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Identifying Research Fields within Business and Management: A Journal Cross-Citation Analysis

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Abstract

A discipline such as business and management (B&M) is very broad and has many fields within it, ranging from fairly scientific ones such as management science or economics to softer ones such as information systems. There are at least three reasons why it is important to identify these sub-fields accurately. Firstly, to give insight into the structure of the subject area and identify perhaps unrecognised commonalities; second for the purpose of normalizing citation data as it is well known that citation rates vary significantly between different disciplines. And thirdly, because journal rankings and lists tend to split their classifications into different subjects – for example, the Association of Business Schools (ABS) list, which is a standard in the UK, has 22 different fields. Unfortunately, at the moment these are created in an *ad hoc* manner with no underlying rigour. The purpose of this paper is to identify possible sub-fields in B&M rigorously based on actual citation patterns. We have examined 450 journals in B&M which are included in the ISI Web of Science (WoS) and analysed the cross-citation rates between them enabling us to generate sets of coherent and consistent sub-fields that minimise the extent to which journals appear in several categories. Implications and limitations of the analysis are discussed.

Key words: subject fields, cross-citations, business and management, factor analysis

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1 Introduction

Business and Management (B&M) constitutes a wide and disparate research area. Its boundaries with other disciplines are fuzzy, both because it draws on a range of foundational disciplines and because it has many application areas. It is also complex within itself, having different sub-disciplines, application areas and technologies. In this paper we will consider the latter problem and attempt to identify a group of clearly demarcated sub-fields within B&M as a whole. Why is this a useful thing to do? Firstly, it is of interest to understand the structure of a large and diverse field such as business and management. We routinely assume that there are particular sub-fields, and our schools are generally split into different subject groups, yet this is done on a very *ad hoc* basis with little empirical justification. Would it not be better to base this on actual behaviour as embodied in citation practices? There are two further, more technical reasons – the increasing importance of journal ranking lists such as the one created by the Association of Business Schools (ABS) (Association of Business Schools, 2010) in the UK which include a range of sub-disciplines and the need to normalise citations metrics such as the impact factor (IF) or the h-index.

Considering firstly journal ranking lists, they are assuming increasing importance in the assessment of research quality. It is extremely time consuming, and inevitably somewhat subjective, to judge the quality of every published paper by peer review. It is therefore very common, instead, to use the supposed quality of the journal as a proxy for the quality of its papers which displaces the problem to assessing the journal quality, hence the use of journal ranking lists. The use of journal rankings in this way is of course contentious. (Paul, 2007; 2008), who was a member of the 2008 RAE Panel, states that "One major conclusion appears

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to be that journal rankings are not a good indicator of the quality of any paper published in that journal, nor necessarily the combined quality of all the papers" (Paul, 2008, p. 324). Macdonald and Kam (2007) argue that the reality of academic publishing in management is one of gamesmanship and game playing. Adler and Harzing (2009) provide another strong critique of the dysfunctional effects of academic ranking systems and journal rankings in particular. The main complaint is that they lead to a narrowing of the discipline, concentrating research into the narrow confines of established journals and discouraging innovation and interdisciplinary work (Rafols et al., 2012).

Within the UK, the regime of Research Assessment Exercises (RAEs), the current one (2013) being called the Research Excellence Framework (REF) (RAE, 2004; RAE, 2005; RAE, 2006), has placed huge emphasis on journal quality as business school Deans are faced with difficult decisions about which people and which papers to enter in their submissions to the REF. This has led to one particular journal list – the ABS one – becoming the *de facto* standard. It is clearly and explicitly used by all business school but it is also implicitly used by the REF Panel itself. Although they say publically that journal ranking lists will not be formally used, the sheer volume of papers to be assessed by a relatively small Panel makes it a necessity. In 2008, the Panel claimed that "most outputs were read in considerable detail" (RAE, 2009, p. 5) but this must have been an impossible task given that there were 12,600 papers to be read by 18 academics in only a few weeks (Mingers et al., 2012).

The ABS list itself has been extensively critiqued (Willmott, 2011; Hoepner and Unerman, 2009; Mingers and Willmott, 2013; Hussain, 2011) and defended (Morris et al., 2011; Morris et al., 2009). The list (currently version 4) covers 823 journals split into 22 categories. This seems a lot of journals, but in fact papers in more than 1600 different journals were submitted in the last RAE and a lack of coverage of particular journals is one of the criticisms of the list. Others criticisms are:

i)   That the categories are somewhat arbitrary and not based on an underlying rationale.

ii)   That the quality levels assigned to different categories are highly variable. For example, 16 out of 38 (42%) psychology journals are awarded the top 4 grading while only 2 out of 53 (4%) information systems journals were.

iii)   That in some categories (but not others), e.g., operational research, there is a bias towards US journals which exclude certain types of research of importance in the UK (e.g., soft OR).

iv)   That the process of compiling the list is not transparent and that the compilers of the list do not engage with subject communities.

In this paper we are mainly concerned with the first of these four issues – that of the subject categories. They are shown in Table 1. As can be seen, there are quite a large number; they differ significantly in size (from 10 to 134 journals); and there is little theoretical justification for them. As one of the founders of the ABS list has said:

"The twenty two so-called subject fields in the *ABS Guide* are an eclectic mix of categories consisting of: academic disciplines (Business History; Economics; Organization Studies; Operations Research and Management Science; and Psychology); business functions (Accounting; Finance; Human Resource Management and Employment Studies; Information Management; Marketing; Operations and Technology Management; and Business Strategy); industries (Tourism and Hospitality Management); sectors (Entrepreneurship and Small Business; International Business and Area Studies; Public Sector Policy, Management and Administration; and Sector Studies, covering a wide range of specialisms that includes health and education); issues or interests (Ethics and Governance; Innovation and Technology Management; Management and Education); as well as more or less residual categories (General Management, which includes many of the leading business and management journals; and Social Sciences)." (Rowlinson et al., 2013).

Table 1 about here

Whilst it may be necessary that such a disparate field as business and management does require different kinds of sub-fields, it should be possible to generate them on the basis of actual publication and citation behaviour rather than purely ad-hoc judgement.

