IMPORTANCE, COHESION, AND STRUCTURAL EQUIVALENCE IN THE EVOLVING CITATION NETWORK OF THE *INTERNATIONAL JOURNAL OF RESEARCH IN MARKETING*

Rik Pieters, Hans Baumgartner, Jeroen Vermunt and Tammo Bijmolt

September 1998

Rik Pieters is at the Department of Business Administration, Tilburg University, The Netherlands. Hans Baumgartner is in the Smeal College of Business, Pennsylvania State University, State College, U.S.A. Jeroen Vermunt is at the Methodology Department of the Faculty of Social Sciences and Research, Tilburg University, The Netherlands. Tammo Bijmolt is at the Department of Business Administration, Tilburg University, The Netherlands. Correspondence can be addressed to the first author (e-mail: F.G.M.Pieters@kub.nl).

IMPORTANCE, COHESION, AND STRUCTURAL EQUIVALENCE IN THE EVOLVING CITATION NETWORK OF THE *INTERNATIONAL JOURNAL OF RESEARCH IN MARKETING*

ABSTRACT

The citation network of the *International Journal of Research in Marketing (IJRM)* is examined from 1981 to 1995. We propose a model that contains log-linear and log-multiplicative terms to estimate simultaneously the importance, cohesion, and structural equivalence of journals in the network across time. Our findings show that the overall importance of *IJRM* in its network is low but growing. The importance of psychology journals in the network appears to be decreasing. Clear cohesive and structurally equivalent groups of core marketing, methodology, managerial and psychology journals with distinct functions in the network are identified. Recommendations for future citation research are offered.

JEL-code : M30, M31

Key words: Citation analysis, social networks, log-multiplicative models

INTRODUCTION

In social networks, actors engage in interactions to exchange valued resources. Citation networks are specific social networks in which the actors are journals, articles, or authors, the valued resources are ideas and knowledge, and the interactions are citations from one actor to other actors. The goal of citation analysis is to describe the citation network as a whole and to understand the influence and role of specific actors and groups of actors in the network.

The burgeoning of citation research has resulted in a growing management and marketing literature on the topic (e.g., Cote, Leong and Cote 1991; Jobber and Simpson 1988; Johnson and Podsakoff 1994; Leong 1989; Pecotich and Everett 1990; Zinkhan, Roth and Saxton 1992). Our study tries to build on this literature in three important ways.

First, previous citation research has emphasized a single aspect of networks or has examined various aspects independently. For instance, some studies have focused on the influence of specific journals (Jobber and Simpson 1988; Johnson and Podsakoff 1994), while others have described the relations between journals in terms of mutual citations (Hamelman and Mazze 1973; Leong 1989). A few studies have examined both the roles that journals play in their networks and their influence, but different methodologies were used to investigate these issues (Rice, Borgman and Reeves 1988; Zinkhan, Roth and Saxton 1992). This study examines citation networks with a unified methodology, as will be explained below.

Second, citation research has emphasized the study of networks at one particular point in time. This appears to be generally true in social network theory. Salancik (1995) points out that network research has underemphasized why a network looks the way it does, why it changes, and why it does not. Hoffman and Holbrook (1993) recently urged researchers to take the time dimension more explicitly into account and to investigate dynamic aspects of citation networks. This study examines a citation network across a period of 15 years.

Third, previous citation research has employed predominantly descriptive methodologies to examine networks. Usually, various indicators of citation activity are calculated and interpreted, but no statistical tests of model adequacy are reported. The work of Pecotich and Everett (1990) is an exception. In reviewing social network research in marketing, Iacobucci (1996) recommends that more work be conducted in which inferential instead of descriptive methodologies are used to investigate network structure and changes in structure over time. This

study applies log-linear and log-multiplicative analysis to examine a specific citation network over time.

Our analysis concerns the evolving citation network of the *International Journal of Research in Marketing (IJRM)* between 1981 and 1995. In an earlier citation analysis, Jobber and Simpson (1988, p. 139) indicated that two years after its birth, the number of citations that *IJRM* received from other journals "must be encouraging to its editorial board." In a follow-up study, Pecotich and Everett (1990, p. 202) argued that "new journals such as *International Journal of Research in Marketing* … will tend to grow in importance as they build up a body of published work." This study was spurred by these remarks to examine the development of *IJRM*'s importance in the marketing field and, more generally, to examine the evolution of *IJRM*'s citation network over time. In the next section, the aspects of *IJRM*'s citation network that we selected for study are introduced, together with the methodology to examine them.

IMPORTANCE, COHESION, AND STRUCTURAL EQUIVALENCE IN CITATION NETWORKS

Two questions that are frequently of interest in citation analysis are (1) how important are journals in their network, and (2) which journals in the network are similar to each other because of either strong mutual citation relationships or similar patterns of sending and receiving relationships. These questions and the issues that follow from them are addressed below.

Importance of journals

In the context of citation analysis a journal is important to the extent that it is cited by other journals. Journals that are cited frequently by other journals are a source of knowledge for others, and they play an important role in the diffusion of knowledge. Importance is sometimes called impact, influence, popularity or prestige in citation analysis (Jobber and Simpson 1988; Wasserman and Faust 1994).

The Social Science Citation Index (SSCI) measures journal impact as the average number of citations that an article in a journal receives. This index corrects for differences in the number of articles published, but otherwise is based simply on the raw number of citations received. Another measure of importance is based on the volume of unreciprocated relations in which an actor is involved (cf. Knoke and Burt 1982). For example, Rice, Borgman and Reeves (1988)

and Zinkhan, Saxton and Roth (1992) assessed journal importance as the ratio of the number of citations sent to the number of citations received. Several other measures of journal importance in citation networks have been proposed as well (Knoke and Burt 1982; Salancik 1986; Scott 1991; Wasserman and Faust 1994).

