectory and whether there is a convergence of paradigms used within disciplines.

A large number of papers including all those written by financial economists used theoretical perspectives that were

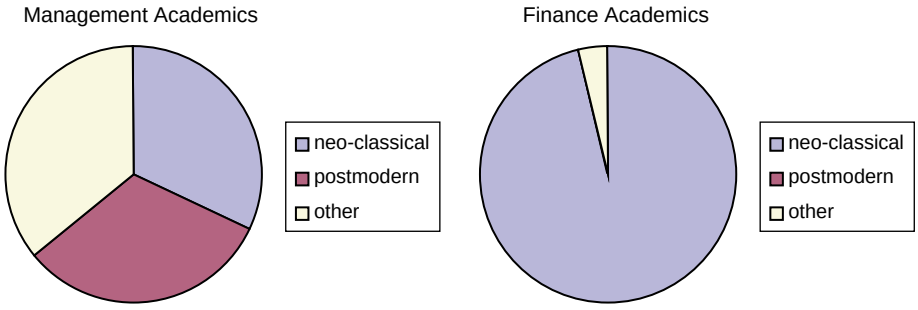


Fig. 1. Theoretical perspectives. (a) Management academics. (b) Finance academics.

based on neo-classical economics, including agency theory (either focused on information asymmetry or on moral hazard), capital market theory, signalling and the more classical supply and demand economics and even game theory. Another large grouping of papers, particularly among the early researchers, were those that were descriptive or exploratory studies and did not have a strong theoretical perspective. The majority of these were written by those in the management disciplines and were written *earlier* than those which utilised a theoretical paradigm. Finally, there were those studies that used a variety of more recent theoretical perspectives including institutional theory, social capital or resource exchange theories, evolutionary theories (environmental, organisational) and even one using critical theory. These papers were predominantly written by management academics (Fig. 1).

We also considered whether the approach to research differed, whether it was qualitative or quantitative and whether the techniques employed were, for example, empirical, model building, surveys or interviews. The techniques employed by the two groups varied only in regard to model building, a practice employed three times more often by finance academics. Thus, while the research front for finance academics appears to be following a single established quantitative trajectory with agency as a predominant paradigm, other researchers are more heterogeneous in their approach. This includes the other large group of researchers found in this database, those publishing in and citing entrepreneurship literature, as seen below. Our second research question, therefore, breaks into two parts. The research front for finance academics is clearly defined under a limited set of theoretical paradigms. However, management (and entrepreneurship) academics have not shown a preference for a particular method or paradigm to guide their studies (Fig. 2).

7. Analysis of research funding, discipline specificity and country of origin

Both our databases included authors from around the world. In order to examine our third research question more closely, we have ignored those authors that were not either North American or European. The work of American authors dominates the research and, as expected, the greater proportion (70%) of this research was quantitative. However, the proportion of quantitative to qualitative research among the Europeans was not that much different with 65% of the research being quantitative. Contrary to expectations, there was little difference among European and American researchers with regard to their preferred approach to data analysis.

Ignoring disciplines for the moment, 58 of the 122 papers in the Science Direct sample received either internal (university) or external funding (largely from governmental agencies). Of these, 25 had external funding, compared to 33 authors who received internal, university, funding. Sixty-four either failed to receive funding or did not mention it. Our fourth research question was indicative of our expectation that those authors with a larger number of citations would, in general, have a higher probability of achieving funding. There was little difference between the citation levels for those who had achieved funding and those who had not. Fully 70% of our core (mapped) authors were included among those *not* in receipt of funding. However, core authors made up 58% of cited authors in receipt of external funding and 75% of the cited authors in receipt of internal (university) funding. Those in receipt of funds were not always the most cited of our mapped authors. Twenty percent of authors in receipt of some sort of funding were uncited.

Those authors who did not receive (or mention) funding appear to have undertaken more exploratory or descriptive research than have our funded authors. Most of this exploratory and descriptive work was in the earlier periods included in the study when the relatively new phenomenon

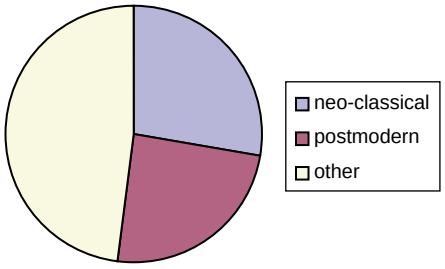


Fig. 2. Entrepreneurship research and theoretical perspective.

