Journal of Accounting and Taxation
e-ISSN 2808-7127
Volume 2 No 1 March 2022

Cross-National Distribution of Research Outputs in Accounting: A Bibliometric Analysis

[1]Monica Lin, [1]Ning Li, [1]Robert Sarikas, Arsen Djatej[*]

[1]Eastern Washington University, United States
zlin2@ewu.edu, ninli@ewu.edu, rsarikas@ewu.edu, adigepsa@gmail.com
[*]corresponding author: Arsen Djatej

ABSTRACT

This paper presents an empirical study of the cross-national distribution of research in accounting as a distinctive subject of business research using bibliometric methods. Data utilized in this study has been extracted from Scopus and sample nations include all OECD countries and Asian Newly Industrialized Economies (NIEs). Our analysis confirms a continuous process of convergence in research specialization in accounting between 1996 and 2015. We also find a developing shift in the connection between accounting and other areas of business research.

Key words: Accounting Research, Accounting Output, Business Research, Bibliometric, Cross-National Distribution, Research Specialization

How to Cite:

Lin, M., Li, N., Sarikas, R., & Djatej, A. (2022). Cross-National Distribution of Research Outputs in Accounting: A Bibliometric Analysis**.** *Journal of Accounting and Taxation, 2*(1). 18 – 36. DOI. https://doi.org/10.47747/jat.v2i1.646

1. Introduction

Research publications are sometimes referred to as scientific wealth of nations (May, 1997). Patterns of international distribution of scientific wealth across nations have long been investigated. However, existing research primarily focuses on disciplines of natural sciences (see King, 2004; Hu and Rousseau, 2009; Yang et al, 2012). Areas of social sciences have received relatively less attention.

This paper focuses on business research, one of the most dynamic fields in social sciences. Specifically, more emphasis is given in this paper on research in accounting. Academic research in primary functional areas of accounting including financial accounting, management accounting, budgeting, auditing, and taxation. This academic aspect is extremely

valuable for nations since it helps understand the effects of economic events on the process of accounting and to help avoiding potential long-term problems. For a nation, a better understanding of how the scientific wealth of accounting research distributes across nations sets up an indicator to determine its strength or weakness in this academic field. Policy makers would also benefit from it in their decisions on resource allocation in research.

Our research attempts to expose the evolutionary patterns of the distribution of research in accounting across nations and of the connection between accounting and other areas in business disciplines. In particular, we investigate the evolutionary patterns through our understanding of whether a nation is specialized in accounting in reference to business research fields as a whole. Our sample nations include all OECD members and Asian NIEs (Newly Industrialized Economies). We utilize sample data extracted from SCOPUS, a large bibliometric database, for a 20-year period from 1996 to 2015 and treat number of publications as the measure of research outputs. First, we examine the medium- and long-term changes in the distribution of national specialization in accounting among other areas/subjects of business research. While a converging process will lead to a more balanced distribution of research in accounting discipline across nations, a diverging process will lead to a more polarized distribution. Our study will confirm whether the evolutionary patterns of national specialization in accounting show a converging, diverging, or a mixed process. Second, we examine the shifts of connections between accounting and other areas in business-related disciplines. We believe crucial topics in accounting research have evolved over time and attempt to identify the patterns of the shifts.

2. Literature Review

The history of applied impact of intellectual contribution and applied research has deep historical roots. Serenko et al quoted a seventeenth century publication where Westerman observed Sweden shipbuilding industry falling behind its peers due "to the lack of professional knowledge". (Serenko and Bantis, 2013, 478). According to Chan et al., assessment of academic research is not a new phenomenon and it definitely has an intrinsic value since it produces a "valuable information for national governments, administrators, faculty, employers, students, and donors". (Chan et al., 2013, 691)

Jarvey, utilizing his clustering analysis, claimed the existence of strong connection between accounting and other business disciplines in the 21st century. (Jarvey, 2012, 34) Thus, according to Jarvey, accounting used to cluster with "finance, economics, international business and statistics. However, Jarvey claims that according to his cluster analysis "during the late 1990s", the subject of accounting became a "relatively independent discipline in business and did not cluster with any other business subfields" (Jarvey, 2012, 34). And, interestingly enough, Jarvey claimed that lately subject of to a closer relationship with organizational behavior and human resource, and industrial relations (Jarvey, 2012, 34).

One of the most fundamental works related to the subject of Intellectual Capital (IC) has been written by Sereneko and Buntis, According to them, "The term intellectual capital emphasizes a combination of intellect and capital to convey the importance of knowledge" (Serenko and Bantis, 2013, 478). Then, Machlup presented the concept of the knowledge industry, measured its economic impact by using accounting principles, and introduced the terms stocks of knowledge, flows of knowledge, and brain worker (Machlup,1962, as cited in Serenko and Bantis, 2013, 478).

Serenko and Bantis also provided a broad of "IC discipline" that "first, successfully disseminates its knowledge beyond the English language world but ignores research published in languages other than English; second, has higher self-citation rates; third, uses books for the development of its theoretical foundation; fourth, successfully converts experiential knowledge into academic knowledge; fifth, exerts a limited yet potentially increasing practical impact; and sixth, is at the theoretical consolidation stage of prescience and is progressing toward becoming a reference discipline. No anomalies in the development of the IC discipline were observed." (Serenko and Bantis, 2013, 476)

In addition, aforementioned authors asserted that "every scientific discipline has two primary objectives. The first is to create the body of theoretical knowledge to explain various phenomena and document this knowledge in credible sources, such as peer-reviewed journals, books, and conference proceedings. The second purpose is to contribute to the state of practice, translate academic findings into actionable items, and improve the quality of life" (Serenko and Bantis, 2013, 476-477).

As it was clearly stated that "previously, Petty and Guthrie analyzed the research literature and identified the key stages of the progression of the IC discipline (Petty and Guthrie, 2000, as cited in Serenko and Bantis, 2013, 477). Guthrie et al. (2012) extended this study to recognize research trends and draw attention to several gaps in IC research (Guthrie et al, 2012, as cited in Serenko and Bantis, 2013, 477). Dumay and Garanina critically reviewed IC research and recommended IC scholars to break free from the dominating accounting paradigm Dumay and Garanina, 2013 as cited in Serenko and Bantis, 2013, 477). Rodrı´guez-Ruiz and Ferna´ndez-Mene´ndez (Rodrı´guez-Ruiz and Ferna´ndez-Mene´ndez, 2009, as cited in Serenko and Bantis, 2013, 477) analyzed the citation patterns of IC journal articles and concluded that IC is not a scientific fad; it is a collection of evolving ideas in search for its scientific paradigm" (Rodrı´guez-Ruiz and Ferna´ndez-Mene´ndez, 2009, as cited in Serenko and Bantis, 2013, 477). Furthermore, according to Serenko et al, other academics "also worked on the development of IC definitions, concepts, tools, and approaches" (Serenko and Bantis, 2013). Sveiby formed the foundation for accounting practices for measuring intangible assets (Sveiby, 1987, as cited in Serenko and Bantis, 2013, 479); Itami and Roehl emphasized the role of organizational "invisible assets" including customer base and technical know-how (Itami and Roehl, 1987, as cited in Serenko and Bantis, 2013, 479); Saint-Onge defined and popularized the term "customer capital," (Saint-Onge, 1996 as cited in Serenko and Bantis, 2013, 479); Wiig differentiated between IC management and KM (Wiig, 1997 as cited in Serenko and Bantis, 2013, 479). In addition, Lev and Zarowin empirically demonstrated deterioration in the usefulness of traditional financial information and linked the value of intangibles to financial performance (Lev and Zarowin, 1997 as cited in Serenko and Bantis, 2013, 479), and Stewart (1997) drew attention of the key business stakeholders to the value of intangible assets (Stewart, 1997 as cited in Serenko and Bantis, 2013, 479).