Cohesion and structural equivalence of journals

Journals can be similar either because they cite each other frequently or because they have a similar pattern of sending and receiving relationships with other journals. In the former case we speak of cohesion, in the latter case of structural equivalence (Burt 1983).

Cohesion is based on the exchange of citations between journals. Journals that cite each other frequently form cohesive groups or cliques that cover a specific content area or domain of expertise. Previous research has explored cohesion between communication journals (Rice, Borgman, and Reeves 1988), between journals in the citation network of the *Journal of Consumer Research* (Zinkhan, Saxton and Roth 1992), and between journals in the citation network of the *International Journal of Research in Marketing* (Pecotich and Everett 1990; see also Everett and Pecotich 1991; Everett 1994), among others.

Structural equivalence is based on the pattern of sending and receiving relationships with other journals. Journals that cite the same journals or that are cited by the same journals but that do not cite each other are structurally equivalent, but not cohesive. Since two journals may have a similar pattern of citing other journals but a different pattern of being cited by other journals (or the other way around), structural equivalence in sending and in receiving citations should be examined separately. Journals with a similar pattern of citing other journals draw from the same "source" journals (i.e., they build on a similar knowledge base). Journals with a similar pattern of being cited by other journals are a source of knowledge for the same "destination" journals. An analysis of structural equivalence is sometimes called a positional analysis (Burt 1983) because it identifies journals that are similar or equivalent in their position as senders or receivers in the citation network. Rice, Borgman and Reeves (1988) examined structural equivalence in a citation network of communication journals. Doreian (1985, 1988; Doreian and Fararo 1985) analyzed structural equivalence in citation networks of psychology, geography, and sociology journals. To our knowledge, structural equivalence has so far not been examined in marketing citation networks, and cohesion and structural equivalence have not been examined

simultaneously in citation analysis. Moreover, previous research has predominantly used descriptive methodologies, such as MDS and cluster analysis, to explore cohesion and structural equivalence.

Evolution of citation networks

Evolution in the importance, cohesion, and structural equivalence of journals in citation networks has received limited attention to date. The few studies exploring network evolution have emphasized changes in journal importance. For example, Rice, Borgman and Reeves (1988) examined changes in the importance of communication journals between 1977 and 1985. Few studies have investigated changes in cohesion and structural equivalence across time explicitly (see Doreian 1988 for some initial work).

In the next section we introduce our methodology to examine importance, cohesion and structural equivalence in *IJRM*'s evolving network from 1981 to 1995.

EXPLORING JOURNAL IMPORTANCE, COHESION, AND STRUCTURAL EQUIVALENCE OVER TIME

Citation data are commonly gathered in a sociomatrix, a square matrix in which the cell entries denote the number of citations that a particular row-journal sends to a particular column-journal. Citations in a network are directional because citations from journal A to journal B differ from citations from journal B to journal A. The diagonal of the citation matrix contains citations from the journal to itself (i.e., self-citations). If the network is examined over time, multiple citation matrices are available.

To explore journal importance, cohesion and structural equivalence over time, we propose a time-heterogeneous log-multiplicative model that is presented in equation 1. After introducing the components of the model, their use in our citation analysis of *IJRM* is explained.

$$(\log F_{ijk})z_{ijk} = u + u_i^S + u_j^R + u_k^P + u_{ik}^{SP} + u_{jk}^{RP} + \delta_{ijk} + \sum_{m=1}^{M} \xi_{ik}^m \psi_k^m \xi_{jk}^m + \sum_{n=1}^{N} \mu_{ik}^n \phi_k^n \nu_{jk}^n \qquad (1)$$

The model is specified for the three-way citation matrix formed by the variables *S*, *R*, *P*, with *S (i = 1, …, s)* for *Sending* citations as the row variable, *R (j = 1, …, r)* for *Receiving*

citations as the column variable, and P $(k = 1, \ldots, p)$ for *Period* as the grouping variable. S and R form a square citation matrix of dimension $L = s \times r$, and P denotes the number of time periods under investigation (i.e., the number of citation matrices available).

The term F_{ijk} denotes the expected cell frequency, and z_{ijk} is a weight vector. The weight vector ensures that structurally zero cells do not influence the results of the analyses, as will be explained below. The u terms in the model are standard log-linear parameters. They are identified with effect coding, expressing them as deviations from the average effect: $\Sigma u = 0$, $\Sigma u^2 = 1$. The parameter δ_{ijk} estimates the effects of self-citations in the diagonal of the citation matrices (i.e., $\delta_{ijk} = 0$ for $i \neq j$ and free otherwise). By estimating separate parameters for the diagonal elements of the matrices, we ensure that self-citations do not influence estimates of the importance, cohesion and structural equivalence of journals.[1] The term $\Sigma\xi\psi\xi$ denotes a symmetric log-multiplicative term, and $\Sigma\mu\phi\nu$ denotes an asymmetric log-multiplicative term (Clogg and Shihadeh 1994; Goodman 1979, 1991). We will now explain the various terms in equation 1 in more detail.

Exploring importance

The log-linear parameters in the model provide information about the importance of journals in the citation network. Importance of journals is indicated by the number of citations received from other journals in the network, and the log-linear parameters that model the column effects in the citation matrices express this (cf. Iacobucci and Wasserman 1988). The u^R parameter assesses average journal importance across all time periods. This is in line with Pecotich and Everett (1989) who assessed journal importance in a single time period with log-linear parameters of the column effect as well (see also Everett and Pecotich, 1991, and Everett, 1994). The u^{RP} parameter in the model for the column-by-grouping interaction expresses period-specific deviations of journal importance from the average importance across all time periods (see the discussion of evolution later in this section). The sum of u^R and u^{RP} indicates the importance of each journal in each time period P.