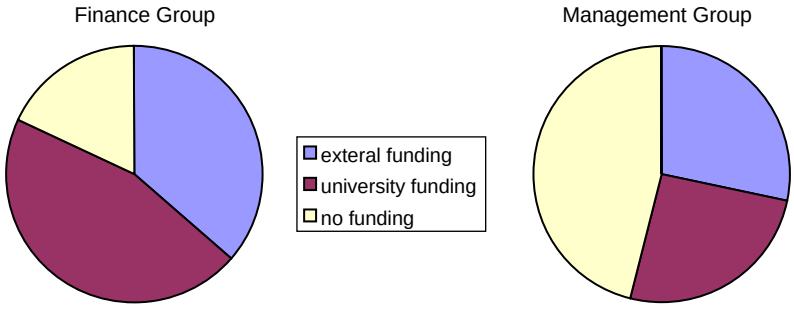


Fig. 3. Funding source by discipline.

of venture capital research was beginning, this does not seem unusual or unexpected. It is natural that this exploratory and descriptive work would drop off as researchers became more familiar with the field. A larger proportion of the total research took place and was financed in the later period as researchers and funding agencies became more familiar with the discipline. In answer to our fourth research question, citation levels do not appear to be linked to funding. However, disciplinary differences do become more apparent between those who received internal funding and those who received external funding.

The predominance of quantitative neo-classical economic perspectives in the university funded research (and, barring the early exploratory work, in the group that received no funding) was largely undertaken by core finance academics. Nearly half of the papers produced by finance academics (46%) were internally funded, just over a third (36%) were externally funded and under one-fifth (18%) had no funding. Management academics, by contrast, had fewer funded papers included in the database. Nearly half, 46%, were unfunded while the split between internal and external funding was relatively even, 26 and 28%, respectively (Fig. 3).

8. Conclusions

We began this research with the intent of discovering as much as possible about research in venture capital. Specifically, we wished to determine the knowledge base and research front in the area. From the many journals that will publish articles on venture capital, it was assumed that there could be more than one knowledge base and that each would be discipline specific. It was also assumed that this discipline specificity would extend to the research front with separate trajectories being followed by academics associated with particular business areas.

We were interested in the relationship between researchers in the field of venture capital and, indeed, found two quite distinct groupings. One group clustered around those researchers, publishing only in finance and economics journals who, while broadly cited, were more commonly cited in those same journals. The other group was clustered around those who both published largely, but not solely, in and were cited in management or entrepreneurship journals. While quantitative neo-classical paradigms are used exclusively in the finance group, no single set of paradigms predominates in the management cluster.

The key researchers in our knowledge base were, with two exceptions, from the finance discipline but were broadly cited by management researchers. However, apart from this core group, the largest number of co-citations were discipline specific. Within the finance discipline researchers follow a narrow research trajectory, but this does not hold in the management discipline. The research paradigms used by finance researchers are more firmly established and are largely quantitative while management researchers used a number of different paradigms and approaches, both qualitative and quantitative. The lack of convergence in research paradigms used by management researchers could be ascribed to the many sub-disciplines professed in management. The heterogeneity of paradigms used by management and entrepreneurship researchers examining venture capital was especially interesting, given its correspondence to the receipt of external funding. A high proportion of externally funded research (44%) was classified as post-modern, while only a small proportion of university funded research (9%) was so classified.

American academics, as expected, used predominantly quantitative methods. However, European academics also used predominantly quantitative methods with the major difference in methods appearing to be a result of discipline rather than origin.

Research funding did not appear to be dependent upon citation rates. While oft cited researchers raised both internal and external funds, so too did non-cited authors. More interesting was the apparent differences between those who were able to achieve internal funding and those who received funds from outside the university system. Whether a causal relationship exists between research paradigms and funding has not been established, but we have noted that neo-classical researchers are more likely to obtain internal university funding while those using post-modern perspectives are more likely to raise funds externally. Whether the research is grounded in post-modernism or employs knowledge gained from neo-classical economics is

fundamentally different from that employed more generally in unfunded research or in research funded by universities. Given the need of universities internationally to raise more external capital to support research, our findings suggest that universities might need to reconsider their funding criteria in order to increase their networks of external stakeholders. In the sciences, academics have found these relationships rewarding and, with relevant research focused on the solution of technical problems of concern to business, non-science academics may find the same rewards.

The data used herein was dominated by American researchers, just as the industry has been dominated by American investors. The industry has, however, spread to Europe and beyond changing its focus and operational procedures as it comes into contact with and adjusts to other business cultures. Further research is warranted to determine the place of European researchers in venture capital studies and their ability to contribute to an understanding of the industry within their own region. Given the differences between internally funded research and externally funded research, it would be useful to determine which, if either, provides more information to industry participants.

The differences between finance and management academics are more profound than had been anticipated. Finance academics use quantitative methods and a limited number of well-established theoretical paradigms. Management academics are more open to a broader array of research techniques and use a number of post-modern paradigms to focus their studies. Further research into the development of management research, particularly entrepreneurship research, may provide insights into the reasons for these disparities.

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