

Entrepreneurship research centers around the world: research orientation, knowledge transfer and performance

Lucio Cassia · Alfredo De Massis · Michele Meoli · Tommaso Minola

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Abstract This work investigates entrepreneurship research centers, and analyzes their research performance. Studies on the determinants of performance of research centers have mainly focused on science and technology, while entrepreneurship has been so far neglected. Through an analysis of 46 centers worldwide, we focus on entrepreneurship research and the role of centers, by discussing how knowledge transfer mechanisms and research orientation affect research performance. Our findings contribute to shed light on the divergence of methodologies and approaches characterizing entrepreneurship research; they also corroborate the view that centers enable a “compound Matthew-effect”, according to which knowledge transfer to external stakeholders, after controlling for research orientation of the center, does foster and enrich research performance.

Keywords Entrepreneurship · Research centers · Science and technology policy · Knowledge transfer · Research performance · Research orientation

JEL Classification O32 · I23 · I28 · L26

1 Introduction

This study investigates the fundamental characteristics of entrepreneurship research centers (ERCs) and analyzes their effect on ERCs’ research performance.

Interest in entrepreneurship as an arena of academic research has grown significantly in recent years (Cornelius et al. 2006). The result has been a rapid and large accumulation of new

L. Cassia · A. De Massis · M. Meoli · T. Minola (✉)
Department of Engineering, University of Bergamo, Viale Pasubio 7b, Dalmine, BG, Italy
e-mail: tommaso.minola@unibg.it

L. Cassia · A. De Massis · T. Minola
Center for Young and Family Enterprise (CYFE), University of Bergamo, Dalmine, BG, Italy

M. Meoli
CisAlpino Institute for Comparative Studies in Europe (CCSE), University of Augsburg, Augsburg, Germany

knowledge about the entrepreneurship domain (Davidsson et al. 2001) and a consequent dramatic growth of ERCs. For example, US alone can count on more than 1,600 centers dedicated to entrepreneurial research, education and knowledge transfer (Finkle et al. 2006).

The knowledge-bridging role of ERCs in linking academic research to entrepreneurial practice is widely acknowledged, e.g., by Sandberg and Gatewood (1991) that indicate ERCs as privileged infrastructures to promote and support the mutual development of entrepreneurship research and practice, and by Katz (1991) that recognizes ERCs as those entities which provide “the model for helping faculty to work with business in a manner practical to business and academic goals” (p. 91).

However, in spite of this knowledge-bridging role of ERCs and their special importance to foster entrepreneurship, which is expected to generate positive effects in all world economies in terms of growth, job creation and local development (Audretsch et al. 2006), it is rather surprising that ERCs have received limited attention in the existing literature. Indeed, to the best of our knowledge, previous work on individual and institutional factors behind the configuration of research centers has mainly focused on science- and engineering-based disciplines, whereas entrepreneurship has been so far neglected. Furthermore, previous research on ERCs (e.g., Finkle 2005; Upton 1997) has focused exclusively on one type of center’s activity, namely entrepreneurial education, whereas no explicit attention has been given to research and knowledge transfer as two further activities typically carried out by ERCs.

This article aims to provide a fine-grained understanding of the effects of distinctive characteristics of ERCs, in terms of activities undertaken and research orientation, on ERCs’ research performance. Through an analysis of 46 ERCs worldwide, this study shows the impact of different features of ERCs on their research performance, therefore pointing to the need for further research aimed at unearthing the heterogeneous nature of ERCs, and builds the foundation for developing a taxonomy of ERCs.

The remainder of the paper is organized as follows. The next section provides a review of the literature, whereas the third section provides the research positioning and motivation of the study. The fourth section illustrates the methodology employed in the empirical analysis and the fifth section reports a description of the sample. The sixth section reports the results, and finally in the last section we proffer the discuss and draw conclusions.

2 Literature review

This research speaks to two different but intertwined literature streams: (1) the role of ERC centers in entrepreneurship research; (2) the distinctive characteristics of scientific production and knowledge transfer dynamics in ERC.

Over the last 20 years there has been a growing acknowledgment of the role of entrepreneurship in driving global economic growth, job creation and local development. Universities are an important instrument in the facilitation of regional economies and social development through their three missions: education, research and business support (Jaffe 1998; Mansfield 1991; Roessner et al. 2010). For instance, empirical evidence shows how knowledge transfer activity benefits the local development in terms of entrepreneurial activity (Audretsch and Lehman 2005), competitiveness (Audretsch et al. 2012) and access to financial markets for science-based firms (Meoli et al. 2012).