Exploring cohesion and structural equivalence

Equation 1 contains a symmetric and an asymmetric log-multiplicative term (Goodman 1991; Clogg and Shihadeh 1994) to model respectively the cohesion and the structural equivalence of journals in the citation network. The terms are particular restricted interactions that model the similarity in sending and receiving relationships in the citation network over time. Specifically, the two-variable interaction of *S* and *R* and the three-variable interaction of *S*, *R* and *P* are restricted as follows:

$$u_{ij}^{SR} + u_{ijk}^{SRP} = \sum_{m=1}^{M} \xi_{ik}^{m} \psi_{k}^{m} \xi_{jk}^{m} + \sum_{n=1}^{N} \mu_{ik}^{n} \phi_{k}^{n} \nu_{jk}^{n} \qquad (2)$$

The asymmetric log-multiplicative term, $\Sigma\mu\phi\nu$, is the product of three sources (ignoring the period subscript k for the moment): (1) an intrinsic level of association in the *n*-th dimension, ϕ^n, (2) the row score of journal i in the *n*-th dimension, μ_i^n, and (3) the column score of journal j in the *n*-th dimension, ν_j^n. Essentially, the log-multiplicative term scales the row and column scores of the citation matrix in order to produce the largest possible linear-by-linear interaction between *S* and *R*. For $N > 1$ (or $M > 1$) multiple dimensions of association are allowed to account for the association between *S* and *R*. Row and column scores are identified by fixing their mean to 0 and their standard deviation to 1. Furthermore, the scores in different dimensions are restricted to be orthogonal. The symmetric log-multiplicative term, $\Sigma\xi\psi\xi$, is a special case of the asymmetric term in which the row and column scores are specified to be the same.

In our model, cohesion between journals is captured by the term $\Sigma\xi\psi\xi$. Journals with similar scores on the symmetric term will be cohesive, and journals with different scores will not be cohesive. To illustrate how the symmetric log-multiplicative term models cohesion, we will show how the scores of journals reproduce the appropriate citation matrix. Consider the following simple example involving four journals (i.e., $s = r = 4$), one period (i.e., $p = 1$) and one dimension (i.e., $M = 1$). Assume that the scores of the four journals on the symmetric component are: $\xi' = [\ -.45\ -.40\ .20\ .30]$ and that the intrinsic association is $\psi = 40$. The scores on the symmetric term indicate that journals 1 and 2 (respective scores -.45 and -.40) are cohesive, and

that journals 3 and 4 are cohesive (respective scores .20 and .30), and that journals 1 and 2 entertain little to no citation relationships with journals 3 and 4.

The citation matrix that is implied by this specification (which is obtained by multiplying out $\psi\xi\xi'$, exponentiating each matrix element and rounding to the nearest integer) is given by:

$$\begin{bmatrix} 3294 & 1339 & 0 & 0 \\ 1339 & 602 & 0 & 0 \\ 0 & 0 & 5 & 11 \\ 0 & 0 & 11 & 37 \end{bmatrix} \tag{3}$$

Inspection of the matrix shows that it has expected properties. First, all citation relationships are symmetric, as required. Second, there are two cohesive subgroups or cliques of journals that are connected by strong mutual citation relationships (cf. Burt 1983; Rice et al. 1988). The first clique consists of journals 1 and 2, and the second clique contains journals 3 and 4. The journals in each clique cite each other heavily, but the two cliques do not communicate with each other. Thus, the cohesion of journals can be assessed by comparing their scores in ξ.

In our model, structural equivalence between journals is captured by the asymmetric log-multiplicative term $\Sigma\mu\phi\nu$. Consider again a simple example involving four journals, one period and one dimension. Assume that μ' = [-.45 -.35 .20 .35], ν' = [-.55 .50 -.40 .40], and φ = 30. The row scores indicate that both journals 1 and 2, and journals 3 and 4 have a similar pattern of sending citations in the network. The column scores indicate that both journals 1 and 3, and journals 2 and 4 have a similar pattern of receiving citations from the network. The citation matrix implied by this specification is given by:

$$\begin{bmatrix} 1677 & 0 & 221 & 0 \\ 322 & 0 & 67 & 0 \\ 0 & 20 & 0 & 11 \\ 0 & 191 & 0 & 67 \end{bmatrix} \tag{4}$$

Inspection of the citation matrix shows that the journals in the network are generally not connected by cohesive bonds (with the possible exception of journals 2 and 3). However, some

of the journals have very similar patterns of citation relationships with other journals. Specifically, journals 1 and 2 both cite journals 1 and 3 heavily but do not cite journals 2 and 4. The opposite pattern characterizes the sending relationships of journals 3 and 4. Furthermore, journals 1 and 3 are cited heavily by journals 1 and 2 and not at all by journals 3 and 4. The opposite is true for the receiving relationships of journals 2 and 4. Journals 1 and 2 on the one hand and journals 3 and 4 on the other hand have structurally equivalent sending relationships with other journals, while journals 1 and 3 on the one hand and journals 2 and 4 on the other hand have structurally equivalent receiving relationships (cf. Burt 1983; Rice et al. 1988). Thus, the structural equivalence of journals can be assessed by comparing their scores in μ and ν.