Moving to citations, it is increasingly the case that research evaluation is being carried out through bibliometric analysis based on citations, either instead of or combined with peer review. It is clear through many empirical studies (Moed et al., 1985; Leydesdorff, 2008; Mingers and Burrell, 2006; Rinia et al., 1998) that citation behaviour, in terms of the average number of citations per paper, varies dramatically between different disciplines (as well as depending on other factors such as age of paper, type of paper and journal). Generally, the

sciences cite much more highly than the social sciences, which in turn cite more highly than the humanities but within each of the areas there are also wide dispersions. Another important factor is the prevalence of review type papers that generally have large numbers of references. This is more common in certain journals, and also in certain disciplines. This means that, in comparative analyses, whether at the level of the individual researcher, the research unit, or the journal, citation data must be normalised to the field of study. This either requires that there exists an agreed set of fields or sub fields, each with its own collection of journals, in order to do the normalisation, or a source-normalised approach such as SNIP is adopted. However, no such sets exist at the moment. One can question whether all journals can unambiguously be attributed to disciplines or specialties (Boyack and Klavans, 2011).

Most citation analyses use one of the major citation databases such as *Thomson-Reuters Web of Science* (WoS) or *Elsevier's Scopus*. One of the main centres for this type of research evaluation is the *Centre for Science and Technology Studies* (CWTS) at Leiden University (Moed, 2010a; van Raan, 2003; van Raan et al., 2011). They have developed their own methodology – the Leiden Ranking Methodology – based on citations taken from the WoS. For the purposes of normalisation, they rely on the definitions of fields within WoS. Whilst it may be reasonable for other disciplines, it is certainly not for B&M (Mingers and Lipitakis, 2013). Table 2 shows the three main fields relevant to B&M – Management, Business, Business Finance, together with several others that are also relevant. The first problem is that these fields are not defined clearly nor are they based on any underlying analysis (Pudovkin and Garfield, 2002; Rafols and Leydesdorff, 2009) and so each contains a strange mix of journals. What exactly is the difference between the three? On looking at the journals within them, they cover what are seen within B&M as very different sub-disciplines. In comparison, the ABS journal list, which was discussed above, has 22 different categories within it. Of the other fields related to B&M, "OR and Management Science" is actually listed in the Science database rather than the Social Science one; information systems is combined with information and library science; and the other two are somewhat eclectic mixtures. All this means that the fields contain journals coming from areas with widely differing citation rates.

Table 2 about here

As can be seen from Table 2, there is also a degree of overlap with the same journal appearing on two or even three fields. This would not perhaps matter so much if the citation levels of the different fields were all similar, but in fact one of the characteristics of B&M is that it has a wide range of very diverse disciplines, from scientific ones such as operational research and economics, through social science ones like organisation studies, to soft, philosophical discourses. If a paper appears in more than one field (and of course some genuinely may do) and the fields have different normalisation rates, it is difficult to find a reasonable value.

Recently, an alternative metric has been proposed by Moed (2010b), that has been implemented within *Scopus*, which normalises without requiring a prior field definition – source-normalized impact per paper (SNIP). In essence, this metric uses the set of journals (within the database) that have cited the journal of interest as the subject field for that journal. In other words, instead of there being a field such as "management science" or "economics", every journal that is being evaluated has its own specific field – all the journals that cite it. SNIP then calculates the "citation potential", ie the average number of citations that papers in this field give, as a way of relativising the citations per paper (cpp).

This is certainly an interesting idea, although the precise algorithmic method has been challenged by Leydesdorff and Opthof (2010a; 2010b; Moed, 2010c), and it may well provide a reasonably normalised average citation measure – certainly better than an un-normalised impact factor. However, it does not provide any insight into the structure of a field, and every single journal has its own, algorithmically-constructed, field that is somewhat opaque as one cannot picture it or see it. It also potentially raises validation problems – at least with defined lists they can be seen and criticised or changed, with the SNIP method there is no way provided of actually assessing the normalisation. A revised version has been developed (Waltman et al., 2013) although this also has been criticised (Mingers, 2014).

This brings us to the subject of the paper. For the reasons outlined, it would be valuable if a set of sub-fields could be identified in terms of journals within business and management. The method used here is to look at the actual citation and referencing behaviour of researchers in terms of the cross-citations between different journals. Given a matrix of the cross-citations between large numbers of journals it should be possible to use statistical methods to discover patterns of cross-citation which essentially correspond to the sub-fields. In Section 2 we explain the data collection and statistical methods used. In Section 3 we

present the results, and then in Section 4 we will discuss the implications and limitations of the study.

2. Data and Methodology

The data collected on citations came from the Journal Citation Reports at Thomson-Reuters' Web of Science which is the most reliable source of citations although it is limited in its coverage, especially in business and management (Mingers and Lipitakis, 2010). All the journals in the ABS list that are in WoS are classified with their ISI abbreviation and this was used to interrogate the WoS in order to obtain the number of citations from those journals, in 2011, to papers from those same journals over all years. This generated a matrix of citations in which the rows (observations) were the citing journals in 2011 and the columns (variables) were the cited journals across all the years. After cleaning, there were 453 variables and 449 cases. As is usual with cross-citation data (Leydesdorff, 2004) the matrix was very sparse with over 85% zeros. This dataset used only the most recent years' worth of data (2011) but there is little point in using more years unless one is doing longitudinal research to detect changes, which was not the purpose of this study.

Three different analysis techniques were used: the Blondel algorithm (2008) for constructing communities or groups from large data networks, traditional cluster analysis, and factor analysis (Zhao and Lin, 2010). The Blondel algorithm is a relatively recent heuristic that has been shown to be highly effective in analysing very large networks. It uses a measure of the modularity of a particular partition and works in two phases that are repeated iteratively. The first phase tests if modularity can be improved by swapping nodes between clusters; the second phase takes the clusters and treats them as the nodes of the network to which phase one is applied again. When applied to our dataset, nine clusters were generated but they were not very satisfactory. Five of them were quite large with between 30 and 130 journals in each, but the remaining four were very small with between one and seven journals in each. Moreover, the large groups included quite diverse communities, for example psychology, HR, marketing and management were all in the same grouping.

The next approach was traditional, agglomerative cluster analysis. In terms of method, two decisions have to be made: which measure of distance between nodes/clusters, and which agglomeration method should be used. With regard to distance measures, there are a range of

possibilities based either on the Euclidean distance or the Pearson correlation coefficient. However, our data is quite unusual in that it has a large number of zeros and also a high degree of dispersion of values. Ahlgren, Jarneving and Rousseau (2003) found that Pearson's coefficient was inappropriate in these circumstances (in particular, simply adding in zero entries into the matrix changes the value), and that the Salton's (1987) cosine normalisation measure was more satisfactory (Egghe and Leydesdorff, 2009). For the agglomerative measures, all measures have their own particular biases in terms of the types of clusters that they form but Ward's method is considered very reliable. The other major question is how many groups to have where there is no theoretical reason for there being a specific number. It is possible to look at a scree diagram to see if there is a significant change of slope, but if there is not it is a matter of judgement based on knowledge of the domain and the coherence of the groups that have been formed. We can see from Tables 1 and 2 that the WoS has 8 relevant but overlapping groups, while the ABS list has 22. These could perhaps be seen as upper and lower limits, although certainly for citation normalisation purposes 22 is very high.