Entrepreneurship has flourished in the academic community, through a large number of courses, schools, endowed positions and academic journals. A growing interest into this discipline characterizes both the business and the academic world, and is gaining

legitimacy within the scholarly community, following the growth pattern initially suggested by Katz (1991). In particular Katz (1991) suggests a view of entrepreneurship as a center-based discipline: “Only when entrepreneurship research can be seen to inform entrepreneurship teaching, as well as it does entrepreneurship consulting, will the academic field of entrepreneurship theory and practice come into its own as a great integrative endeavor. [...] It is reasonable to suggest that ERCs hold promise as an institutional device for organizing, facilitating, supporting, and directing faculty involvement with small and emerging businesses. The centers appear to have in place the kind of constituency orientations and agendas that would make the business school consistently real world in its orientation” (Katz, 1991; pp. 91). Although centers—as in other disciplines—often raise some issues and conflicts with academic departments in a dialectic relationship driven by overall scarcity of resources, they can be crucial to the development of a discipline. According to Welter and Lasch (2008) the growth of academic infrastructures like centers and chairs reflects an institutionalization of entrepreneurship research, that achieves progress by moving beyond individual initiative and realizing progressive accumulation of knowledge; this is found to be very important to entrepreneurial learning (De Massis et al. 2012).

In the same vein, Sandberg and Gatewood (1991) maintain ERCs play a pivotal role as durable structures for academics and firms to collaborate and achieve mutually beneficial goals. In particular, according to the authors, entrepreneurship is characterized by a continuous balancing in the research focus between theoretical development and applied research (responding to specific needs towards application for customers or stakeholders). They suggest that the determinants of this balance should be further investigated, with regard to the contingent effect of centers’ resource endowment and governance.

The legacy of the aforementioned papers has long remained unheard. Only recently scholars have returned to devote attention to ERC design and strategies. Finkle et al. (2006) focus on the difference between ranked and non-ranked ERCs in US and suggest ERCs are an important alternative means for university sustainability; they find that centers top-ranked in “US News and the World” report have significantly larger resources and personnel, students, endowed chairs, and have more comprehensive graduate programs. Finkle (2007), consistently with Bowers and Alon (2010), looks at the differences between US and non-US centers, finding several significant differences: US center directors tend to have an MBA, are affiliated with endowed chairs and perceive their center as excellent in research; international counterparts are in many cases still the founders of the center, have longer entrepreneurial experience, and report more services and students enrolled in the center. Menzies (2009), after recalling the role of ERCs as an important vehicle to nurture entrepreneurship, suggests two major taxonomies to support an initial theory building on ERCs: the former uses the role of director as leader and main constituent of the centers activities, so that ERCs are classified as Academic, Professional, or a balance between them; the latter is a taxonomy based on the salience of center stakeholders, though no empirical implication is provided.

Somewhat surprising in both waves of scholarly contributions on ERC is the fact that research performance measurement and analysis has been mostly ignored, with researchers being more focused on governance, funding and educational issues; this represents a clear gap in this literature.

The second stream of literature we refer to investigates the determinants of research center performance (not necessarily in entrepreneurship), and in particular the influence played by collaboration with external stakeholders. As to the first issue, an extended review from journals such as *Research Policy*, *Scientometrics*, and *Research Evaluation* suggests recurring determinants of research performance in factors like budget and faculty size

(Azagra-Caro et al. 2007; Maclean and Janagap 1993), economies of scale, lack of bureaucracy (Coccia 2009), organizational environment (Chawla and Singh 1998), as well as explicit leadership within the center and commitment toward external stakeholders (Babu and Singh 1998).

The debate on scientific productivity of research centers often meets a problem of contradictory pulls in research orientation, suggesting the existence of trade-offs to be taken into account. It has been long argued that as an academic field matures, scientific orientation and production should concentrate on quantitative methods for the purpose of prescriptive and theory testing research (Cornelius et al. 2006). Nevertheless it could be argued that openness and curiosity, that are crucial for the development of theories, tend to be more easily supported by explorative and qualitative research, especially in the early stage of a discipline, which is the case for entrepreneurship (Hjorth 2008). It remains questionable whether crossing the methodological boundaries and embracing also explorative research orientation still allows building rigor and legitimacy, which in turn enables relevant scientific production.