The use of log-multiplicative terms in our model has important advantages over alternative model formulations. Compared to log-linear formulations, log-multiplicative formulations require significantly fewer parameters. For example, degrees of freedom for the symmetric log-multiplicative term are $(S - M)(R - M - 1)$, with M for the number of dimensions required. In a single dimension, this would leave 6 *df* for the 4 x 4 matrices provided earlier. A log-linear formulation of cohesion would require parameters for each of the $s(s-1)/2$ dyadic relations between journals in the matrices in addition to the row and column parameters, which would leave 0 *df* for a 4 x 4 matrix. Another advantage over log-linear terms is that log-multiplicative terms have attractive geometric properties that allow graphical presentations of their results (row and column scores) (Goodman 1991; Clogg and Shihadeh 1994). This is particularly useful when large matrices are examined, as is usually the case in citation analysis.

An advantage over descriptive methodologies in citation research such as MDS and cluster analysis, is that log-multiplicative formulations allows tests of model adequacy. Finally, log-multiplicative terms allow a simultaneous analysis of cohesion and structural equivalence in a single framework, where previous research has usually applied multiple methodologies sequentially.

Exploring evolution

The model in equation 1 examines evolution in journal importance, cohesion and structural equivalence. Evolution in importance is modeled through the log-linear interaction parameters between receiving citations and time period, u^{RP}. The relative magnitude of these effects over time can be used to track changes in the importance of journals in the network.

To examine evolution in journal cohesion and structural equivalence, the two multiplicative terms are specified as conditional or multi-group terms (Clogg and Shihadeh 1994). This is indicated by the subscript *k* in the row and column scores, and in the intrinsic levels of association in equations 1 and 2. The subscript *k* indicates the number of time periods under study. Equation 1 offers the most general model formulation, in which separate intrinsic levels of association and separate row and column scores are estimated for each time period. To examine more specific hypotheses about evolution in cohesion and structural equivalence, the row and column scores, and the intrinsic levels of association can be restricted to be stable across time (Clogg and Shihadeh 1994). In addition, the intrinsic level of association can be modeled as a (linear or higher-order) function of time as in regression analysis (cf. Luijkx 1994). In the results section, specific restricted versions of the model in equation 1 will be estimated to examine evolution of the citation network over time.

When a citation network is tracked over time, not all journals may be present at all times. Over time new journals may enter the network and existing journals may exit the network. If a journal enters the network late, the row and column marginals of the journal in the earlier time periods are zero. Yet, unlike observed zeros which occur when an existing journal does not send or receive citations, zero cells of journals that enter late in the network are structurally zero. Likewise, journals that exit the network before the end of the observation period cannot send citations to other journals in the network. After exiting, these journals have structurally zero row marginals in the citation matrix. Of course, one could examine only the journals that are present during the whole time period under study. Yet that might seriously reduce the number of journals in the sample, and it might lead to biased conclusions about the importance, cohesion and structural equivalence of present and absent journals. The model in equation 1 allows journals to have structural zeros in one or more time periods. It accommodates structural zeros in the citation network by applying a weight vector, z_{ijk}, to the log-frequency term (cf., Clogg and Eliason 1987). The weight vector ensures that estimated frequencies of structural zeros are actually zero.

In summary, the proposed model examines the importance, cohesion, and structural equivalence of journals in a citation network simultaneously, and it allows explorations of the evolution of the network over time. The model takes self-citations into account, and it accommodates journals that enter the network late or exit from it early. The log-multiplicative

parameters can be displayed graphically, which facilitates the identification of cliques of cohesive and groups of structurally equivalent journals in the network.

Estimation and model selection

To examine evolution in journal importance, cohesion, and structural equivalence, nested versions of the model in equation 1 are examined. All models are estimated with *ML*, using the program *LEM* (Vermunt 1997). Degrees of freedom for the models are obtained by *df* = number of non-zero fitted cells – number of estimable parameters (Clogg and Eliason 1987).

Model selection is based on the difference in the likelihood-ratio chi-square (L^2) between nested models, and on the absolute value of the Bayesian Information Criterion (*BIC*) (Long 1997; Vermunt 1997). Differences in the L^2 of nested models indicate the contribution of specific terms or the effect of restrictions on the model. The *BIC* is a conditional information index that compares the tested model with the saturated model. In the context of log-linear and log-multiplicative models, it is calculated as $BIC = L^2 - logN\ df$, where N is the number of observations and *df* is the degrees of freedom. The lower the value of *BIC*, the more information a particular model contains, relative to the number of parameters it requires. If *BIC* is smaller than 0, the estimated model is more likely than the saturated model.

In the next section the sample of journals in *IJRM*'s citation network and other methodological details are described. Then, estimation results are offered.

METHOD

Most citation data were collected from the Journal Citation Reports of the Social Science Citation Index (SSCI). The International Journal of Research in Marketing (*IJRM*) was not included in the SSCI Journal Citation Reports until 1996. Hence, all citations from *IJRM* to the other journals and vice versa were counted by examining the reference lists of all articles published in the journals across the selected periods.

Sampling of journals for this study was done as follows. First, journals were selected that were consistently sampled in previous studies of citation networks in marketing (e.g., Jobber and Simpson 1988; Leong 1989; Zinkhan, Roth and Saxton 1992). Second, four volumes of *IJRM* (1984, 1987, 1990 and 1993) were consulted and the number of citations that *IJRM* made to other journals were counted. Journals which were cited frequently by *IJRM*, but which had not

been included in the first selection step, were added to the list. This led to the selection of a final set of twenty journals that comprise *IJRM*'s core citation network.