In the event we performed two cluster analyses based on cosine normalisation and Ward's method with 10 and 15 groups respectively. In both solutions there are several well-established and stable groupings – information systems/information technology, operations research/operations management, agricultural economics/development, psychology, economics and marketing. There are also some groups that get combined together, e.g., accounting and finance, and transport and regional. But, in both solutions there is one very large and very mixed cluster with 154 journals in the 15-group and 186 in the 10-group. This includes finance, health, technology, statistics, tourism, education, economics, HR and so on. Other clustering algorithms were tried but the results were broadly the same. These results were not considered satisfactory, and so the third analysis method – factor analysis, which has been recommended for this type of analysis (Leydesdorff, 2006; Leydesdorff, 2004), was deployed. One reason that this may work well is the possibility of rotating the factors to create better defined groups.

Factor analysis is a multivariate method that aims to uncover general factors that underlie a set of data with many variables (Hair et al., 1998). It is based on the correlations (or covariances) between variables. If all the variables were independent of each other, then each variable would be its own factor. But where there is a correlation structure we can explore the

extent to which that is reflective of some underlying, or latent, factors. In our case, there is a pattern in the data in that the cited journals will tend to cluster as a result of the citing patterns of behaviour (of the same journals). We might expect that the journals will group into fields, and the factor analysis should be able to uncover what these fields are. There will be some journals that span several fields and others that are very specialised to a particular field.

There are generally two stages in factor analysis – the extraction of the factors, and then the possible rotation of them. The most common extraction method is principal components analysis (PCA). This is an analytical method of data reduction that represents the variability (covariance) of a data set by extracting a set of orthogonal (independent) components in order of the amount of variability explained. The first PC is the linear combination of variables that captures the greatest amount of variability. The second factor is the line, orthogonal to the first, which captures the next greatest amount of variance. The process continues until there are as many components as variables and all the variance has been explained. In practice, one stops after a specified number of components have been extracted. This process means that each component is independent of the others so choosing to extract more components does not change the preceding ones. It also means that a decision has to be made about how many to extract. This can be based on theoretical considerations, or on the pattern of variance that is explained as more factors are extracted. There is potentially a second process called rotation where the whole set of components can be rotated in multi-dimensional space in order to clarify the results – i.e., to make the components sharper. This rotation may be orthogonal (maintaining the independence of the components) or oblique.

In this analysis, the aim is to see if a relatively small set of underlying components, citing sub-fields, can explain the overall covariability of cited journals. PCA was used to extract the components, and two rotational methods were tried. The results, described in the next section, were very interesting.

3. Factor Analysis results

There were 453 cited journals that constituted the set of variables for this analysis. We employed a PCA extraction, normalised by using the correlation matrix. The correlation matrix was used because there is a very high dispersion in citation rates and the covariance

matrix would have been dominated by the highly cited journals. We then needed to consider if greater clarity can be obtained by rotating the factors. We considered only orthogonal rotations and there are two main types. The first, varimax, aims to simplify the columns of the factor loadings. That is to try and make the coefficients in each factor as near to 0 or |1| as possible. Alternatively, quartimax aims to make the coefficients for each row (in this case journal) as near to 0 or |1| as possible so that each variable is as clearly represented in only a small number of factors. In our case, the first approach tries to make each sub-field as clear as possible, with potentially a relatively small number of journals, but journals may appear in several sub-fields. The latter approach tries to link a particular journal to only one sub-field thus reducing the number of journals appearing in multiple sub-fields. Given that one of the purposes of the research was to avoid the problem of journals appearing in multiple fields, it was felt that quartimax was most suitable.

Table 3 shows the extraction details for the first 22 components. The first component had a variance (Eigenvalue) after rotation of 27.11 which by itself represented 5.99% of the total variance. The main question at this stage is how many components to retain. Statistical guidance suggests components with an Eigenvalue of greater than 1 which would give 21 components explaining 41.21% of the original variation. An examination of the scree plot does not show any significant points of discontinuity. However, we believe that it is better to consider this in terms of the actual classifications generated rather than just the statistical results. At the first stage we decided to keep 22 factors as that is the number of fields in the ABS list. Later we will discuss solutions with less groups.

Table 3 about here

The actual factor loadings table, with 453 journals and 22 factors is too large to present in the paper but is available on the publisher's website. The method, however, worked well generating groups that were generally clearly defined. The first two columns of Table 4 show brief descriptions of the groups together with the number of journals within them. Journals are allocated to the factor for which their loading is highest positively given that it was at least 0.1. They may also have significant loadings in other factors, indicating they are also well cited in other groups. They may also be negatively loaded on a factor indicating that there are less cross citations with journals in that factor than would be expected.

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Table 4 about here

The 22-group solution covers 423 of the 453 journals in the data set (see Table 5). Those not included did not load significantly on these particular factors. These tend to be journals in specialised areas that would generate a factor of their own if more factors were extracted. For example, one group is seven education journals which, upon further analysis, were contained by principal component 54. The groups themselves do seem to have logical coherence and are a mix of disciplines, e.g., economics or OR, and application areas, e.g., energy and environment or transport.

Table 5 about here

We should perhaps discuss the split into two economics groups, which is maintained in the results with fewer groups to be discussed below. At first sight it seems strange that there should be a split within economics, and looking at the journal titles does not display any particular clues. However, producing a graphical representation using network mapping software (Pajek/VOSViewer) (Figure 1) shows that actually there is a core of economics journals that are largely self-contained and that the second group actually cluster around the edge of the core ones. The implication is that the second group are journals that are more related to the rest of the B&M literature, as well as to the economics ones so that they can be seen as more applied, or as forming a bridge between B&M and economics proper.