Serenko and co-authors also referred to the early definition and importance of intangible assets and other early 1900 research related to the role of assets and resources in order to adopt to a rapidly evolving business environment. (Serenko and Bantis, 2013, 478) Thus, "the United Kingdom regularly conducts research assessment exercises to gauge the performance of its higher education institutions (HEIs), and uses the findings in decisions about the allocation of research funding. Similarly, popular media such as US News & World Report rely on faculty publication data for their annual HEI rankings" (Chan, 2013, 676)

Chan and his coauthors conducted a compressive study in accounting research output in Europe for the years of 1991-2002 and concluded that "UK universities overwhelmingly

represented in the top ranking (Chan et al., 2006). Furthermore, according to Chan, "the accounting research productivity, however, is dominated by select institutions in Australia, Hong Kong, New Zealand, and Singapore. Several of the institutions in these four countries/areas are highly ranked. In terms of top-6 accounting journals, the top five institutions are the University of New South Wales, Nanyang Technological University, the University of Melbourne, Hong Kong Polytechnic University, and Hong Kong University of Science and Technology. The percentage share of the research output among the top five institutions is high, suggesting that the hurdle for up-and-coming institutions to improve in the rankings is significant. (Chan, 2013, 691). Hong Kong and Singapore are special cases since they "are multicultural, internationalized and capitalist territories, have been part of globalization since its beginning, and they are renowned for their vibrant research communities. However, given that East Asia and Southeast Asia are becoming worldwide centers of research power and are facing increasing regional competitiveness, a persistent question is whether the two territories are keeping up with the competition and are key players in the global knowledge race. Analysis of their knowledge creation and worldwide impact over the past 20 years indicates that these two territories are struggling to keep up and are showing declining competitiveness. This loss of competitiveness, including in major thematic areas such as Decision Sciences and Business where they had substantial leads in the past, is making these territories indistinguishable from others as knowledge centers, and they are thus potentially less visible and less appealing to potential knowledge related investors. As they continue to be highly internationalized, the main reason behind these trends seems to be related to critical underinvestment in their research systems." (Horta, 2018, 427) Furthermore, according to Horta In 1996–2000, Hong Kong published around 3.5 times more than the world average in Decision Sciences and Business, almost three times more in Economics, and slightly above twice the world average in Computer Science. (Horta, 2018, 433)

Singapore is also very productive in terms of academic output. Thus, in 1996–2000, out of the 27 major thematic areas, Singapore had seven that had a comparative advantage in terms of publications, three with values equal or close to the worldaverage, and 17 below the world average. Singapore published almost three times more than the world average in Computer Science, 2.5 times in Business, and slightly more than twice as much in Decision Sciences and Engineering." (Horta, 2018, 435)

3. Research Method

3.1 Data Source and Sample Selection

The growing importance of publication records to different type of processes and disciplines "have brought a range of bibliometric measures into broad use over the past decade" (Jarvey, Usher, and McElroy, L. 2012). Data for analysis are extracted from a bibliometric database of large scale. The present study uses data from SCImago Journal & Country Rank (SCImago, 2007), a free access portal that provides country level scientific indicators developed from the SCOPUS database. SCORPUS now contains over 60 million records of bibliometric data, including 14,200 journals (Scopus, 2016). In the Scopus database, publications are grouped into 4 board areas, 27 subject areas, and 313 specific subject categories. One of the 27 subject fields is labeled as "Business, Management, and Accounting". This subject field incorporates 17 specific subject categories and accounting is one of those categories. We collected data for a 20-year period from 1996 to 2015 (see Table 1).

Table 1. World's Total Number of Publications in Business Research, 1996-2015, by subfield

BUSINESS SUBFIELDS	CODE	NUMBER OF PUBLCIATRIONS	PERCENT
Accounting	ACCT	56042	2.88%
Business and International Management	IBUS	163138	8.37%
Business, Management and Accounting (miscellaneous)	MEUS1	152057	7.80%
Decision Sciences (miscellaneous)	MEUS2	34441	1.77%
Economics and Econometrics	ECON	373409	19.16%
Economics, Econometrics and Finance (miscellaneous)	MEUS3	98248	5.04%
Finance	FINC	122917	6.31%
Industrial Relations	IDRL	25885	1.33%
Information Systems and Management	ISMG	106159	5.45%
Management Information Systems	MISC	55262	2.84%
Management of Technology and Innovation	MGTI	129224	6.63%
Management Science and Operations Research	DSCI	144038	7.39%
Marketing	MKTG	84878	4.36%
Organizational Behavior and Human Resource Management	HUMR	69513	3.57%
Statistics, Probability and Uncertainty	STAT	104011	5.34%
Strategy and Management	STMG	196779	10.10%
Tourism, Leisure and Hospitality Management	TLHM	32913	1.69%
Grand Total		**1948914**	**100%**

According to Every system of bibliometrics requires a database from which to draw information. Our analysis uses a sample that includes all OECD countries plus three Asian NIEs -- Taiwan, Hong Kong and Singapore. Thus, our sample represents the world's developed economies (see Table 2). In general, these economies are the world's top producers of research publications in business. Although China is also among the top producers of business research, it is excluded from our sample by the cause of several reasons. Firstly, China is not a developed nation and its accounting rules and regulations differ greatly from

those of developed nations. Secondly, the number of research publications for China in the SCOPUS database are highly doubtful as we found total number of publications fluctuated dramatically along the period of our study. We believe including China in our sample will cause serious reliability issues of research.

Table 2. List of Sample Countries

COUNTRY	CODE	COUNTRY	CODE
Australia	AUS	Israel	ISR
Austria	AUT	Italy	ITA
Belgium	BEL	Japan	JPN
Canada	CAN	Korea, Rep.	KOR
Switzerland	CHE	Mexico	MEX
Czech Republic	CZE	Netherlands	NLD
Germany	DEU	Norway	NOR
Denmark	DNK	New Zealand	NZL
Spain	ESP	Poland	POL
Finland	FIN	Portugal	PRT
France	FRA	Singapore	SGP
United Kingdom	GBR	Sweden	SWE
Greece	GRC	Turkey	TUR
Hong Kong SAR, China	HKG	Taiwan	TWN
Ireland	IRL	United States	USA

3.2. Measure of Specialization

In bibliometric studies, "Activity Index" (AI) and "Relative Specialization Index" (RSI) are commonly used measures of disciplinary specialization. Specifically, the formula for *AI* in subject field *i* of country *j* is: $AI_{ij} = \frac{P_{ij} / \sum_i P_{ij}}{\sum_j P_{ij} / \sum_i \sum_j P_{ij}}$, where P_{ij} represents publications in field *i* from country *j*. The numerator is the percentage share of a given field in a nation's total publications, and the denominator is the percentage share of a given field in the total publications of the sample nations. Therefore, the *AI* values compare national disciplinary profiles against the grand research profile of the sample nations. For a given discipline of a nation, if $AI > 1$, the nation is said to be specialized in that discipline and vice versa if $AI < 1$.

As discussed below, this paper employs regression analysis to determine whether distributional changes over time is statistically significant. Thus, the indicator of specialization should meet the assumptions of regression analysis. The probability distribution of *AI*s raises the concern about violation of the normality assumption required in regression analysis. Since the value of *AI*s falls between 0 and infinity with an average of 1

(or very close to 1), it is likely that the distribution of *AI*s is skewed. For the purpose of regression analysis, using RSI as an alternative indicator may fix the problem and thus make the regression results more reliable. An *RSI* is calculated as: $RSI = \frac{AI-1}{AI+1}$

Obviously, RSI takes a value between -1 and +1. For a discipline, if AI>1, then *RSI*>0; if AI<1, then RSI<0. For a nation in a given subject discipline, a positive *RSI* indicates that the nation has a higher-than-average academic activities, or is specialized in that discipline; a negative *RSI* means the nation has a lower-than-average activity, and a zero *RSI* reflects the nation has equal-to-average activity or that type of activity is completely balanced. As *RSI* values fall between -1 and +1, distribution of *RSIs* tends to be symmetric, with better normality than *AIs*. This notion is supported by studies of trade specialization (Dalum, Laursen, and Villumsen, 1998; Laursen, 2015) and disciplinary specialization (Li, 2017).