Besides, another puzzle that has long animated the discussion about academic-industry collaboration (e.g., Hülsbeck et al. 2011) regards the potential conflict between commitment towards knowledge transfer and excellence in scientific production. Research performance, especially when measured by the number of publications, is found to be enhanced by patent disclosing (Guan and Wang 2010; Wong and Singh 2010), university-industry collaboration (Boardman and Gray 2010; Crespo and Dridi 2007; Davis and Bryant 2010), industry funding (Gulbrandsen and Smeby 2005) and scientists' post-doctoral training (Su 2011). This positive interaction is not obvious since, as recalled by Van Looy et al. (2004), there are many reasons why the external relationship may be problematic (publication delay, secrecy problem, contamination of research focus, and researchers' individual incentives). The authors, however, through an empirical analysis at KU Leuven (Belgium), find the existence of a mutual reinforcement, rather than a trade-off between these components, since evidence suggests that entrepreneurial and scientific performances are positively associated: "The findings reported here indicate not only that the rich get richer but also that the diversity of their richness increases. [...] Hence, our findings suggest that performance in both areas (scientific excellence as measured by number and nature of the publications) and entrepreneurial performance (as measured by the size of the budget of the division) mutually reinforce; resulting not only in a Matthew-effect, but also into the direction of a compound Matthew-effect as it encompasses both activity domains" (p. 439). This compound Matthew-effect, according to the authors, is mainly due to the strategic role played by division (research centers) at KU Leuven. Similarly, Ranga et al. (2003) maintain that collaborations do not affect center's basic research, whereas its combination with applied research indeed consolidates the R&D potential of centers.

As a gap in this literature stream, we believe there is a clear lack of investigation in the field of entrepreneurship. To the best of our knowledge, no previous research has concentrated on research performance of ERCs and the contradictory pulls raised by the strategic research orientation of its faculty and by the engagement with stakeholders for the purpose of knowledge transfer and service provision.

3 Research positioning and motivation

This paper aims at assessing the determinants of scientific production of ERCs around the world, with particular respect to their research orientation and activity configuration. The

configurational approach, based on strategic orientation and resources to explain organizational performance, is particularly common in strategic management and entrepreneurship research (Cassia and Minola 2012). With reference to the first literature stream mentioned above, we attempt to make a step forward in the Sandberg and Gatewood (1991) vein, by devoting attention to ERCs as unique infrastructures for the development of the field of entrepreneurship. We adopt an original perspective of analysis based on research performance, which has mostly been disregarded by the aforementioned literature on ERCs. Previous research on entrepreneurship centers and scholars was carried out by Upton (1997), Finkle (2005), Katz (2004); however, these studies were focused on entrepreneurial education activities, with no explicit focus on research.

With respect to the literature on research center performance and knowledge transfer processes (see, e.g., Boardman and Gray 2010; Coberly and Gray 2010; Hayton et al. 2010), we intend to fill a gap that exists on collaboration dynamics in entrepreneurship. Further, this is done at a *proper* level of analysis, i.e. ERCs (Katz 1991), when discussing about the field of entrepreneurship.

According to Welter and Lasch (2008), a common critique to entrepreneurship refers to the lack of rigor in methods and naïf research designs; the progress of the discipline, when measured by the use of multivariate analyses and theory testing seems evident (Chandler and Lyon 2001) but a divergence in methods and epistemological approaches still characterizes the research community. Cornelius et al. (2006) suggest that entrepreneurship as a field of research is in a transition phase towards maturity; it generates knowledge accumulation dynamics that can be measured in terms of importation of knowledge (terms, concepts, models and methods) from mainstream disciplines, and in terms of discovery-oriented research. Sandberg and Gatewood (1991) provide a reliable measurement tool for these dimension, referring to the concept of research orientation, built around four main constructs (epistemology, research process, survey extension and research aim). Given the moderate maturity of entrepreneurship that should be mirrored in scientific production, and the growing tolerance of journal editors towards methodological divergence (Welter and Lasch 2008), we formulate the following:

Hypothesis 1 All else being equal, we expect maturity in research orientation to negatively affect the research performance of ERCs.

The Matthew-effect in science (Merton 1988) refers to “the ways in which initial comparative advantages of trained capacity, structural location, and available resources make for successive increments of advantage such that the gaps between the haves and the have-nots in science (as in other domains of social life) widen until dampened by countervailing processes” (p. 606). A common formulation of this phenomenon is summarized by the expression that “the rich gets richer”. Eminent scientists are found to get disproportionately great credit for their contributions with respect to less known colleagues who are capable of comparable contributions. Examples of adoption of such perspective range from welfare economics and education (Walberg and Tsai 1983), administrative science (Hunt and Blair 1987), and other disciplines. A compound and reciprocal Matthew-effect is introduced by Van Looy et al. (2004) while examining possible reconciliation of entrepreneurial and scientific performance in academia. Their findings indicate that (1) the two activities do not hamper each other since entrepreneurial engagement coincides with increased publication outputs; (2) outperformance in publication rates are in strong relationship with the resources committed to “divisional activities” (a proxy for entrepreneurial engagement of the academia). This suggests that scientific excellence and entrepreneurial performance can be combined (compound Matthew-effect), and this should

be particularly true for the field of entrepreneurship research (Katz 1991). Based on this we formulate the following:

Hypothesis 2 All else being equal, we expect knowledge transfer (as measured by activities other than education and research, namely service and knowledge transfer provision) to positively affect the research performance of ERCs.