Figure 1 about here

3.1 Comparison with the ABS groups

Table 6 shows a cross tab of the ABS groups with our own for those journals that were classified. As can be seen, there is a considerable degree of commonality as perhaps would be expected since at least some fields are reasonably clearly defined and should appear both by judgement and by cross-citations. The adjusted RAND index for this table is 0.374 which is reasonable given the large number of groups (Steinley, 2004). Comparing these groups with the 22 ABS ones, there are some clear differences, but we should remember that we are only dealing with a specific subset of ABS journals – those included in ISI Web of Science – and

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these are not distributed evenly across the ABS groups. For instance, over 70% of journals in economics, IS, OR, psychology and social science are included in ISI, while less than 30% of journals in accounting, ethics/governance, international business, management education and tourism are (Mingers and Lipitakis, 2010). Thus these latter categories are not well represented in our dataset.

Table 6 about here

In Table 6, the fields that are well defined in both classifications are highlighted in grey. They include accounting, finance, HRM, IS, operations and operational research, and public sector. Economics, the largest single field in ABS, is widely spread although there are significant numbers in economics, economics 2 (the difference between these two is discussed above), energy, and labour economics which shows that in terms of actual citation behaviour economics is not an homogeneous field. Other ABS fields that are not well captured in terms of actual citations are: general management and sector (which are rather arbitrary groups anyway), and IB, organisation studies, social science and strategy. Psychology is split between two, what we have labelled "organisational psychology" and "psychology".

Looking at the figures from the viewpoint of our groups, the ones that do not occur in ABS are mainly applied areas such as regional and environmental, energy, development and transport, although also appearing are more disciplinary areas such as statistics and informatics. Generally the journals from these groups are spread widely across the ABS groups. Overall, our classification is broadly similar to that of ABS but is more well-grounded in that it is based on actual citation patterns between journals rather than ad-hoc judgements. However it is subject to the limitation of poor coverage in ISI in certain areas particularly. Note that the position of a journal in the list in Table 5 is based purely on the loading of the journal into the group – i.e., the first ones are more central to the group than the later ones – but it does not imply anything about the *quality* of the journal.

3.2 Differing Citation Rates for Normalisation

The aim of this research was not simply to replicate or improve on the ABS list. It was also concerned to produce a set of sub-fields that represented differential citation behaviour within the management discipline to improve normalisation processes and reduce the extent to

which a journal was represented in several different groupings. With this in mind, and noting that WoS itself only has a small number of relevant sub-fields (no more than five or six), we went on to look at solutions with smaller numbers of factors and therefore groups. In particular, we will examine 6, 10 and 15 group solutions (see Table 4), i.e, the solution when that particular number of factors were specified. The statistical analysis actually moves from few groups to many groups as new ones are split off, but we will discuss it in the opposite direction.

As the number of groups reduces, we find that three things can happen: i) groups move in their entirety into another group, examples being accounting into finance and informatics into information. Or, ii) they spread across a small number of other groups, for example public administration into economics (periphery) and psychology. Or iii) they more or less disappear with journals being widely spread or not appearing significantly in any groups, for example statistics and economic history. It is noticeable from the column totals that the number of journals classified in the groups is reducing. This is because, in the larger groups, some journals no longer appear as significant. Or, in terms of the alternate direction, as more factors are produced, new groupings are generated and journals that were "lost on the crowd" now become significant within their own specialised subject. In the 6 group solution, 105 journals have disappeared in comparison with the 22 group solution. Even in the 22-group analysis, 28 journals do not appear in any grouping. These are shown in Table 7. These can generally be seen to be peripheral to business and management as a whole, although some of them, *Ann Tourism Res* or *Hum Factors*, are slightly surprising. Table 7 also shows 15 journals that have significant loadings across at least seven different fields, indicating a high degree of cross-disciplinary material.

Table 7 about here

For the purposes of normalisation, what matters is whether different groups actually do differ significantly in terms of the number of citations they generate. To investigate this, we have calculated the mean citations per paper (for the year of our data – 2011) for each of the groups in all four solutions. These are also shown in Table 4. To be precise, we have recorded the number of citations that each journal made, in 2011, to the other journals in the list and the number of papers that it published in 2011. Dividing one by the other gives the citations

made per paper for papers published in 2011. Note that this is not the same as the more usual citations *of* a paper but that figure would be very difficult to calculate reliably as the number of citations *of* a journal in our data covers all years of publications and it would be difficult to know exactly how many papers that might have covered. But, we do know precisely how many papers were published in 2011 and that still gives us a measure of the overall citation rate of the field. In fact, it is a better measure of general citation rates because the number of citations generated by papers in a field does not vary much, but the citations *received* by papers can vary hugely depending largely on the journal. For example, there are a few journals with extremely high citation counts, *Am Econ Rev* has 16,000, *J Pers Soc Psychol* has 14,000, *Man Sci*, *Acad Manage Rev*, J. *Finance* and *Econometrica* each have over 10,000 in contrast with many journals that only have a few hundred.

Beginning with the 6 group solution, it can be seen that there are broadly three different levels – management and marketing which are over 30 per paper; economics, and finance and accounting which are between 15 and 30, and the rest which are below 15. This represents a significant difference for normalisation as some groups are over twice as large as other groups. As the number of different groups grows, the rates for the core groups, e.g., economics, management and marketing, remains much the same but new groups appear which are themselves equally differentiated. In the 22-group solution, there are four groups over 30, ten groups between 15 and 30, and eight under 15 but the between group dispersion has increased slightly with the largest being over four times the smallest. To some extent this would be expected statistically – the fewer the groups (and thereby the larger), the more the means will tend towards the overall mean.

Generally in these groups it is the large number of reasonably highly cited journals that generates the high mean. It might be suggested that the analysis method itself (factor analysis) might choose groups in terms of number of citations, but in fact the analysis was done on the correlation matrix rather than the covariance matrix and so was not affected by the absolute size of the citations. The main two factors generating the differences are: i) general differences in citation behaviour that are found between different disciplines, especially between sciences and the social sciences or humanities which might explain the high rates in economics and finance; ii) size of population differences between general subjects and specialised or niche subjects. This might explain why, for example, the

management/strategy and marketing categories are high while public admin, development and transport are low – there are simply fewer academics writing and citing fewer papers in the specialist areas.

In terms of normalisation, it is certainly clear that there needs to be a differentiation between fields based on actual citation behaviour as opposed to the rather *ad hoc* groupings that currently exist in WoS. On the basis of our results, we would suggest potentially three groupings: a) high citations including all the areas under management and marketing; b) medium citations, mainly economics and finance and accounting; c) low citations, all the other, mainly specialised, subject areas. However, clearly further analysis of a larger set of journals would be needed to resolve this question more adequately. Ideally, this should also include journals not in WoS (or *Scopus*) but this poses problems as the main alternative, *Google Scholar,* does not allow large-scale data collection.