The sample contains, in addition to *IJRM*, the following 19 journals (in alphabetic order): Econometrica (*Eco*), European Journal of Marketing (*EJM*), Harvard Business Review (*HBR*), Industrial Marketing Management (*IMM*), Journal of Advertising (*JA*), Journal of Advertising Research (*JAR*), Journal of Business Research (*JBR*), Journal of Consumer Research (*JCR*), Journal of Experimental Social Psychology (*JESP*), Journal of Marketing (*JM*), Journal of Marketing Research (*JMR*), Journal of the Market Research Society (*JMRS*), Journal of Personality and Social Psychology (*JPSP*), Journal of Retailing (*JR*), Management Science (*ManS*), Marketing Science (*MarS*), Psychological Bulletin (*PB*), Psychological Review (*PR*), and Psychometrika (*Psy*).

Citation data were collected from 1981 to 1995. To control for annual fluctuations in citation incidence, five three-year time periods were examined by pooling the yearly data: 1981-1983, 1984-1986, 1987-1989, 1990-1992, and 1993-1995. For each time period a 20 x 20 citation matrix was constructed, with the sampled journals in both rows and columns and with the number of citations that a row-journal makes to a column-journal in a particular time period in the cells of the matrix. Since the first complete volume of *IJRM* appeared in 1984, the journal is absent from the first time period. This allows us to examine the evolution of the marketing network under study after the introduction of *IJRM*. The row and column entries for *IJRM* in the citation matrix of the first time period are structurally zero.

RESULTS

Citations in *IJRM*'s network

In Table 1, the total number of citations that each journal sends to (S) and receives from (R) the other journals in the network in each time period is indicated, as well as the number of self-citations of each journal (D).

*** Insert Table 1 about here ***

Across the four relevant time periods that *IJRM* was included in the network, the journal sent 41% of all its citations inside the network of 20 journals. This is high but as expected

because sampling was partly based on *IJRM*'s citation relationships. The remaining citations were sent to a wide range of journals. Adding extra journals to the network would increase the number of citations captured by the network only minimally. Other marketing journals sent comparable, but somewhat lower, percentages of their citations inside the network: Journal of Marketing (*JM)* 35%, Journal of Marketing Research (*JMR)* 38%, Journal of Consumer Research (*JCR)* 34%. The psychology, management and economics journals sent the lowest percentages to other journals in the network. For example, in 1995 Psychological Review and Psychological Bulletin sent 10% and 14%, respectively, to other journals in the network, mostly to other psychology journals. The absolute number of citations that *IJRM* receives is low, but the figures have risen sharply over time, from a single one in the second time period to 109 in the fifth time period.

The number of self-citations varies widely across journals. For instance, *JMR* had 674 self-citations in the last time period, 24% of the number of citations it received from other journals in the network, while *JCR* had 1123 self-citations, 62% of the number of citations received from other journals in the network. This illustrates the importance of controlling for self-citations in the network.

.

Accounting for citation patterns in *IJRM*'s network

Nested versions of the model in equation 1 are estimated to examine importance, cohesion, and structural equivalence in the network over time. First, importance, cohesion, and structural equivalence are modeled with time-homogeneous, log-multiplicative terms (models 1 to 10), then evolution in the log-multiplicative terms (and in self-citations) is taken into account as well (models 11 to 13). Fit indices for the various models are presented in Table 2. Notation in Table 2 follows Clogg and Shihadeh (1994) and Vermunt (1997).

*** Insert Table 2 about here ***

Models 1 to 3 serve as a baseline for comparisons with other models. Model 1 is the independence model in which the Sending (S), Receiving (R) and Time Period (P) variables are assumed to be unrelated. Both L^2 (254654, with df = 1918) and *BIC* (232165) indicate that the assumption of independence is not justified. Apparently, citations from and to other journals in

the network are not random. Model 2 examines the interaction effects of Sending with Time Period (SP) and Receiving with Time Period (RP). This model is significantly better than model 1, which means that significant differences exist in how journals send and receive citations over time and that it is worthwhile to examine the evolution of the network. Yet, in absolute terms model 2 is still unsatisfactory. Model 3 includes the interaction between Sending and Receiving (SR). It is a significant improvement over model 2, as shown by the large decrease in L^2 and by the negative and low value of *BIC* (–10659). This indicates that the pattern of sending and receiving relationships between journals in the network is highly systematic. While model 3 fits the data well, it provides little insight into the pattern of communication between journals, and it needs a large number of additional parameters (difference in *df* between models 2 and 3 = 361).

Models 4 to 10 attempt to account for the association between Sending and Receiving found in Model 3 in more parsimonious and theoretically interesting ways. Model 4 is the quasi-independence model. It examines the independence of Sending and Receiving (S, R) after the information in the main diagonal of the citation matrix has been accounted for. The difference in fit between model 2 and 4 indicates that a significant part of the interaction between Sending and Receiving is due to self-citations (i.e., the difference between models 4 and 2 is L^2= 147165, *df* = 20, *BIC* = 146930). Still, model 4 does not fit the data adequately in an absolute sense. Apparently, Sending and Receiving are not quasi-independent.

Models 5 to 10 introduce symmetric and asymmetric log-multiplicative terms. Fit indices are presented in Table 2. Model 5 adds a time-homogenous, symmetric log-multiplicative term in one dimension to Model 4. Model 6 adds a time-homogeneous, asymmetric log-multiplicative term in one dimension to Model 4. In Table 2, RC(1) denotes a log-multiplicative term in one dimension, and 6a and 5a indicate that the term is symmetric time-homogeneous, or asymmetric time-homogeneous, respectively. Subsequent models introduce symmetric and asymmetric terms simultaneously and increase the dimensionality of the log-multiplicative term to 2. Inspection of the table shows that with the addition of each successive term and dimension, the fit of the model improves. The final model (Model 10) contains a two-dimensional symmetric term and a two-dimensional asymmetric term. The fit of this model relative to the number of required parameters is very good as indicated by a *BIC* value that is lower than that of the benchmark model 3. Hence, it is chosen as the starting point for exploring the evolution of the network.