In order to test these hypotheses, we identify a sample of research centers using the sampling strategy described in the Methodology section. Then, in the following two sections we provide our empirical analysis. First, we describe the characteristics of ERCs, classifying them according to the breakdown of efforts dedicated to research, teaching and knowledge transfer activities, and then focusing on their research orientation. Second, we investigate the determinants of research performance in ERCs through a regression analysis.

4 Methodology

Our research builds on the previous contributions by Benoit and Marsh (2009) and Ruane and Tol (2007), and on the research by Finkle et al. (2006) and Sandberg and Gatewood (1991) in developing the methodology of data collection from entrepreneurship centers.

In this paper, we analyze a sample of 46 ERCs distributed worldwide. A list of ERCs was obtained by searching all centers that were mentioned, at least once, as affiliation of authors in the papers published between 2008 and 2010 in one of the entrepreneurship journals listed in the Association of Business Schools (ABS) Academic Journal Quality Guide. Centers were identified by searching for “Center” or “Centre” or “Institute,” in combination with one of the following keywords: “Entrepreneurship” or “Enterprise.”

The 90 ERCs obtained were therefore submitted an extensive survey, that consisted of 13 items and took respondents, on average, about 25 min to be completed; we explicitly asked the respondent to be the ERC director. The survey was developed by the authors and was pre-tested with several colleagues. Appropriate changes were made based on the comments of the pre-test group. We received responses from 46 ERC, and we made arrangements for a follow-up telephone call in order to obtain a wider set of information. Details from the ERC websites were also used for this analysis. 26 are from EU, 15 from US, and 5 from other countries; 80 % of ERCs are public, 96 % are university-based, and 56 % are within a business school.

The final version of the survey included questions on the following topics: effort breakdown (research, education, transfer); mission and research orientation; strategy and activities; center’s resources: director, stakeholder and funding. Respondents were also required to list the top three researchers affiliated to the center. These lists were used to collect secondary data on the scientific performance of the center, through the use of the “Publish or Perish” software by Harzing.¹ Specifically, information on the number of publications and on the number of citations of each author was collected. A correction was introduced to account for co-authorship (not to count a publication more than once) and for researcher’s previous affiliation, so to count only publication made with the affiliation of the considered ERCs, in case the scholar would hold (or have held) two or more affiliations.

¹ The software is available at www.harzing.com.

Table 1 Sample description

Variable	All ERCs			EU ERCs			US ERCs		
	Min 1936	Max 2010	Mean (variance) 2005–2010 ^a	Min 1936	Max 2010	Mean (variance) 2005–2010 ^a	Min 1977	Max 2008	Mean (variance) 1995–1999 ^a
Foundation year									
<i>Center effort breakdown</i>									
% Research	0	100	44.8 (705)	30	100	56.08 (457.8)	0	70	22.47 (408.2)
% Education	0	75	28.1 (382.6)	0	70	25.35 (318.4)	0	75	36.2 (396.7)
% Knowledge transfer and service	0	98	26.1 (451.9)	0	50	18.58 (194.9)	0	98	38.27 (651.1)
<i>Director</i>									
Age	38	65	51.91 (47.67)	38	64	51.08 (48.58)	40	65	53.14 (48.12)
Number of businesses started	0	4	1.41 (1.33)	0	3	1.08 (1.15)	0	4	1.93 (1.00)
Years as entrepreneur	0	33	9.11 (80.90)	0	26	6.12 (56.49)	0	33	15.60 (75.71)
Number of business started ^b	0	4	2.03 (0.66)	0	3	1.87 (0.52)	0	4	2.07 (0.78)
Years as entrepreneur ^b	0	33	13.23 (63.01)	0	26	10.60 (50.37)	0	33	16.71 (62.49)
Performance (publications)	0	50	11.78 (10.17)	0	50	13.93 (11.43)	0	21	7.33 (7.00)

^a The value is the mode, not the mean; ^b the value is calculated only on centers whose response was not null

5 Description of the sample

Table 1 summarizes the main features of our sample. The surveyed institutions are on average young (less than 5 years), reflecting a recent flourishing of entrepreneurship discipline through centers around the world, although this phenomenon seems to have reached EU countries later, since US centers are older (between 10 and 15 years).

In order to investigate the span of activities carried out by the surveyed research centers, according to Finkle (2007), we asked each center's director to assess the distribution of the center's effort among the three main areas of activity: research; training and education; knowledge transfer and service. Based on the replies, we introduced a novel classification of ERCs encompassing the center commitment to research, education, and knowledge transfer activities. This differs from previous classifications developed in the literature (Menzies 2009; Bozeman and Boardman 2003; Finkle 2007) since we assess strategic orientation through explicit commitment to research, education and knowledge transfer as pillars of the ERC mission.