4. Conclusions

This paper has shown that it is possible to identify sub-fields within the business and management discipline by analysing the cross-citations between journals. Using factor analysis, we have been able to construct several solutions, with different numbers of sub-fields, which are clear and consistent. There are several reasons for doing this. The first is for the purpose of normalising citation metrics since citation rates vary significantly across disciplines. We have found that there are at least three significantly different groups of sub-fields with respect to citation rates whether we consider the 6- 10- or the 22-group solution. These are different from the fields that are defined in WoS, which are somewhat arbitrary although they are often used for citation metrics.

The second reason is for journal ranking lists where the list as a whole needs to be split into a number of different subjects. The current ABS list has 22 and we have emulated that number although our groupings are different and have a more rigorous underlying logic. There remains a question of how many there should be as any particular split is essentially arbitrary. Based on the experience of one of the authors with two subject specific disciplinary associations (*Committee of Professors in OR, Committee of IS Professors*), it would seem likely that each disciplinary area would like to have its own specialised journal list.

The main limitation of this research is the set of journals that have been used as it does not fully represent the business and management literature. The sample is limited in two ways. First, because the citations were taken from WoS it only includes those journals in WoS and, as we have seen, there is a very uneven coverage across the different sub-fields. This will particularly affect the identification of sub-fields in those areas. The only way to overcome this is to use a different source of citations – possibly *Google Scholar* (GS) (Mingers and Lipitakis, 2010) – which covers all disciplines more evenly, although the citations themselves are less rigorously collected, However, GS is set up in such a way that large-scale, automated data collection is not possible at the present time. Another alternative would be *Scopus* which contains a wider range of journals.

The second limitation is the ABS list itself which does not contain all journals within B&M. For example, in the 2008 RAE in the UK, papers from over 1600 journals were submitted to the B&M Panel, although some may well be in application disciplines rather than B&M itself.

Subject Code	Subject Covered	No. of journals
ACCOUNT	Accounting. This field includes auditing and taxation journals (See also Finance	35
BUS HIST	Business History. This field includes related specialist journals focusing on management, firms, industries and employees	14
. ECON	Economics. This is a very broad field with many sub-specialisms. The focus in the selection of journals has been on general economics journals and those that publish articles dealing with business, management and industrial economics and related fields.	134
ENT-SMBUS	Entrepreneurship and Small Business.	17
ETH-GOV	Ethics and Governance.	16
FINANCE	Finance. All general and specialist finance journals including insurance and actuarial journals.	62
GEN MAN	General Management. This is a broad field containing many of the"heartland" journals of business and management studies, which have a broad coverage and inter-disciplinary content.	31
HRM&EMP	Human Resource Management and Employment Studies. This field includes journals dealing with personnel, human resource management, employee and industrial relations as well as those that apply sociological perspectives to work and employment.	35
IB&AREA	International Business and Area Studies. This field brings together international business and interdisciplinary area studies.	24
INNOV	Innovation and technology change management.	10
INFO MAN	Information Management. Studies of information systems and information technology and information processes.	53
MGT&ED	Management and Education. This includes career, employee and management development as well as publications focusing on education, skills and training	29
MKT	Marketing. The field covers advertising and marketing and related. specialisms such as communications and public relations.	54
ORG STUD	Organization Studies.	28
OR&MANSCI	Operations Research and Management Science. This field includes the application of mathematical analysis, operations research,	35
OPS&TECH	Operations and Technology Management	40
PSYCH	Psychology. This is a small sub-set of the psychology journals that attract contributions from business and management academics.	38
PUB SEC	Public sector policy, management and administration	33
SECTOR	Sector Studies. This covers health, education, arts, not-for-profit, engineering and other fields of management practice. It extends beyond issues of services management to include specialisms in manufacturing and primary industries	37
SOC SCI	Social Sciences. These in the main are sociological, geographical economic historical, cultural and political journals that are attractive, publication outlets for business and management academics.	60
STRAT	. Business Strategy.	12
TOUR-HOSP	Tourism and Hospitality Management	24

Table 1 Subject Groups in ABS Journal List

	Business	Business Finance	Economics	Industrial Relations & Labor	Information Science & Library Science	International Relations	Management	Operational Research & Management Science
Business	103	-	13	-	-	1	39	-
Business Finance	-	76	35	-	-	1	1	-
Economics	13	35	305	4	-	10	9	1
Industrial Relations & Labor	-	-	4	22	-	-	4	-
Information Science & Library Science	-	-	-	-	77	-	8	-
International Relations	1	1	10	-	-	78	-	-
Management	39	1	9	4	8	-	144	8
Operational Research & Management Science	-	-	1	-	-	-	8	75

Table 2. Fields in WoS showing overlapping coverage (numbers of journals) from WoS 2011

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	32.481	7.170	7.170	27.114	5.985	5.985
2	20.193	4.458	11.628	14.557	3.213	9.199
3	14.663	3.237	14.865	12.695	2.802	12.001
4	11.859	2.618	17.482	12.296	2.714	14.715
5	10.273	2.268	19.750	10.097	2.229	16.945
6	9.309	2.055	21.805	9.283	2.049	18.994
7	8.419	1.858	23.664	9.090	2.007	21.000
8	7.980	1.762	25.425	8.874	1.959	22.959
9	7.488	1.653	27.078	8.558	1.889	24.848
10	7.184	1.586	28.664	7.549	1.666	26.515
11	6.780	1.497	30.161	7.374	1.628	28.143
12	6.473	1.429	31.589	7.290	1.609	29.752
13	6.036	1.332	32.922	6.957	1.536	31.288
14	5.398	1.192	34.113	6.593	1.455	32.743
15	5.109	1.128	35.241	6.097	1.346	34.089
16	4.920	1.086	36.327	5.684	1.255	35.344
17	4.875	1.076	37.403	5.681	1.254	36.598
18	4.692	1.036	38.439	5.655	1.248	37.846
19	4.587	1.013	39.452	5.157	1.138	38.984
20	4.249	.938	40.390	5.121	1.130	40.115
21	3.997	.882	41.272	4.943	1.091	41.206
22	3.950	.872	42.144	4.249	.938	42.144