In Model 10, the log-linear terms model evolution in journal importance (RP), but the log-multiplicative terms that model cohesion and structural equivalence are time-homogenous. They account for the interaction between Sending and Receiving (SR), but no attempt is made to represent the evolution of cohesion and structural equivalence in the citation network. Models 11 to 13 examine evolution in the citation network further by introducing time-heterogeneous log-multiplicative terms. In all three models, the diagonal parameters are allowed to vary freely over time (DP in Table 2) to account for heterogeneity in self-citations.

Model 11 is the most general model. Changes in the citation network across the five time periods are represented by time-heterogeneous symmetric and asymmetric log-multiplicative terms in two dimensions. In this model, both the level of intrinsic association (ψ, ϕ) and the row and column scores of the journals are allowed to vary freely over time. If this proved to be the best model, it would imply that *IJRM*'s citation network is different in each time period, and that it is fundamentally incomparable across time. On the practical side, the results from the model would be difficult to interpret because of the large number of parameters required. Inspection of Table 2 shows that Model 11 has a good fit in terms of L^2 but that it uses up many degrees of freedom (528 more than Model 10). As a result, its *BIC* is worse than that of Model 10, which does not model evolution in the network at all. Model 11 is not the best model.

Model 12 contains partially heterogeneous log-multiplicative terms. The model restricts the scores of the journals to be homogeneous over time, but it allows the levels of intrinsic association to vary freely across the five time periods. The *BIC* value indicates that Model 12 is better than Model 11 or any previous model. This result is of substantive interest because it implies that the relative distances between the scores of the journals in *IJRM*'s network are essentially similar across the five time periods. This means that the network is comparable over time and stable in its basic structure.

Model 13 examines linear trends in the intrinsic levels of association over time, specifically $\varphi_k = \varphi_0 + \varphi_1 * k$ (cf. Luijkx 1994; Vermunt 1997). Inspection of Table 2 shows that this model is an improvement over Model 12 in terms of its *BIC* value. The *BIC* of model 13 is the lowest of all models (–10927). Also, the L^2 of model 13 is 3% of the L^2 of model 1, the independence model. Hence, it accounts for 97% of the total amount of non-independence or association that is present in the *SRP*-matrix. Based on these results, model 13 is chosen as the final model, and we examine its substantive results next.

Importance of journals in *IJRM*'s network

In Table 3 the importance of journals in each of the five time periods is presented. The last column contains the mean importance scores across the five time periods. Journal importance in each time period is the sum of the overall importance and deviation per time period ($u^R + u^{RP}$) based on Model 13. The parameters are scaled such that the sum of the importance scores across journals is zero for each time period. Thus, a value of zero indicates that the importance of a journal is the average in that period. Negative values indicate lower than average importance, positive values indicate higher than average importance.

*** Insert Table 3 about here ***

Inspection of Table 3 indicates that across the entire 15-year period the most important journals in the network were Journal of Marketing Research (*JMR*: 2.70), Journal of Personality and Social Psychology (*JPSP*: 2.19), Journal of Consumer Research (*JCR*: 1.97), Journal of Marketing (*JM*: 1.84), and Psychological Bulletin (*PB*: 1.63). The least important journals in the network were International Journal of Research in Marketing (*IJRM*: –2.78), Marketing Science (*MarS*: –2.61), European Journal of Marketing (*EJM*: –2.35), and Journal of the Market Research Society (*JMRS*: –1.82).

Table 3 identifies several journals with steep growth paths over time. The importance of the International Journal of Research in Marketing (*IJRM*) has grown substantially from –5.09 in the period 1984-1986 to –1.06 in the period 1993-1995. Although the importance of *IJRM* in the final time period is still lower than average, it is already higher than that of *EJM*, *JA*, *JMRS*, and *IMM*. Marketing Science (*MarS*) experienced the most dramatic growth from –14.04 in 1981-1983 to .74 in 1993-1995. The very low importance of Marketing Science in the period 1981-1983 is partially due to the fact that the journal was established in 1982, in the middle of the period, and hence was zero times until 1983 (see Table 1).

Table 3 also shows that the importance of non-marketing journals in the network has decreased over the years, notably the importance of Management Science (*ManS*), Psychometrika (*Psy*), Econometrica (*Eco*), Journal of Personality and Social Psychology (*JPSP*), Psychological Review (*PR*) and Psychological Bulletin (*PB*). Still, even in the final time period

the importance of non-marketing journals, in particular of psychology journals, in this citation network remains high.

Cohesion of journals in *IJRM*'s network

In Table 4, the row and column scores of the journals for the symmetric and asymmetric log-multiplicative terms are presented, and in Figures 1 to 3 they are displayed graphically.

*** Insert Table 4 and Figures 1 to 3 about here ***

Figure 1 is a two-dimensional representation of the cohesion of journals in the network. It shows clear cliques of mutually citing journals. The first (horizontal) dimension distinguishes psychology journals, located at the right of the plot, from business/economics journals, located towards the left of the plot. The second (vertical) dimension differentiates methodological/ formal journals, located at the top of the plot, from substantive/empirical journals, located towards the bottom of the plot.

Closer inspection shows a clique of marketing journals slightly to the left of the middle, including *JMR*, *JCR*, *IJRM*, *JMRS*. In the lower left portion of the plot, the management-oriented journals cluster together (*JBR*, *HBR* and *EJM*). In the upper part of the plot, the method-oriented Management Science and Econometrica form a clique, and the two form a looser cluster with Marketing Science and Psychometrika, as judged from their relative closeness. On the right side of the plot, the psychology journals form a loose cluster (*PR*, *PB*, *JESP*, and *JPSP*). It is apparent from Figure 1 that, despite its relatively low importance in the network, *IJRM* entertains mutual citation relationships with core marketing journals.