3.3. Technic Analysis

This paper divides the time span of 1996-2015 into three 6-year periods and uses measures for each period as the unit of analysis. The three 6-year periods are defined as Period I – 1996 to 2001, Period II – 2003 to 2008, and Period III –2010 to 2015. There is a 7-year gap between the consecutive periods and a 14-year gap between the starting and the ending periods. Therefore, comparison between the three periods allows exploration of both medium-term and long-term changes in disciplinary structures across nations.

We employ two major research methods. First, we use simple regression analysis to test whether research specialization in accounting across nations have experienced significant structural changes over time and, if yes, whether the changes have led to a converging, diverging, or mixed pattern. Second, we use cluster analysis and multidimensional scaling technique to investigate and portrait the connection between accounting and other business subfields during each period to see if the nature of the relationship shifted over time.

Statistical tests of the stability of the disciplinary specialization in accounting across nations are conducted through a simple regression model, following the methods utilized by Cantwell (1989) and Dalum, Laursen, and Villumsen (1998):

$$RSI_i^{t_2} = \alpha_i + \beta_i RSI_i^{t_1} + \varepsilon_i$$

where RSI_{ij} stands for Relative Specialization Index in accounting of nation *i*, and t_1 and t_2 refer to the initial time period and the final time period, respectively. α and β are linear regression parameters and ε is the residual term. Simple regressions are performed for *RSI* for the changes over three time-spans: Periods I to II, Periods II to III, and Periods I to III.

For statistical testing of structural stability, the β value should be tested against zero for each regression. If β=0 cannot be rejected at a certain significance level, then no relationship is found between the initial and ultimate values of *RSI*s across nations. In the cases that there is a linear relationship between the initial and ultimate *RSI*s, if β is significantly below zero, the ranking of publication activities across disciplines has been deeply changed or even reversed (the case of β=-1), meaning disciplines with lower-than-average activities became higher-than-average and vice versa. If β is significantly above zero, then the null hypothesis of β=1 should be tested. For interpretation of the regression coefficient, β=1 corresponds to perfect stability in the profile of a discipline's research area; β>1 means the discipline has become

more specialized in nations where respective research fields were in place or became even lower in nations with previously lower-than-average activities; $0<\beta<1$ indicates the nation has decreased in the degree of respective research area in nations with higher-than-average activities and became higher in previously lower-than-average nations in terms of publication activity. Therefore, if the alternative hypothesis of $\beta\neq1$ is accepted, then the signs and values of $\hat{\beta}$, the estimated value of β, signal the degree and direction of national structural changes for a discipline revealed by regression. Thus, the magnitude of $(1-\hat{\beta})$ can be treated as the estimated measure of the "regression effect", an indicator of the degree of structural change explained by the regression model.

The process of convergence or divergence can be confirmed by comparing the β value against the Pearson correlation coefficient value (R). With reference to Cantwell (1989, p.30):

$$(\sigma_i^{t_2})^2/(\sigma_i^{t_1})^2 = \beta_i^2/R_i^2 \ . \text{ Thus, } \ \sigma_i^{t_2}/\sigma_i^{t_1} = |\beta_i|/|R_i|$$

Since σ measures the level of dispersion, using the estimated values, when $|\hat{\beta}| = |R|$, the dispersion of a given distribution is unchanged; $|\hat{\beta}| > |R|$ indicates an increase in the dispersion, equivalent to a process of divergence or specialization; $|\hat{\beta}| < |R|$ implies a decrease in the dispersion, equivalent to a process of convergence or de-specialization. Furthermore, the value of coefficient of determination (R^2) represents the percentage of the total variation that is explained by the regression model, and the value of ($1-R^2$) is the percentage of total variation caused by random errors. Thus, the magnitude of ($1-|R|$) can be used as a measure of random variation. Cantwell (1989) terms the value of ($1-|R|$) as the measure of the "mobility effect". If $|R|$ is close to 1, then the relative position of disciplines has been fairly stable. If the $|R|$ value is low, then the linear relationship between *RSI*s in t_1 and t_2 are relatively weak and the mobility effect is more significant. This is caused by the changes in the ranking of nations in their specialization in accounting– some nations are moving closer together and others are moving further apart. Hence, the dispersion in the distribution of a subfield's specialization across nations is decomposed into a "regression effect" ($1-|\beta|$) and a "mobility effect" ($1-|R|$). Since the condition of ($1-|\beta|$) > ($1-|R|$) is equivalent to that of $|\beta| <|R|$, a convergence process in a nation can be explained as the case when the regression effect outweighs the mobility effect.

Our cluster analysis and multidimensional scaling charts are based on *RSI* values across nations and across subfields of business research. Thus, subfields with more nations having a higher-than-average activity tend to cluster together. The same applies to nations have a lower-than-average activity. Standard cluster analysis procedures are followed and the analysis was conducted using SPSS. Research methods employed in this study capitalizes on earlier studies conducted by Li and published in 2017 (Li, 2017).

Finally, although this approach was practical from the perspective of collecting data and applying this research method, the analysis might be limited the degree to which our interpretation of results may be drawn.

4. Result and Discussion

4.1. Regression Analysis

The overall evolutionary patterns of research specialization in accounting across nations is tested using regression with the dataset that covers *RSI* values for all sample nations for each of the three periods. Regression analysis is conducted for three pairs of values: *RSI*s of Period II on Period I, of Period III on Period II, and of Period III on Period I. The purpose is to use empirical data to show both medium- and long-term patterns.