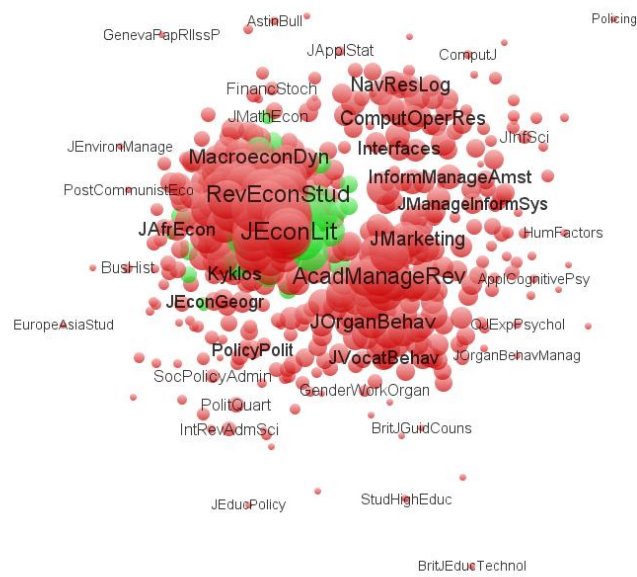**Table 3 Factor Loadings: PCA Extraction, Quartimax Rotation**

Figure 1 Grouping of Economics (periphery)

22 Groups	No.	Mean cites per paper	15 Groups	No.	Mean cites per paper	10 Groups	No.	Mean cites per paper	6 Groups	No.	Mean cites produced per paper
Economics (core)	56	18.0	Economics (core)	61	18.0	Economics (core)	75	17.6	Economics	106	17.4
Operations research (OR) and operations management	31	13.0	Operations research (OR) and operations management	33	14.0	Operations research (OR) and operations management	37	12.3	Operations research (OR) and operations management	49	11.8
Management, strategy, SME, sociology	31	38.3	Management, strategy, SME, sociology, technology	42	37.3	Management, strategy, SME, sociology, technology, org psych, IR	55	33.1	Management, org psych, IR,	57	32.4
HR, org. psychology, org. behaviour	20	36.1	HR, org. psychology, org. behaviour	24	37.0	To management, psychology					
Marketing	30	30.2	Marketing	31	33.9	Marketing	44	33.4	Marketing, IB, strategy, information systems	65	32.5
Psychology	19	17.9	Psychology	19	18.5	Psychology	29	17.3	Psychology (+), regional, environment, transport, public admin (-)	75	12.9
Finance	16	24.9	Finance	16	24.4	Finance, Accting	26	27.5	Finance, accounting	34	24.6
Economics (periphery)*	20	17.7	Economics (periphery)*	26	17.6	Economics (periphery)*	28	15.6	To economics		
Information systems, IT	23	16.3	Information systems, IT, informatics	34	19.8	Information systems, IT, informatics	36	19.2	To marketing		
Regional, environmental studies	23	15.5	Regional, environmental studies, transport	31	14.1	Regional, environmental studies, transport	45	13.2	To psychology		
IR, work, labour	16	18.3	IR, work, labour, labour economics	28	15.3	To HR and Economics					
Energy, environment, agriculture	16	13.4	Energy, environment, agriculture	16	13.6	Energy, environment, agriculture	23	14.2	To psychology		
Public admin	18	9.9	Public admin	21	9.3	To psychology and econ peripheral					
Development	13	16.9	Development	12	15.7	Mainly to economics					

Transport	9	12.0	To regional								
Accounting	10	32.3	Accounting	10	32.3	To finance					
Labour econ.	8	15.4	To IR								
Technology, Ops Mgt	17	26.5	To management, econ, marketing								
Sociology, SME[2]	15	9.2	To management, regional, public admin								
Statistics	12	10.4	Spread around								
Informatics	9	8.1	To IS								
Economic history	11	10.9	Spread around								
Total	423			374			348			318	

[1]The economics split is discussed in the text

[2]SME is negatively loaded on to sociology

[3]In the results, the ordering of the groups was different but they have been shown here in alignment to make the comparison easier.

Table 4 Four Possible Sets of Sub-fields in Business and Management

Econ (core)	OR.	Strategy/Mgt	HR	Marketing	Psychology	Finance	Econ (periph)	IS/IT	Regional	IR/labour
EUR ECON REV	NAV RES LOG	**ADMIN** SCI QUART	J APPL J. APPL PSYCHOL	J MARKETING RES	PERS SOC PSYCHOL B	J FINANC QUANT ANAL	J ECON THEORY	MIS QUART	REG STUD ECON	IND RELAT
OXFORD B ECON STAT	EUR J OPER RES	ACAD MANAGE REV	J ORGAN BEHAV	J MARKETING	J PERS SOC PSYCHOL	J FINANC	GAME ECON BEHAV	J ASSOC INF SYST	GEOGR ENVIRON	BRIT J IND RELAT
IMF STAFF PAPERS	OPER RES ANN OPER RES	ORGAN SCI	PERS PSYCHOL	J ACAD MARKET SCI	J EXP SOC PSYCHOL	J FINANC ECON	EXP ECON	INFORM MANAGE-AMSTER	PLANN A URBAN	EUR J IND RELAT
BROOKINGS PAP ECO AC	OR SPECTRUM	ADV STRATEG MANAGE	J OCCUP ORGAN PSYCH	INT J RES MARK	PSYCHOL SCI	REV ECON STUD	REV ECON STUD	INFORM SYST RES	STUD J ECON	INT J HUM RESOUR MAN
EMPIR ECON J	IIE TRANS	STRATEGIC MANAGE J	J BUS PSYCHOL	EUR J MARKETING	EUR J SOC PSYCHOL	J ECON BEHAV ORGAN	J ECON BEHAV ORGAN	EUR J INFORM SYST	GEOGR INT J URBAN	PERS REV
MACROECON	COMPUT OPER RES	J MANAGE STUD	APPL PSYCHOL-INT REV	MARKET LETT	PSYCHOL BULL	J FINANC INTERMED	ECONOMETR ICA	J MANAGE INFORM SYST	REGIONAL ANN	IND LABOR RELAT REV
N REV ECON STAT	OPER RES LETT	ACAD MANAGE J	J OCCUP HEALTH	J BUS RES J SERV RES-US	GROUP PROCESS INTERG	J FINANC MARK	J FINANC MARK THEOR DECIS	INFORM SYST	REGIONAL SCI	INT J MANPOWER
ECON LETT	MANAGE SCI INFORMS J	ORGAN STUD AM J SOCIOL	PSYCH J OCCUP HEALTH PSYCH	J BUS-BUS MARK IND MARKET MANAG	ANNU REV PSYCHOL	J BANK FINANC	J PUBLIC ECON	J STRATEGIC INF SYST REG SCI	URBAN ECON	ECON IND DEMOCRAC Y
OPEN ECON REV	COMPUT J OPER RES SOC	ANNU REV SOCIOL	EUR J WORK ORGAN PSY	J CONSUM RES	PSYCHOL REV	FINANC MANAGE	J LAW ECON ORGAN	J INF TECHNOL COMMUN ACM	J URBAN ECON	J LABOR RES J WORLD BUS
SCAND J ECON	INTERFACES J	CALIF MANAGE REV	HUM PERFORM	J BUS IND MARK	BRIT J SOC PSYCHOL	J CORP FINANC	ECON THEOR RAND J	INFORM SYST J	ENVIRON	RELAT IND-IND RELAT
INT J FINANC ECON	SCHEDULIN G	AM SOCIOL REV	WORK STRESS	J RETAILING HARVARD	J APPL SOC PSYCHOL	J PORTFOLIO MANAGE	ECON SOC CHOICE	INFORM SYST MANAGE	PLANN D EUR PLAN	WORK EMPLOY
ECON J ECONOMICA	COMPUT IND ENG	HUM RELAT	J VOCAT BEHAV	BUS REV MIT SLOAN	J BEHAV DECIS MAKING	EUR FINANC MANAG	WELFARE J MATH ECON	INT J HUM-COMPUT ST	STUD EUR URBAN	SOC INT LABOUR
J ECON LIT	PROD PLAN CONTROL	INT J MANAG REV	RES ORGAN BEHAV	MANAGE REV	BRIT J PSYCHOL	J LAW ECON	INT J	REG STUD	SOC
ECON POLICY J MONETARY ECON	INT J PROD ECON	ACAD MANAGE	J INT MARKETING	J FUTURES MARKETS	J ECON MANAGE STRAT	ELECTRON COMM	REV INT POLIT	WORK
APPL ECON LETT	M&SOM-	PERSPECT	ORGAN RES METHODS	INT MARKET	SOCIOL METHODOL	MATH FINANC J RISK	SUPPORT	ECON J REGIONAL	OCCUPATIO N GENDER