Structural equivalence in *IJRM*'s network

Figure 2 displays structural equivalence in the sending patterns of journals in the network. In the middle of the plot there is a tight cluster of journals that have a similar pattern of citing other journals. These journals apparently draw from the same journals as sources for their knowledge. In the periphery of the plot, journals are located that have a deviating pattern of sending relationships in the network. They either draw much less from the journals in the network, or they draw from different journals in the network.

The first (horizontal) dimension distinguishes the only economics journal in the network, Econometrica (*Eco*), located on the left side of the plot, from two psychology journals (*JESP*, *JPSP*), located on the right side of the plot. Econometrica sends almost no citations to other journals in the network (only 8 between 1993 and 1995, see Table 1). The psychology journals send many citations to other journals in the network, but mainly to other psychology journals and not to the marketing journals. Similar to the marketing journals, Psychological Bulletin (*PB*) and Psychological Review (*PR*) send many citations to *JPSP* and to *JESP*, so they are located closer to the marketing journals in the plot.

The second dimension distinguishes three marketing and management journals (*IMM*, *JAR*, *JA*) that are oriented towards knowledge-transfer, at the bottom of the plot, from journals (*Psy*, *Eco*, *JPSP*, *JESP*) that are oriented towards knowledge-development, at the top of the plot. The sending pattern of the three journals at the bottom differs substantially from the other journals. For instance, in the period 1993-1995 *IMM* cited *EJM* 38 times, which is 45% of the total number of citations *EJM* received in that period. *JAR* made 124 citations to *JA* in the same period, whereas only few journals cite *JA* extensively.

Figure 3 displays structural equivalence in the receiving patterns of journals in the network. A different picture emerges here. The first (horizontal) dimension separates different business journals and distinguishes journals with a macro/organizational focus (*Eco*, *ManS*, *HBR*, *EJM*, *IMM*, *MarS*), located on the left, from journals with a micro/individual focus (*JA*, *JAR*, *JCR*). The second (vertical) dimension separates different psychology journals and differentiates methodology, at the top (*Psy*), from theory, at the bottom (*JPSP*, *JESP*). Journals that are close to each other in the plot receive citations from the same journals. For instance, compared to the other journals Management Science (ManS) and HBR, which are close together in the plot, receive a substantial portion of their citations from IJRM, JBR, and EJM.

Table 4 shows that for both cohesion and structural equivalence the first dimension dominates the solution, as indicated by the magnitude of the intrinsic levels of association of the first dimension relative to the second dimension. It is apparent that the psychology journals and the other journals form relatively close cliques of journals that cite each other frequently. The intrinsic association of the first dimension for cohesion has increased over time (.72), and the intrinsic association of the second dimension has decreased (-.49). This indicates that over time the cliques of psychology journals on the one hand and of business and economics journals on

the other hand have become tighter and more separated from each other, while the distinction between methodological/formal journals and substantive/empirical journals has become less pronounced . Table 4 also shows that over time the patterns of sending citations (3.42) and receiving citations (2.38) have become more clearly distinguishable. In other words, economics and psychology have become even more separated from the core marketing and management journals in their pattern of citing, and being cited by, other journals.

CONCLUSION

We have offered a methodology comprising log-linear and log-multiplicative terms to examine simultaneously the importance, cohesion and structural equivalence of journals in citation networks over time. The methodology accommodates partially missing journals, it allows tests of model adequacy, and it enables graphical presentations of the results.

Application of the methodology to the evolving citation network of the *International Journal of Research in Marketing* led to several interesting results. We observed clear differences in the importance of journals in *IJRM*'s citation network, a distinct structure in the cohesion and structural equivalence of journals, and interesting changes over time. Tight cliques of journals that mutually cite each other were found, in particular cliques of psychology journals, methodological/formal journals, managerial journals, and core marketing journals. Within cliques the incidence of reciprocating each other's citations is high, and between cliques it is lower. Also, the analyses identified journals with distinct roles or positions in the citation network. For example, some journals play the role of feeder journals (e.g., Econometrica, Psychometrika, and the psychology journals), and other journals are more oriented towards knowledge-transfer than knowledge-development (e.g., Industrial Marketing Management, Journal of Advertising Research, and Journal of Advertising). These patterns of cohesion and structural equivalence would be difficult to discern by inspecting 5 matrices of 20-by-20 journals, or by applying various methodologies in sequence (e.g., Pecotich and Everett 1990; Zinkhan, Roth and Saxton 1992).

The International Journal of Research in Marketing appears to be progressing toward a position among the preferred journals in the marketing network, albeit at a slower pace than some scholars expected directly after its start (Jobber and Simpson 1988; Pecotich and Everett

1990). *IJRM* is positioned almost exactly at the center of the marketing network, with connections to the key journals.

Our analyses indicate that the marketing field as a whole is maturing, and that it is becoming an independent field of inquiry. Marketing journals become more important in the network and non-marketing journals become less important. While psychology and economics remain important feeder disciplines, the cohesion of marketing journals in terms of the frequency mutual citations has been on the increase.

Discussion

The citation network under study is journal-centric because *IJRM* is the focus, and only journals which are most intensely engaged in citation relationships with *IJRM* are examined. Hence, results are conditional upon the specific journals selected. If another marketing journal had been focused upon, some currently present journals might not have been sampled, while some currently absent journals might have been included. As a result, the importance, cohesion and structural of journals in the citation network might change somewhat. The classic network literature assumes that the network under study is closed, that is, it includes all actors. Examining closed networks in consumer and industrial markets is already quite difficult, from a data collection and analysis viewpoint. Examining complete citation networks is virtually impossible for most domains of academic inquiry, due to the large number of journals that entertain at least some citation relationship with each other. Despite such considerations, the results of this study should be interpreted within the confinements of the present network (i.e., matrix-conditional).