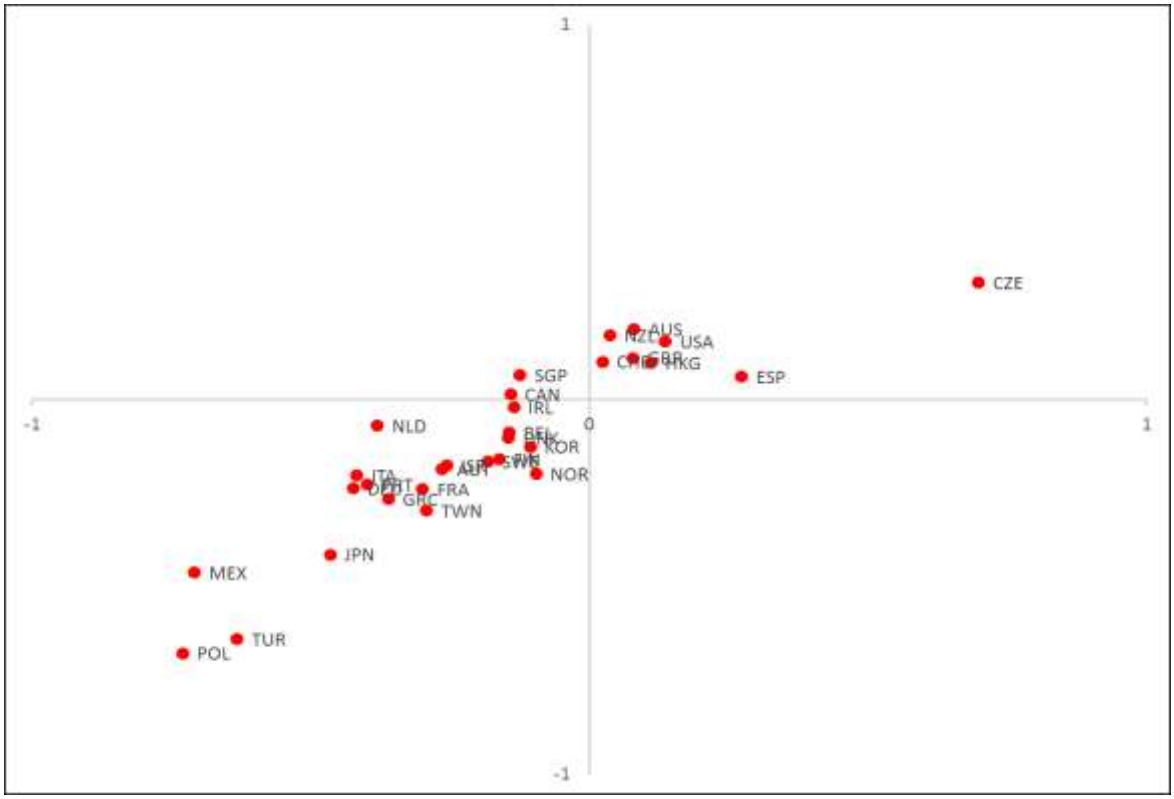


Figure 1. National Research Specialization in Accounting: Period I to Period II

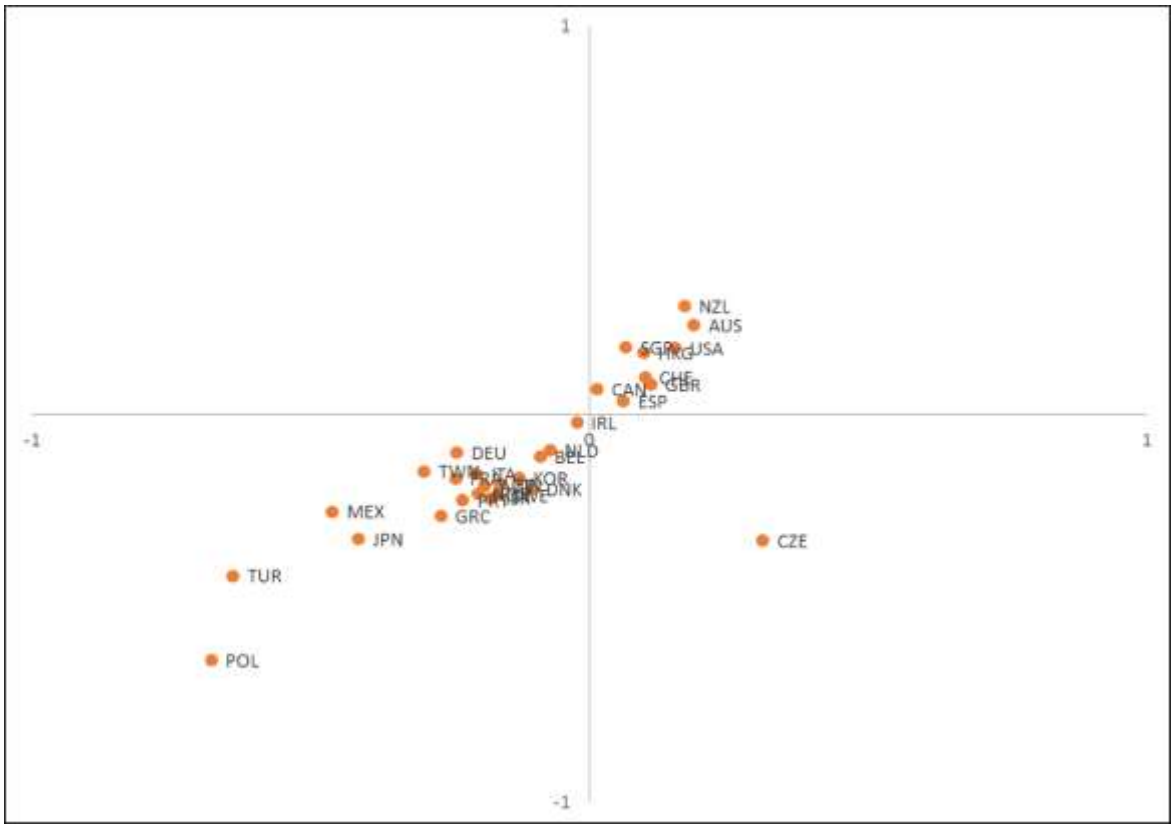


Figure 2. National Research Specialization in Accounting: Period II to Period III

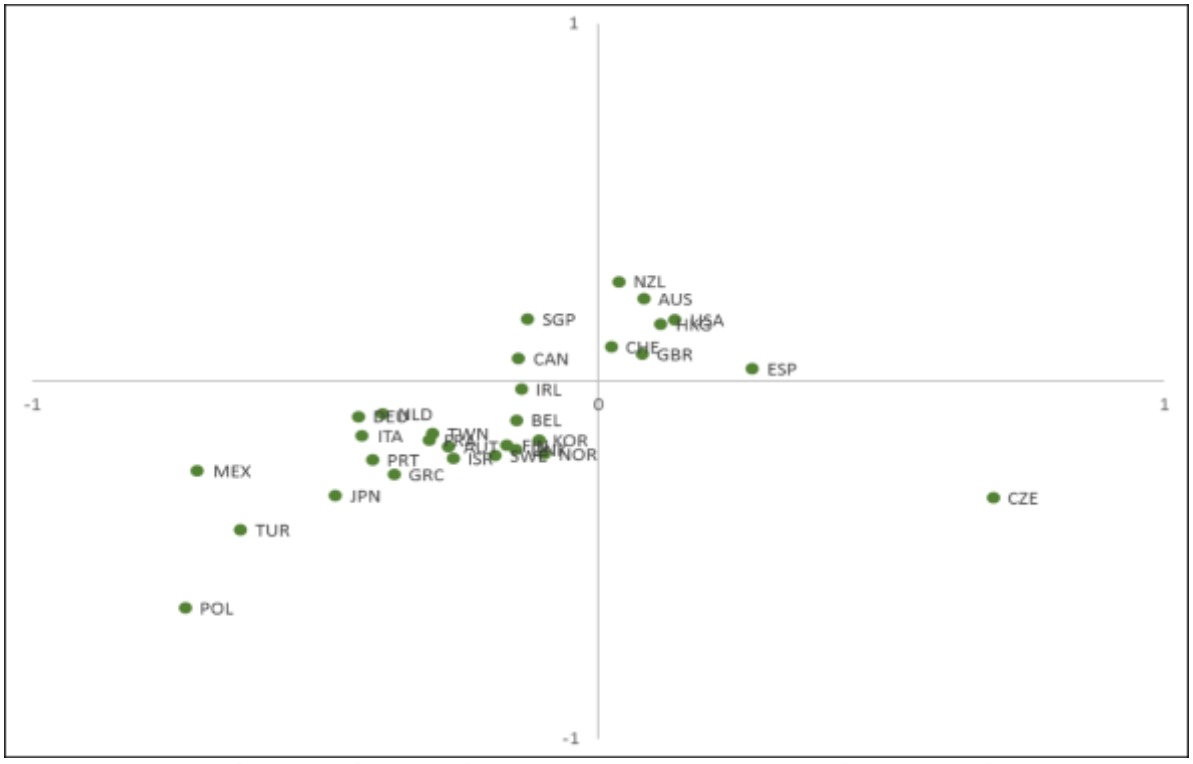


Figure 3. National Research Specialization in Accounting: Period I to Period III

Table 3. Regression Results for Publications in Accounting across Nations

Sample Size	Regression Model	$\hat{\beta}$	t	R^2	$\lvert\hat{\beta}\rvert/\lvert R\rvert$	$1-\lvert R\rvert$	$1-\lvert\hat{\beta}\rvert$
n=30	Period I to Period II	0.710	-4.450***	0.809	0.789	0.101	0.290
	Period II to Period III	0.690	-3.084***	0.626	0.872	0.209	0.310
	Period I to Period III	0.375	-5.736***	0.298	0.687	0.454	0.625
n=29 (excluding Czech Republic)	Period I to Period II	0.809	-2.634**	0.821	0.893	0.094	0.191
	Period II to Period III	0.856	-2.391**	0.882	0.911	0.061	0.144
	Period I to Period III	0.660	-3.717***	0.658	0.814	0.189	0.340

Notes:
All β-values are significantly different from zero at the 1% level.
t-statistics refer to the hypothesis H_0: β=1, *** denotes p<0.01, and ** denotes p<0.05.