STUD	MANUF	J INT BUS	ORGAN	REV	PERS INDIV	QUANT	UNCERTAI	SYST	SCI	WORK
NONLINEA R DYN E	SERV OP	STUD ORGANIZATIO N	BEHAV HUM DEC	PSYCHOL MARKET	DIFFER GROUP DYN-	FINANC	NTY J INST	BEHAV INFORM	J HOUS ECON	ORGAN NEW TECH
OXFORD ECON PAP	INT J PROD RES	ORGAN DYN	J MANAGE GROUP	MARKET SCI J	THEOR RES J EXP		THEOR ECON	TECHNOL J GLOB INF	ENTREP REGION	WORK EMPLOY
J MONEY CREDIT	OMEGA-INT J MANAGE S	J BUS VENTURING	ORGAN MANAGE	ADVERTISIN G	PSYCHOL- APPL		ECON PHILOS	MANAG INT J INFORM	DEV ENVIRON	
BANK	TRANSPORT SCI	LONG RANGE PLANN	INT J SELECT ASSESS	J INTERACT MARK	Q J EXP PSYCHOL		PUBLIC CHOICE	MANAGE INFORM SYST	PLANN C J REAL	
MANCH SCH INT ECON REV	PROD OPER MANAG	ENTREP THEORY PRACT	SMALL GR RES LEADERSHIP	J ADVERTISIN G RES	APPL COGNITIVE PSYCH		J ECON PSYCHOL INT REV	FRONT IEEE T SOFTWARE	ESTATE FINANC REAL	
SCOT J POLIT ECON	MATH OPER RES MATH	PRACT BUS ETHICS Q	QUART CAN J ADM	QME-QUANT MARK ECON			LAW ECON	ENG INTERNET RES	ESTATE ECON	
J INT MONEY FINANC	PROGRAM J OPER	J SMALL BUS MANAGE	SCI BRIT J GUID	J PUBLIC POLICY				INFORM SOFTWARE	J RURAL STUD	
SOUTH ECON J	MANAG EXPERT SYST	J BUS ETHICS BRIT J	COUNS GROUP DECIS	MARK SERV IND J				TECH IND MANAGE	TIME SOC NEW POLIT	
CAN J ECON J INT ECON	APPL EXPERT SYST	MANAGE J MANAGE	NEGOT	INT J MARKET RES				DATA SYST ACM T SOFTW	ECON CHINA	
ECON MODEL J POLIT ECON	J OPTIMIZ THEORY APP	INQUIRY INT BUS REV		INT J ADVERT SUPPLY				ENG METH	QUART	
J ECON PERSPECT	J APPL PROBAB	J ORGAN CHANGE MANAG		CHAIN MANAG						
APPL ECON ECONOMET J	IEEE T SYST MAN CY A	MANAGE LEARN		TOTAL QUAL MANAG BUS						
AM ECON REV	INT J COMPUT	ORGAN ENVIRON		TOURISM MANAGE						
ECON INQ J	INTEG M RELIAB ENG	ACAD MANAG LEARN EDU								
ECONOMET RICS ECONOMET	SYST SAFE									

REV									
CONTEMP ECON POLICY									
Q J ECON									
J EUR ECON ASSOC									
ECON REC									
MACROECON DYN									
OXFORD REV ECON POL									
FISC STUD									
WORLD ECON									
J ECON DYN CONTROL									
REV ECON DYNAM									
INT TAX PUBLIC FINAN									
J ECON SURV									
J POLICY MODEL									
S AFR J ECON									
REV WORLD ECON									
REV INCOME WEALTH									
J PROD ANAL									
AM J ECON SOCIOL									