Since the aim of our analysis is to address whether the relevance of the knowledge-transfer activity has an impact on the research performance, we cluster ERCs in three groups: a) *pure* ERCs, for centers dedicating more than 50 % of their effort to research; b) *educational* ERCs, for centers attributing more than 50 % of their effort to education; c) *multi-service and knowledge transfer* ERCs are all the others, because they are either focused on knowledge-transfer activity or, more in general, declare to be involved with no dominant focus on the three missions of a research center. The KITeS, at the Bocconi University (Italy), or the Entrepreneurship Research Centre, at the EM Lyon Business School (France), are example of pure research centers, dedicating 100 % of their effort to research activities. The Institute for Entrepreneurship and Small Business Management, at the University of Maribor (Slovenia), is a perfect example of Educational Center, dedicating 70 % of its effort to teaching, and 30 % to research. We classify as “*multi-service and knowledge transfer*” ERCs the Falcone Center for Entrepreneurship, at the Syracuse University (USA), focusing 70 % of its activity on knowledge transfer and 30 % on research, as well as the Arthur M. Blank Center for Entrepreneurship at Babson College (USA), that dedicates its effort in equal shares to research, education and transfer activities. The ERCs included in our analysis are classified in the three clusters in Table 2.

Furthermore, as the second attribute of ERCs that we consider in our analysis is the research orientation, we refer to the seminal work by Sandberg and Gatewood (1991) to develop a detailed instrument for assessing the research attitudes of the centers. Research orientation is analyzed along four main dimensions: Epistemology; Research process; Extension of surveys; and Research aim. Table 3 presents the mean value for overall, US and EU sample, and suggests that entrepreneurship is an expanding discipline, that has not reached an ultimate maturity and we can see the same balancing suggested by Sandberg and Gatewood (1991); still, in terms of theoretical development and research focus, a prudential approach seems to be dominant (notice the equilibrium between application to specific needs and theoretical development, as well as between description of conditions and prescriptions for action), as ERCs in our sample are found to focus simultaneously on testing theories quantitatively and developing in-depth cases (or designing new applications). Despite the strategic prevalence of education activities shown in Tables 2 and 3, ERCs also reveal a more ambitious research orientation characterizing US centers, especially concerning the research process and extension of surveys; this is remarkably consistent with Welter and Lasch (2008) description of US academic research in

Table 2 Classification of ERCs based on their prevalent activities

Pure ERCs	Educational ERCs	Multi-service and knowledge transfer ERCs
Austrian Institute for SME Research, Austria	Center for Entrepreneurship, Wichita State University, USA	Centre for Entrepreneurship, Innovation and Family Firms, Università della Svizzera Italiana, Switzerland
CEFAGE Research Center, Évora University, Portugal	Centre for Entrepreneurship, Grand Valley State University, USA	Entrepreneurship and Innovation Center, Universidad del Desarrollo, Santiago del Chile, Chile
Center for Family Enterprise and Ownership (CeFEO), Jönköping International Business School, Sweden	Centre for Regional Economic and Enterprise Development, University of Sheffield, UK	Amsterdam Center for Entrepreneurship, Amsterdam University, The Netherlands
Center for Industry, SME and Business Competition Studies, University of Trisakti, Indonesia	Entrepreneurship Center, West Virginia University, USA	Centre for Entrepreneurship and Family Enterprise, University of Alberta, Canada
Center for Managemnt Buy-Our research, Nottingham University Business School, UK	Institute for Entrepreneurship and Innovation, Vienna University of Economics and Business, Austria	Entrepreneurship Hub, Imperial College London, UK
Center for Venture Research, Whittemore School of Business and Economics, University of New Hampshire, USA	Institute for Entrepreneurship and Small Business Management, University of Maribor, Slovenia	Arthur M. Blank Center for Entrepreneurship, Babson College, USA
Center for Young and Family Enterprise (CYFE), University of Bergamo, Italy	Miami University Institute for Entrepreneurship, Richard T. Farmer School of Business, Miami University, USA	Berkley Center for Entrepreneurship & Innovation, Stern School of Business, New York University, USA
Center of Family Enterprise Research, Mississippi State University, USA	Robert H. and Beverly A. Deming Center for Entrepreneurship, University of Colorado, USA	Cox Family Enterprise Center, Coles College of Business, Kennesaw State University, USA
Centre for Entrepreneurship, Innovation and Community, Deakin University, Australia	The Weinert Center for Entrepreneurship, University of Wisconsin, USA	Chair of Entrepreneurship & Technology Commercialization, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland
Centre for Small and Medium Sized Enterprises, University of Warwick, UK		Falcone Center for Entrepreneurship, Syracuse University, USA
Charles P. Skene Centre for Entrepreneurship, Aberdeen Business School, Robert Gordon University, UK		Family Business Center, Loyola University, USA
EntER, Bocconi University, Italy		Gary S. Holmes Center for Entrepreneurship, Carlson School of Management, University of Minnesota, USA
Enterprise Research and Development Unit (ERDU), Lincoln Business School, UK		Institute for Entrepreneurship and Enterprise Development, University of Lancaster, UK