Figures 1 through 3 are scatter diagrams showing relationships between national research specialization in accounting of our sample counties for the three comparing periods. While all three diagrams reveal a clear pattern of linear relationship, it seems Czech Republic stands out as an outlier for all three cases. Removing Czech Republic from the regression may end up with a regression model of better explanatory power. Therefore, regression analysis are conducted for both cases: including Czech Republic and excluding the nation (Table 3).

Table 3 shows that, for all regressions with sample countries including and excluding Czech Republic, the $\hat{\beta}$-values are significantly different from 0 and from 1, meaning there have been statistically significant changes in national research specialization in accounting within our sample countries for both medium and long terms. As shown by R^2 values, regressions excluding Czech Republic have better explanatory power than those including the nation.

The $\hat{\beta}$-values are all between 0 and 1, indicating that, in general, nations decreased in the degree of specialization in accounting with higher-than-average activities and became higher in previously lower-than-average activities. Further, values of $|\hat{\beta}|/|R|$are all below 1, confirming that, overall, OECD and Asian NIEs have experienced a process of convergence in national disciplinary specialization in accounting. Also noteworthy here is the cumulative effect. It seems that the long-term change between Period I and Period III results from an additive of the changes during Period I to Period II and Period II to Period III. The fact that the values of $\hat{\beta}$ and are among the lowest for regression of Period III on Period I among the three regressions suggests a continuous convergence process.

The decomposition of a nation's disciplinary structural changes into a "regression effect" (1-β) and a "mobility effect" (1-R) enables a more in-depth exploration. Based on the regression results, values of the regression effect are higher than the corresponding mobility effects for all regression cases. Therefore, for both medium-term and long-term changes in the distribution of national disciplinary specialization in accounting, the major causes have been the regression effects rather than the mobility effects. No dramatic change in rankings of specialization in accounting has occurred. Interestingly, similar converging patterns are found in disciplinary study in physical and life sciences (see Glänzel and Schlemmer, 2007; Horlings and van den Besselaar, 2013).

As shown in Figures 3, in the long term, among our sample nations, Australia, United States, Hong Kong, United Kingdom, New Zealand, Switzerland, and Spain remained specialized in accounting in their national research profiles. Czech Republic went through a de-specialization process in accounting. Canada and Singapore evolved from not specialized to well specialized in accounting. Other nations remained comparatively disadvantageous in accounting. Figures 1 and 2 shows that the changes in position for Canada and Singapore happened from Period I to Period II, and the position change for Czech Republic happened from Period II to Period III. Clearly dramatic changes have happened in accounting research in Czech Republic, but the causes to these changes remains unclear.

4.2. Cluster Analysis of Disciplinary Specialization Patterns across Nations

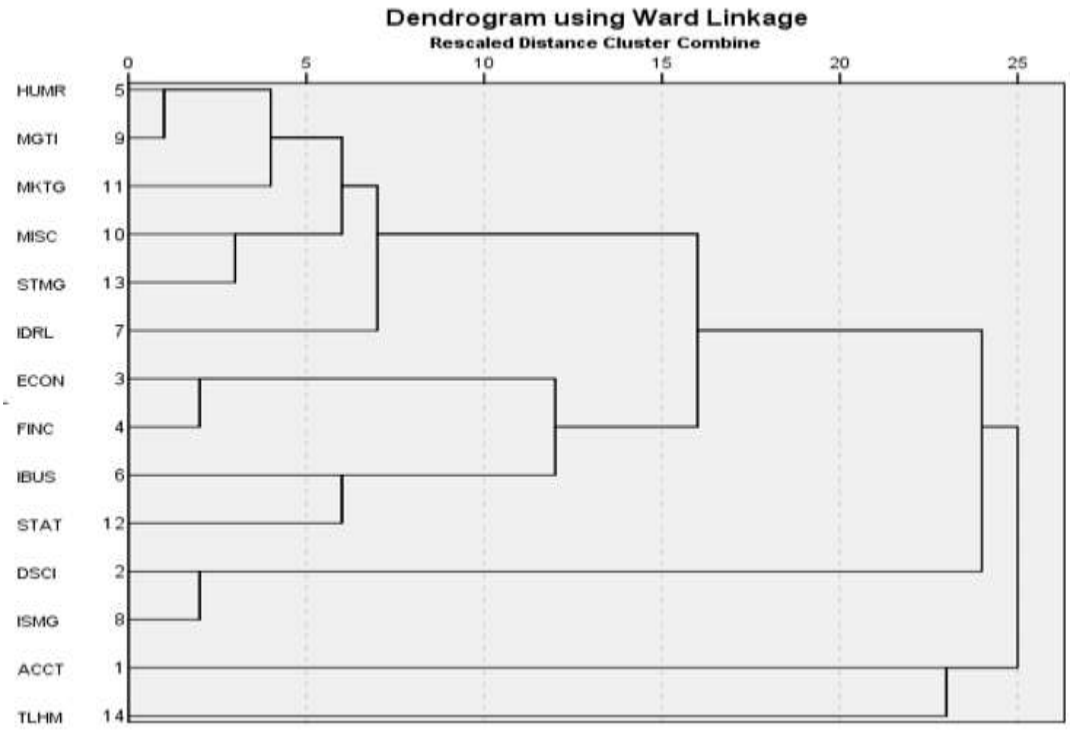
Our cluster analysis is based on the data of disciplinary specialization (*RSIs*) across nations. We conducted cluster analysis for each of the three periods in order to reveal shifts in the relationship between accounting and other subfield of business research. Note that we exclude subfields marked as miscellaneous as papers in these subfields do not have coherent subjects. We would like to note that the primary objective of cluster analysis in this study doesn't not necessarily unknowledge and recognize differences between individual countries, but rather, attempts to identify distinct and interpretable patterns or groups.

Figures 4 through 6 present the cluster analysis and multidimensional scaling charts for the three periods. The figures depict changes in connections among business subfields as revealed by *RSIs* over time. The multidimensional scaling charts portray relative positions of each business discipline so that we can identify clusters and have an intuitive sense of the distance between subfields.

Usually, the number of clusters chosen in cluster analysis depends on the purposes of the study. A too broad or a too detailed clustering may well lose necessary information. In this paper, we choose a moderate linkage distance so that three to four clusters may be formed for each of the three periods (see Figures 4, 5 and 6).

As revealed in Figure 4, during period I (1996-2001), "accounting" was relatively independent from all other business subfields. During the same period, four clusters can be identifies: cluster one – "management science and operations research" together with "information systems and management"; cluster two – "statistics, probability and uncertainty" together with "business and international management"; cluster three – "finance" and "economics"; cluster four – all other subfields except tourism.

During period II (2003-2008), "accounting" showed close connections with "finance", "economics", "statistics, probability and uncertainty", and "business and international management" (see Figure 5). "Management information systems" and "industrial relations" formed a new cluster. During period III (2010-2015), significant changes happened to the relationships between accounting and other subfields in business. Accounting during this period clustered together with "industrial relations" and "organizational behavior and human resource management".