KYKLOS DEFENCE PEACE ECON									

27

Energy	Public Admin	Development	Transport	Accounting	Labour	Technology	Sociology	Statistics	Informatics	Econ. History
RESOUR ENERGY ECON	PUBLIC ADMIN	ECON DEV CULT CHANGE	TRANSP ORT RES A-POL	ACCOUNT REV	J HUM RESOUR	RES POLICY	SOCIOL OGY	J AM STAT ASSOC	INFORM PROCESS MANAG	J ECON HIST
ENVIRON RESOUR ECON	PUBLIC MANAG REV	J DEV STUD	TRANSPORT REV	J ACCOUNT RES	LABOUR ECON	R&D MANAGE IND CORP CHANGE	SOCIOL REV SOC SCI MED	J R STAT SOC B	J AM SOC INF SCI TEC	ECON HIST REV
J ENVIRON ECON MANAG	POLIT STUD-LONDON	WORLD DEV WORLD BANK ECON REV	TRANSPORTAT ION	CONTEMP ACCOUNT RES	J LABOR ECON	INT J TECHNOL MANAGE	SOCIOL HEALTH ILL	ECONOMET THEOR	ANNU REV INFORM SCI	BUS HIST BUS HIST REV
LAND ECON	GOVERNANC E	J DEV ECON	TRANSPORT POLICY	J ACCOUNT ECON	J HEALTH ECON	TECHNOVATIO N	BRIT J SOCIOL	J BUS ECON STAT	J INF SCI	EXPLOR ECON HIST
ECOL ECON	ADMIN SOC	AGR ECON-BLACKWEL L	J TRANSP ECON POLICY	REV ACCOUNT STUD	HEALTH ECON	TECHNOL ANAL STRATEG	MILBANK Q	J R STAT SOC C-APPL	INFORM RES	ENTERP SOC HIST POLIT ECON
ENERG J	INT REV ADM SCI	WORLD BANK RES OBSER	TRANSPORT RES D-TR E	AUDITING-J PRACT TH	REV IND ORGAN	J IND ECON	ECON SOC SMALL BUS ECON	J FORECAST ING	INFORM SOC RES EVALUAT	CAMB J ECON
J AGR ECON	J PUBL ADM RES THEOR	J AFR ECON	J TRANSP GEOGR	ACCOUNT ORG SOC	J POPUL ECON	TECHNOL FORECAST SOC	J SOC POLICY	J APPL STAT	INTERACT COMPUT	EUR J HIST ECON THOU
AUST J AGR RESOUR EC	PUBLIC ADMIN REV	FOOD POLICY J COMP ECON	TRANSPORT RES B-METH	EUR ACCOUNT REV	ECON EDUC REV	IEEE T ENG MANAGE	CRIT SOC POLICY	J R STAT SOC A STAT		J POST KEYNESIAN EC
ENERG ECON	POLICY POLIT	ECON TRANSIT	TRANSPORT RES E-LOG	J BUS FINAN ACCOUNT		INT J IND ORGAN	INT SMALL BUS J	INT J FORECAST ING		J ECON ISSUES
J REGUL ECON	POLIT QUART	CHINA ECON REV		ABACUS		DECISION SCI	THEOR CULT SOC	FINANC STOCH		
ENERG POLICY	PUBLIC MONEY MANAGE	FEM ECON				J PROD INNOVAT MANAG	J EUR SOC POLICY	INSUR MATH ECON		
EUR REV AGRIC ECON	LOCAL GOV STUD					INT J OPER PROD MAN	HUM ORGAN	ASTIN BULL		
AM J AGR ECON	SOC POLICY ADMIN					J EVOL ECON	J LAW SOC			
J ENVIRON MANAGE	PARLIAMENT AFF					INF ECON POLICY				
RISK ANAL	J EUR PUBLIC					FUTURES				
MAR POLICY						TELECOMMUN				

	POLICY NONPROF VOLUNT SEC Q JCMS-J COMMON MARK S PUBLIC ADMIN DEVELOP				POLICY				

Table 5 Journals in the 22-Group configuration (note that the order of the list does not reflect the quality of the journals)

Our Groups:	Econ	OR.Ops	Strat/sociol/mgt	HR/org psych	Mkting	Psych	Finance	Econ 2	IS	Regional	IR/labour	Energy	Public admin	Development	Transport	Accounting	Lab econ	Technology	Sociology	Statistics	Informatics	Econ hist	All
ABS Groups																							
ACCOUNT																9				1			10
BUS HIST																						4	4
ECON	49							17		3		10		7			8	4		2		4	104
ENT-SBM			3							1									2				6
ETH-GOV			2										1						1				4
FINANCE	4						15			1						1				2			23
GEN MAN			9	2	2									1									14
HRM&EMP											15												15
IB&AREA			2							1	1		1	1									6
INFO MAN		4							23												7		34
INNOV																		3					3
MGT&EDU			2	1																			3
MKT					22																		22
OPS&TECH	1	10			2													3					16
OR&MAN SCI		16		1				1										1		6			25
ORG STUD			7	4		2																	13
PSYCH				14		16		1															31
PUB SEC	1			1						1			11						4				18
SECTOR		1			2							4	1	1	9			1					19
SOC SCI	1		3							16		1	3	3				4	8	1	1	3	44
STRAT			3				1	1										1					6
TOUR-HOSP	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
All	56	31	31	22	30	18	16	20	23	23	16	15	18	12	9	10	8	17	15	12	8	11	421

Table 6 Cross-Tab of 22 group solution with ABS groups (well-defined fields are highlighted in gray)

Journals not included in any group (isolates)	Journals that have loadings (>0.1) on 7 or more groups (inter-disciplinary
POST-COMMUNIST ECON	REV ECON STAT
J MANAGE ENG	J ECON PERSPECT
SYST RES BEHAV SCI	EXPERT SYST APPL
J CONSTR PSYCHOL	EXPERT SYST
J ORGAN BEHAV MANAGE	J SMALL BUS MANAGE
ANN TOURISM RES	HARVARD BUS REV
J SPORT MANAGE	J LAW ECON
NEGOTIATION J	J LAW ECON ORGAN
HUM FACTORS	RAND J ECON
J RISK INSUR	J ECON MANAGE STRAT
INNOV EDUC TEACH INT	J HUM RESOUR
TEACH HIGH EDUC	REV IND ORGAN
STUD HIGH EDUC	J IND ECON
BRIT J EDUC TECHNOL	INT J IND ORGAN
EUROPE-ASIA STUD	SMALL BUS ECON
J RISK RES	
SYST DYNAM REV	
SOCIOL TRAV	
POLICING	
SYST PRACT ACT RES	
ERGONOMICS	
BRIT EDUC RES J	
J ADV NURS	
J EDUC POLICY	
PHYSICA A	
GENEVA PAP R I-ISS P	
J HIGH EDUC	
IEEE T INF TECHNOL B	

Table 7 Journals that are isolated from others and journals that are inter-disciplinary

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