Table 2 continued

Pure ERCs	Educational ERCs	Multi-service and knowledge transfer ERCs
Entrepreneurship Research Centre, EM Lyon Business School, France		Institute for Entrepreneurship and Organizational Development, Johannes Kepler University Linz, Austria
Institute for SME-Management and Entrepreneurship, Vienna University of Economics and Business Administration, Austria		NIKOS, University of Twente, The Netherlands
KITeS, Bocconi University, Italy		Pierre L. Morrisette Institute for Entrepreneurship, Richard Ivey School of Business, University of Western Ontario, in London, Ontario, Canada
Paisley Enterprise Research Centre, University of Paisley, UK		Spiro Institute for Entrepreneurial Leadership, College of Business and Behavioral Science, Clemson University, USA
Research Centre for Entrepreneurship, EHSAL-K.U., Hogeschool-Universiteit Brussel, Belgium		Swiss Research Institute of Small Business and Entrepreneurship, University of St. Gallen, Switzerland
Small Business Research Centre, Kingston University, London, UK		

The lists of 46 entrepreneurship research centers included in our analysis, classified according the prevalent activities carried out. A list of ERCs was obtained by searching all centers that were mentioned, at least once, as affiliation of authors in the papers published between 2008 and 2010 in one of the entrepreneurship journals listed in the Association of Business Schools (ABS) Academic Journal Quality Guide. Centers were identified by searching for “Center” or “Centre” or “Institute,” in combination with one of the following keywords: “Entrepreneurship” and “Enterprise.” The 90 ERCs obtained were therefore submitted an extensive survey, and we obtained 46 replies. The centers were then grouped in the three clusters according the breakdown of the members’ effort in the three main activity of an entrepreneurship research center: research, education and knowledge transfer: pure ERCs are centers dedicating more than 50 % of their effort to research; educational ERCs are centers attributing more than 50 % of their effort to education; multi-service and knowledge transfer ERCs are all the others

entrepreneurship as more mature and closer to a development of paradigm to be tested with quantitative methods.

Our data showed differences between EU and US centers; ERCs in EU have an explicitly dominant focus on research (56.08 %) and the other two dimensions are substantially minor, whereas US centers put similar effort in training and services (36.20 and 38.27 % respectively) and both dominate research. Further differences emerge if we focus on the directors’ statement of the center’s mission: research is mentioned by 82.60 % of EU centers and 60.00 % of US; training by 80.40 and 100 % respectively; services by 32.60 and 46.70 % respectively. Consistently with the above-observed patterns, EU centers are more concentrated in *pure* and *multi-service and knowledge transfer* categories, while US centers in *educational* and *multi-service and knowledge transfer* groups. In order to take into account this divergence, we controlled for differences between EU and US centers throughout all our analyses.

Table 3 The four components of ERCs research orientation (Sandberg and Gatewood 1991) (mean values)

<i>Epistemology</i>					TOT	3,33
Application to specific needs			Theory development and testing		EU	3,27
1	2	3	4	5	US	3,64
<i>Research process</i>					TOT	3,17
Description of conditions and practice			Prescriptions for action		EU	3,00
1	2	3	4	5	US	3,64
<i>Extension of surveys</i>					TOT	3,43
Small sample or case studies			Larger samples or data bases		EU	3,31
1	2	3	4	5	US	3,91
<i>Research aim</i>					TOT	3,98
Exploring issues and challenges identified elsewhere			Identifying new issues, challenges		EU	3,81
1	2	3	4	5	US	4,27

6 Research in ERCs: performance and configuration

Our empirical analysis aims to investigate the determinants of ERCs' research performance, relying either upon the number of publications or the number of citations available for the top researchers in each center. We model the two measures of observed research performance with negative binomial regressions, in order to analyze what are the effects of research orientation variables, and whether the classification of ERCs according to the activities they perform (research, education, or multi-service and knowledge transfer ERCs) also has an impact. Details on the variables employed in the analysis are provided in Table 4, while empirical results are presented in Table 5. All regressions in Table 5 include controls for ERCs that are not located in Europe (US, or non EU/US), and for the research budget.

In models (1) to (4) we test our two hypotheses separately. First, in model (1) and (2), we regress number of publications and citations, respectively, against the four variables measuring the research orientation of ERCs. The only significant result regards the *research process* variable; an orientation toward description of conditions and practice, as opposed to prescription for action, is associated with better performances both in terms of publications and citations. This result supports Hypothesis 1, and may reflect the fact that entrepreneurship still suffers from a lack of robust paradigms, and descriptive publications are more likely to be accepted by journals. Second, in models (3) and (4) we regress the performance measures against two variables identifying *educational* ERCs and *multi-service and knowledge transfer* ERCs (pure research ERCs are the reference case), but we do not find any significant evidence of impact on publications and citations.