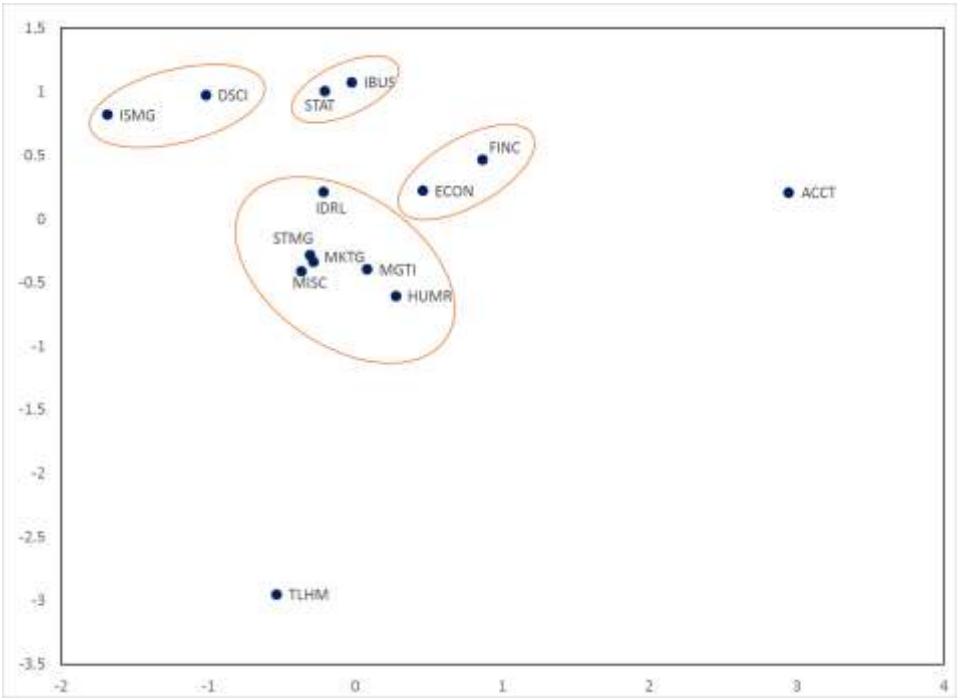
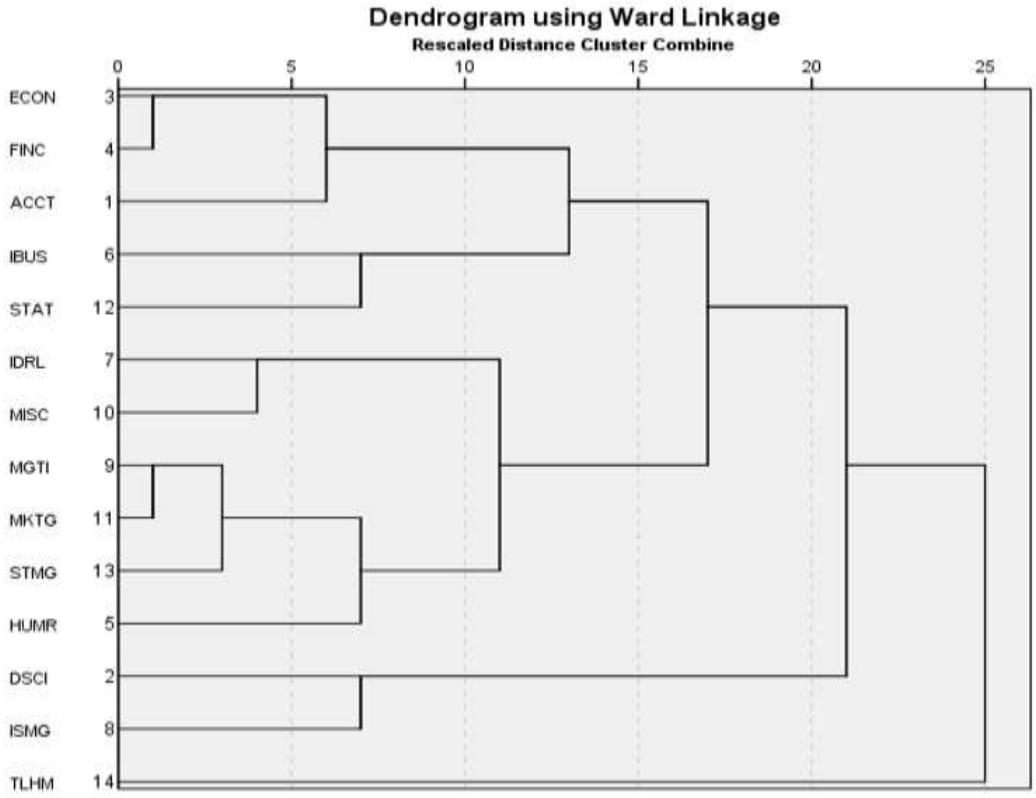


Figure 4. Cluster Analysis and Multidimensional Scaling: Period I 1996-2001



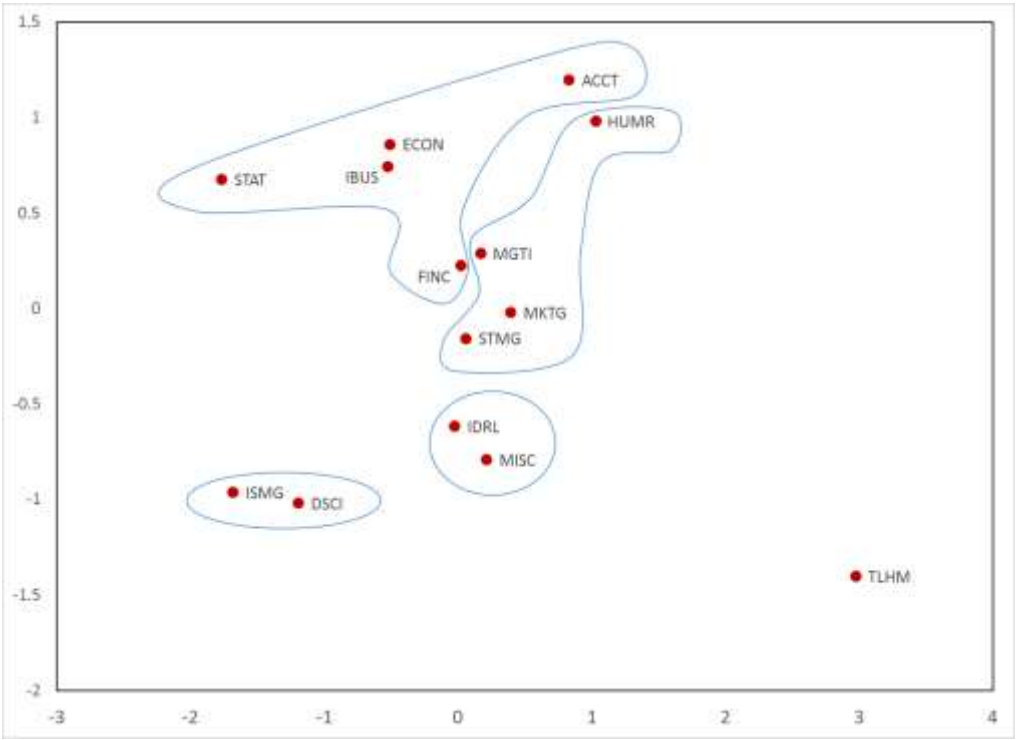
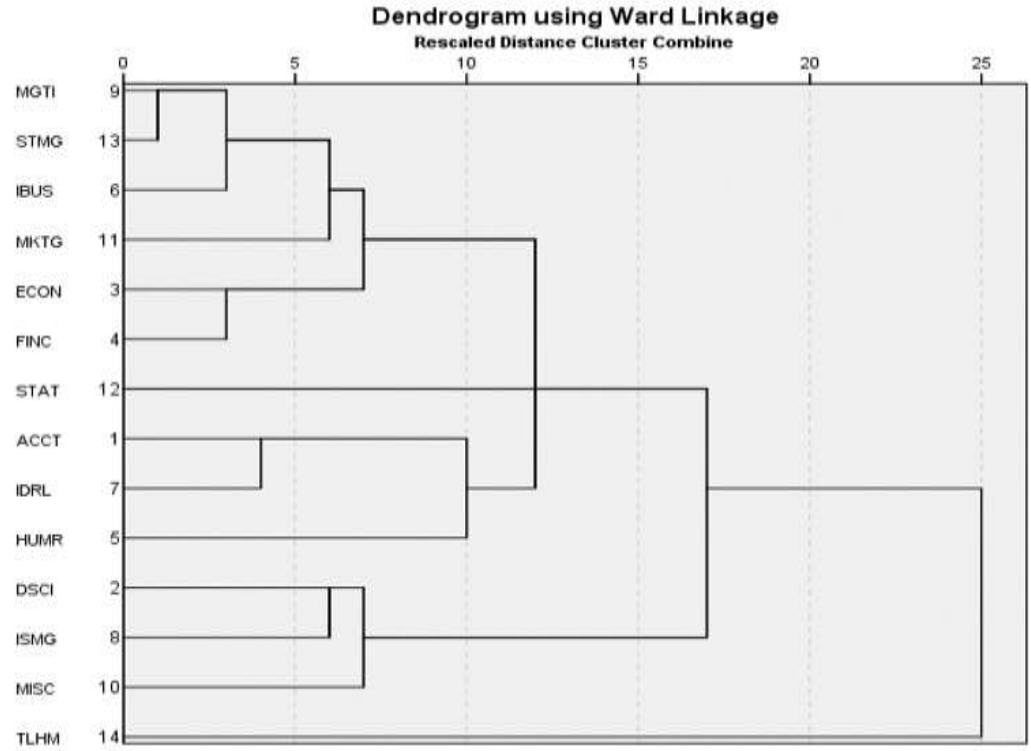