Last, we corroborate our analysis in models (5) and (6), by including both research orientation and activity variables. In this last model we confirm the previous evidence with respect to the *research process* variable, and we now find a positive coefficient for the *multi-service and knowledge transfer* ERCs, which is weakly significant in terms of publication, and strongly significant with respect to citations. On the one side, this evidence supports our second hypothesis, concerning the positive role on research outcomes for research centers that are actively involved in knowledge-transfer activity. On the other side, being this result statistically robust only when we simultaneously control for the research orientation of the surveyed ERCs, we have the opportunity of better understanding the phenomenon.

Table 4 Variable description

Variable	Definition
<i>Research performance</i>	
Publications	Number of publications for the top scholars affiliated in an Entrepreneurship Research Center (ERC). Top scholars were identified by respondents to the survey submitted to the sample of ERCs. The number of publication is obtained through Harzing's "Publish or Perish" software Coauthored papers are counted once. Affiliation period is taken into account for the count
Citations	Number of citations for top scholars affiliated in an Entrepreneurship Research Center (ERC). Top scholars were identified by respondents to the survey submitted to the sample ERCs. The number of publications is obtained through Harzing's "Publish or Perish" software Coauthored papers are counted once. Affiliation period is taken into account for the count
<i>Research orientation</i>	
Epistemology	Answer to a questionnaire question on the ERC research orientation, measured on a 7-point Likert scale, where 1 identifies "application to specific needs," and 7 is "theory development and testing"
Research process	Answer to a questionnaire question on the ERC research orientation, measured on a 7-point Likert scale, where 1 identifies "description of conditions and practice," and 7 is "prescriptions for action"
Extension survey	Answer to a questionnaire question on the ERC research orientation, measured on a 7-point Likert scale, where 1 identifies "small samples or case study," and 7 is "large samples or databases"
Research aim	Answer to a questionnaire question on the ERC research orientation, measured on a 7-point Likert scale, where 1 identifies "exploring issues and challenges identified elsewhere," and 7 is "identifying new issues, challenges"
<i>Activities</i>	
Pure research ERC	Dummy variable set to one if Effort on Research is higher than the sum of Effort on Education and Services (reference case, not included in the regression analysis)
Educational ERC	Dummy variable set to one if Effort on Education is higher than the sum of Effort on Research and Services
Multi-service and knowledge transfer ERC	Dummy variable set to one if an ERC is neither a Pure Research ERC, or an Educational ERC
<i>Controls</i>	
Budget	Annual budget for research, as answered to the questionnaire question (thousands of euro)
EU, US, Non EU/US	Set of dummies identifying European (EU), US, and other ERCs. EU is the reference case

Research performance variables were collected at the end of 2011 through the use of the "Publish or Perish" software by Harzing, (available at www.harzing.com). All the others are obtained through a questionnaire answered by the ERCs' directors

As a conclusion, our results support the idea that entrepreneurship follows the compound Matthew-effect as described by Van Looy et al. (2004), and in particular knowledge-transfer activity does not act as a distraction for scholars. By contrast, the experience in such activities promotes the research progress of the field, but this result becomes evident only if we also consider the significant effect of research orientation. In other

Table 5 Negative binomial regressions on the determinants of research performance

Variables	(1) Y = Publications	(2) Y = Citations	(3) Y = Publications	(4) Y = Citations	(5) Y = Publications	(6) Y = Citations
<i>Research orientation</i>						
Epistemology	0.137 (0.139)	0.202 (0.239)			0.159 (0.133)	0.313 (0.233)
Research process	-0.190* (0.102)	-0.293* (0.163)			-0.197* (0.101)	-0.353** (0.159)
Extension survey	0.0793 (0.136)	-0.0454 (0.223)			0.122 (0.131)	0.0345 (0.204)
Research aim	0.0890 (0.121)	0.260 (0.203)			0.0894 (0.116)	0.292 (0.190)
<i>Activities</i>						
Educational ERC			-0.548 (0.377)	-0.640 (0.573)	-0.233 (0.368)	-0.243 (0.555)
Multiservice ERC			0.175 (0.280)	0.375 (0.468)	0.491* (0.279)	1.007** (0.479)
<i>Controls</i>						
Budget	-0.466 (0.379)	-0.687 (0.592)	-0.327 (0.366)	-0.359 (0.505)	-0.652* (0.360)	-1.051* (0.546)
US centers	-0.714** (0.305)	0.112 (0.514)	-0.695** (0.306)	-0.0767 (0.479)	-0.737** (0.301)	0.0881 (0.484)
Non EU/US centers	-0.0993 (0.402)	-0.411 (0.649)	-0.123 (0.415)	-0.550 (0.684)	-0.159 (0.383)	-0.688 (0.614)
Constant	2.277*** (0.446)	3.987*** (0.741)	2.749*** (0.260)	4.616*** (0.403)	1.955*** (0.475)	3.096*** (0.823)
Observations	46	46	46	46	46	46
Pseudo R-squared	0.111	0.045	0.039	0.036	0.147	0.087

Negative binomial regressions. Model (1), (3) and (5) use Publications as dependent variable. Model (2), (4) and (6) use Citations as dependent variable. Robust standard errors are in parentheses. Significance level at 1 % (***), 5 % (**), and 10 % (*)

words, our results show that the research performance of ERCs can be interpreted only when the involvement in knowledge-transfer activity is considered together with the research orientation. Ultimately, these arguments suggest that a proper taxonomy of ERCs, able to capture the actual drivers of research performances, should jointly consider the two dimensions.

As a further remark, looking at the control variables, all regressions on the number of publications report a significant negative coefficient of the US dummy, suggesting that US centers underperform EU counterparts in the number of publications. A first argument sustaining this result is provided by Albarrán et al. (2010), supporting that US scholars are less productive but more impacting (normally measured by citations). This argument is verified when we measure the research performance in terms of citations, rather than number of publications, because there is a change in the sign, although the coefficients are not statistically different from zero.

7 Discussion and conclusion

This study extends prior research on ERCs by providing an insightful description of ERCs' distinctive features and shedding new light on their effects on ERCs' research performance.

Our analysis of 46 ERCs worldwide supports the existence of important relationships between the research orientation, the activities of centers, and their research performance. Besides, the study showed that not only the research orientation, in terms of *research process*, but also the *multi service and knowledge transfer* classification is relevant in explaining ERCs' research performance. Thus, our study responds to calls for exploring the unique characteristics of ERCs as compared to other academically based centers related to science or engineering-based disciplines (Van Looy et al. 2004) and understanding which are the most important features affecting their research performance (Ranga et al. 2003).

This study supports the idea that the research orientation and the type of activities undertaken by ERCs should be considered as important predictors of their research performance, and paves the way for future work aimed at developing a taxonomy of ERCs, thus contributing to the recognition that ERCs are heterogeneous and also need to be compared with each other in order to fully understand their performance dynamics.

We are aware that our study suffers from some limitations that open up avenues for future research. First, the current number of observations is limited and further empirical efforts will be needed to corroborate our results on a larger sample and augment the statistical significance of our analysis.

Second, at present, the number of publications and the number of citations are the only dependent variables that we could relate to statistical significant effects. Our aim is to test whether our results are robust to alternative proxies of research performance, such as the *h-index* or the number of highly relevant papers (above a threshold of citations), identified according to commonly adopted approaches.

Third, future research should also be aimed to investigate whether and how the research performance of ERCs is contextual upon a set of exogenous factors that were not considered in our exploratory analysis. For example, country-specific cultural settings (e.g., individual versus collective orientation or the propensity of firms to collaborate with academic institutions) may influence the activities and characteristics of ERCs, and their research performance.

Fourth, future research should also theoretically and empirically study if our findings apply to other types of ERCs (e.g., non-academic and privately-held research centers) and consider as well other ERCs' features potentially affecting their research performance, which were outside the scope of the present analysis. For instance, it would be interesting to see whether and how the center director's background and top management team composition play a role in affecting the centers' performance. This is consistent with Finkle et al. (2006) and Menzies (2009) that focus on the director of the center as one of the main strategic resources of ERCs.

Finally, since ERCs are likely to produce also non-research outcomes (Finkle et al. 2006), we hope that our study will inspire future investigation of further dimensions to evaluate ERCs' non-research performance, such as the number of patents or spin-off companies generated. Specifically, we think that both academic research and corporate practice would benefit from the development of a comprehensive list of indicators to evaluate ERCs' research performance and the identification of the key factors affecting their performance. This would be important to identify the critical success factors of ERCs. However, we believe that the current state of research is too embryonic and we are still too far from a conceptualization of success in ERCs. Indeed, success coincides with the achievement of goals, and further research on the distinctive goals of ERCs is required in order to be able to conceptualize their success.

These directions for future study will strongly benefit entrepreneurship research, which has started only very recently indeed, as noted in the literature review section of this paper, in particular when considering, theoretically and empirically, how the characteristics of an ERC affect its research performance. This of course also represents a very important issue for managers and people working in ERCs, who should carefully think about how the characteristics of the centers they work in could affect their performance and how the good practices to manage an ERC should be revised to best suit its distinctive characteristics.

We hope our work will encourage scholars to extend the results of our study and take a step forward towards the development of a comprehensive taxonomy of ERCs, which is needed to inspire future work with strong impact on entrepreneurship practice.

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