Figure 5. Cluster Analysis and Multidimensional Scaling: Period II 2003-2008



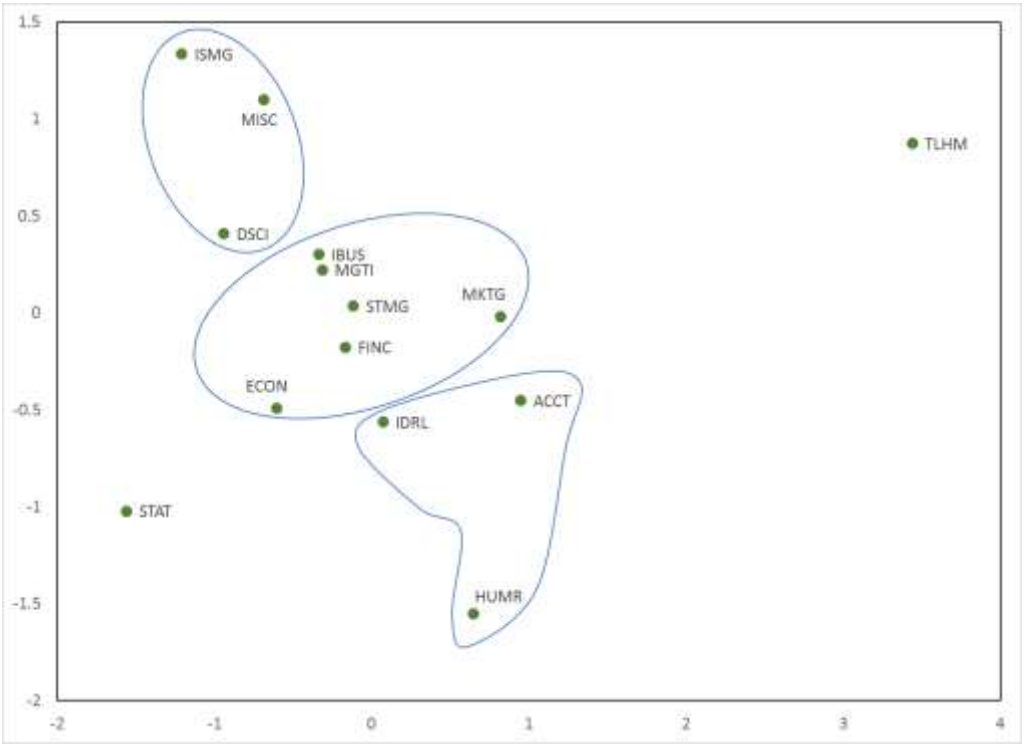


Figure 6. Cluster Analysis and Multidimensional Scaling: Period III 2010-2015

Our cluster analysis using bibliometric data has revealed interesting and important patterns as to the relationship between accounting and other business subfields. Overtime, accounting as a research field was either positioned alone by itself as a relatively independent area or clustered with other subfields. Further, accounting clustered with different subfields during different periods. Some insightful analysis about the shifts of connections between business

subfields is needed to justify patterns revealed in this paper. However, this would be beyond the scope of this paper.

4.3.Discussion and Research Limitations

Every research has its limitations. These limitations might appear be related to constraints on methodology or research design. Needless to say, limitation may impact whole academic study or research paper. Most researchers prefer to not discuss their study limitations because they think it may decrease the value of their paper for the reviewers or potential future readers. However, it is important for the authors of this research to recognize the existence of these potential limitations and to show their existence to the respective audience and public.

While the study of intellectual output in the field of accounting has produced important insights, broader research in the field of accounting has not been fully incorporated into the mainstream of academic studies in accounting. This misstep has limited the capacities to develop a complete understanding of how intellectual output matters in this important subject. We identify some limitations in our study and provide some recommendations for how this subfield of broader accounting research to move forward most productively. First, we tend to primarily treat broad accounting research as a statistical empirical study primarily centered on narrowly defined measurable quantitative studies rather than recognizing historical functioning of accounting to support the decision-making process and involves keeping accurate records of all the past transactions made in the business, resource allocation and prevention of fraud. However, In this academic study we have followed the mainstream of accounting research and constructed study of interactive process of categorization. Other noteworthy limitation in this study relates to measurement issues. Thus, the divarication of variables used can possibly result in loss of information about particular and identifiable differences. Other limitation of this study is selected methodology and design. For example, data may not accurately and timely reflect patterns and characteristics under research. Additionally, this data was collected ending 2015. Therefore, increasing changing trends in accounting discipline suggest these data may not be representative of contemporary environment of this discipline. In addition, the cross-sectional nature of this data can restrict the direction or causal nature of association of clusters identified. On the other hand, the nature of this relationship, be it bidirectional or otherwise, cannot be determined using this cross-sectional data. Future work utilizing longitudinal data will be useful in that regard. Asit was mentioned above, shortcoming might involve the choices of data analyzed. The data from limited number of countries may have had imperfections, with no guarantee that samples were statistically representative. This concern is mitigated however, by the fact that our sample represents the world's developed economies and corroborates with the findings of scholarly studies. In general, these economies are the world's top producers of research publications in general business including accounting. As Jarvey and his coauthors noted bibliometric measures don't cover all scholarly activities and considered to be "inadequate" (Jarvey, Usher, and McElroy, L. 2012). Furthermore, they also consider that those bibliometrics can be biased and, "potentially", misleading with proxies for "multiple interpretations (Jarvey, Usher, and McElroy, L. 2012).

Finally, according to Jarvey et al, "the most important weakness of bibliometric analysis comes when attempts are made to compare scholars across disciplines without taking into account the dramatic differences in publication cultures. Scholars in different disciplines tend to produce research at different rates (Jarvey et al, 2012, 19). They also cite other papers at different frequencies, co-author papers with differing numbers of other scholars, collaborate at different levels and publish in books, monographs, and journals at different rates. For

example, only the most productive scholars in the humanities publish on a monthly basis, rarely with more than one or two authors. In other disciplines (e.g., biological sciences) however, this level of productivity and multiple authors is quite common. This affects most of the basic inputs of common bibliometric measures, including the number of articles published in peer-reviewed journals, the citation rate of published articles and the number of authors per paper" (Jarvey et al, 2012, 19).

4.4. Future Research

Cole clearly outlines the patterns of future research. According to him "among more developed countries we find that differences in scientific productivity cannot be completely explained by differences in national wealth. Our data show that when wealth is controlled, cultural variables like religion, and structural variables like the decentralization and competitiveness of a country's scientific establishment, influence the number of research scientists - which in turn is the strongest determinant of the number of high-quality papers published per capita. More research is needed on the ways in which changes in cultural and structural variables influence scientific capacity. Has the poor job market for scientists in the United States over the last 20 years affected the country's scientific capacity? Our data suggests that it has not yet had such an effect but it might in the future. The last question which deserves a great deal more research is how these economic, cultural and structural conditions influence the foci of attention of a nation's scientists. We have shown that countries which spend relatively little on supporting basic research produce more low-cost research than countries which spend more money. Other research we are undertaking - not reported here - suggests that countries which produce more applied research may produce less basic research, and vice-versa. The reasons for such relationships require additional study (Cole, 1999, 23) Therefore, more countries and, ultimately, more variable could be included in future research. Moving forward, creating a larger sample and incorporating more countries and more variables might produce a new variety of causal relationships

5. Conclusion

This paper provides an empirical study examining the evolutionary patterns of research outputs in accounting as a subfield of business research. Our sample for this empirical study covers all OECD nations and three Asian NIEs. We use number of publications as the indicator of research outputs and Relative Specialization Index (RSI) as the indicator of the level of specialization in a research field of a nation.

As to the evolutionary patterns of the distribution of research specialization in accounting across nations, our regression analysis confirms a converging process for both medium and long terms. The time span between 1996 and 2015 has seen a continuous process in which nations of higher-than-average-activity in accounting research have become less specialized and nations of lower-than-average-activity in accounting have strengthened their research in this field. Further, our study reveals that the general converging process has been driven by graduate evolutions (regression effects) rather than radical revolutions (mobility effects) in the ranking of national specialization in accounting.

However, these findings also should be interpreted with caution, given the exploratory nature of the analyses and limitations mentioned in previous paragraphs.

In this academic study we also communicated that mainstream research in accounting has been limited by its failure to fully incorporate broader work on overall accounting across business discipline. This reality, has, somewhat, limited the theoretical, experimental and empirical sophistication of work of academic output in accounting. Thus "it would be beneficial if future research would reveal insights in accounting research" in a broader aspects. (Jarvey et al, 2012)

References

Cantwell, J. (1989). Technological innovation and multinational corporations. Oxford: Blackwell, pp. 16-48

capital", Strategy & Leadership, Vol. 24 No. 2, pp. 10-16

Chan, K. C., Chen, C. R. & Cheng, L.W. (2006) A ranking of accounting research output in the European region, Accounting and Business Research, 36 (1): 3-17

Chan, K. C., Tong, J. Y. & Zhang, F. F. (2013) Accounting research in the Asia–Pacific region: an update, Review of Quantitative Finance and Accounting, 41 (4), 675–694

Cole, S. and Phelan, T. J. (1999). The Scientific Productivity of Nations. Minerva, (37)1, 1-23 Dalum, B., Laursen, K., & Villumsen, G. (1998). Structural change in OECD export

Dumay, J. and Garanina, T. (2013), "Intellectual capital research: a critical examination of the

Glänzel, W. & Schlemmer, B. (2007) National research profiles in a changing Europe (1983–2003) An exploratory study of sectoral characteristics in the Triple Helix. Scientometrics, 70(2): 267-275

Guthrie, J., Ricceri, F. and Dumay, J. (2012), "Reflections and projections: a decade of intellectual capital accounting research", The British Accounting Review, Vol. 44 No. 2, pp. 68-82.

Horlings, E. & van den Besselaar, P. (2013). Convergence in science growth and structure of worldwide scientific output, 1993-2008. Rathenau Instituut, Working Paper 1301

Horta, H. (2018). The declining scientific wealth of Hong Kong and Singapore. Cientometrics 117:427–447

Hu, X., & Rousseau, R. (2009). A comparative study of the difference in research performance in biomedical fields among selected Western and Asia Pacific countries. Scientometrics, 81(2), 475-491

Itami, H. and Roehl, T. (1987), Mobilizing Invisible Assets, Harvard University Press, Cambridge, MA.

Jarvey, P., Usher, A. and McElroy, L. 2012. Making Research Count: Analyzing Canadian. Academic Publishing Cultures. Toronto: Higher Education Strategy Associates., 1-30

King, D. A. (2004). The scientific impact of nations. Nature, 430(6997), 311-316

Laursen, K. (2015). Revealed comparative advantage and the alternatives as measures of international specialization. EurAsia Pacific Business Review, 5(1), 99-115

Lev, B. and Zarowin, P. (1999), "The boundaries of financial reporting and how to extend them", Journal of Accounting Research, Vol. 37 No. 2, pp. 353-385.

Li, N. (2017). Evolutionary Patterns of National Disciplinary Profiles in Research: 1996-2015. Scientometrics, 111(1), 493-520

Machlup, F. (1962), The Production and Distribution of Knowledge in the United States, Princeton University Press, Princeton, NJ.

May, R. M. (1997). The Scientific Wealth of Nations. Science, 275(5301), 793-796

Petty, R. and Guthrie, J. (2000), "Intellectual capital literature review: measurement, reporting and management", Journal of Intellectual Capital, Vol. 1 No. 2, pp. 155-176. pp. 203-219.

Rodrı´guez-Ruiz, O´. and Ferna´ndez-Mene´ndez, J. (2009), "Intellectual capital revisited: a citation analysis of ten years of research in the area (1997-2007)", Management Research: The Journal of the Iberoamerican Academy of Management, Vol. 7 No. 3,

Saint-Onge, H. (1996), "Tacit knowledge: the key to the strategic alignment of intellectual

SCImago. (2007). SJR – SCImago Journal & Country Rank. Retrieved August 20, 2018, from http://www.scimagojr.com

Scopus. (2016). Content Coverage Guide, January 2016. [Accessed 25 Aug 2018].

Serenko, A. and Bontis, N. (2013), Investigating the current state and impact of the intellectual capital academic discipline, Journal of Intellectual Capital, Vol. 14 No. 4, pp. 476-500.

specialisation patterns: de-specialisation and 'stickiness'. International Review of Applied Economics, 12(3), 423-443

Stewart, T.A. (1997), Intellectual Capital: The New Wealth of Organizations, Doubleday Currency, New York, NY.

Sveiby, K.E. (1987), The Invisible Balance Sheet: Key Indicators for Accounting, Control and Valuation of Know-How Companies, Konrad Group, Stockholm.

third stage", Journal of Intellectual Capital, Vol. 14 No. 1, pp. 10-25.

Wiig, K.M. (1997), "Integrating intellectual capital and knowledge management", Long Range Planning, Vol. 30 No. 3, pp. 323-405.

Yang, L. Y., Yue, T., Ding, J. L., & Han, T. (2012). A comparison of disciplinary structure in science between the G7 and the BRIC countries by bibliometric methods. Scientometrics, 93(2), 497-516.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/)