In our model log-linear parameters of the columns in the citation matrix indicate journal importance. Because the column parameters are estimated simultaneously with other parameters in the model, they estimate journal importance while "controlling" for other effects. This procedure corrects for the number of citations that journals send in the network. Hence, it is similar in spirit to indicators of net importance as used, for example, by Zinkhan, Roth and Saxton (1992). The validity of our measures is supported by their correlation with the Social Science Citation Index (SSCI) impact scores. Recall that the SSCI impact scores measure the average number of citations that an article in a journal receives, and journals differ in the number of articles they publish per year. Despite differences in calculation and in the number of journals

involved in the calculations, the correlation between the SSCI impact score across the entire time period and our mean importance scores of journals is .541 (n = 20; significant at $p < .02$). Still, alternative measures of importance in social networks exist (Iacobucci 1996; Salancik 1986; Wasserman and Faust 1994), and applying them may lead to somewhat different results than those obtained here.

Future Research

Follow-up studies could track *IJRM*'s citation network in the future, by adding additional time periods when they become available. In view of our results, it is unlikely that dramatic changes in the cohesion and structural equivalence between journals in the network will occur in the near future. Perhaps the traditional "feeder" journals such as Econometrica and the psychology journals will continue to lose importance in the longer run, and perhaps the core marketing journals in network become more closely knit.

Future research could build on the proposed model in several ways. For instance, it might be interesting to extend the model by including explanatory variables for the importance or cohesion between journals. The importance of journals could be related to the broadness or narrowness of their domain of investigation. Developments in journal importance could be related systematically to the first year of publication of journals. In such studies, tests of linear and higher-order trends in importance could be performed to determine if common patterns exist in which journals gain in importance from their first date of publication onwards.

Future research might also apply the proposed model to other social networks, such as networks of gift-giving or brand loyalty. Previous research on brand loyalty and switching has applied, among others, log-linear models of symmetry to find systematic patterns of brand switching (e.g., Iacobucci, Henderson, Marcati and Chang 1996). The joint analysis of symmetry and asymmetry in brand switching using log-multiplicative terms may build on this, and may lead to new insights. The ability of our model to examine changes over time can be extended to examine differences between markets or countries, and to examine these differences over time. We hope that the present research will alert readers to the potential usefulness of log-multiplicative models in addressing important issues in social networks.

REFERENCES

Burt, Ronald S. (1983), Cohesion versus Structural Equivalence as a Basis for Network Subgroups, in Ronald S. Burt and Michael J. Minor (eds.), *Applied Network Analysis: A Methodological Introduction*, Beverly Hills, Ca.: Sage Publications, 262-282.

Clogg, Clifford C. and Scott R. Eliason (1987), Some Common Problems in Log-Linear Analysis, *Sociological Methods and Research*, 16(1), 8-44.

Clogg, Clifford C. and Edward S. Shihadeh (1994), *Statistical Models for Ordinal Data*, Thousand Oaks, Ca.: Sage Publications.

Doreian, Patrick (1985), "Structural Equivalence in a Psychology Journal Network," *Journal of the American Society for Information Science*, 36 (November), 411-417.

Doreian, Patrick (1988), "Testing Structural-Equivalence Hypotheses in a Network of Geographical Journals," *Journal of the American Society for Information Science*, 39 (March), 79-85.

Doreian, Patrick and Thomas J. Fararo (1985), "Structural Equivalence in a Journal Network," *Journal of the American Society for Information Science*, 36 (January), 28-37

Everett, James E. (1994), The Journal Relations of Human Relations, *Human Relations*, 47(1), 1-12.

Everett, James E. and Antony Pecotich (1991), A Combined Loglinear/MDS Model for Mapping Journals by Citation Analysis, *Journal of the American Society for Information Science*, 42(6), 405-413.

Goodman, Leo A. (1979), Simple Models for the Analysis of Association in Cross-Classifications having Ordered Categories, *Journal of the American Statistical Association*, 74 (367), 537-552.

Goodman, Leo A. (1991), New Methods for Analyzing the Intrinsic Character of Qualitative Variables Using Cross-Classified Data, *American Journal of Sociology*, 93(3), 529-583.

Hamelman, Paul W. and Edward M. Mazze (1973), Cross-Referencing Between AMA Journals and Other Publications, *Journal of Marketing Research*, 10, 215-218.

Iacobucci, Dawn (1996), *Networks in Marketing*, Thousand Oaks, Ca.: Sage Publications.

Iacobucci, Dawn, Geraldine Henderson, Alberto Marcati, and Jennifer E. Chang (1996), Networks Analysis of Brand-Switching Behavior, *International Journal of Research in Marketing*, 13, 415-429.

Iacobucci, Dawn and Stanley Wasserman (1988), A General Framework for the Statistical Analysis of Sequential Dyadic Interaction Data, *Psychological Bulletin*, 103 (3), 379-390.

Jobber, David and Paul Simpson (1988), A Citation Analysis of Selected Marketing Journals, *International Journal of Research in Marketing*, 5, 137-142.

Knoke, David and Ronald S. Burt (1982), Prominence, in Ronald S. Burt and M.J. Minor (eds.), *Applied Network Analysis*, Beverly Hills, Ca.: Sage Publications, 195-222..

Leong, Siew Meng (1989), A Citation Analysis of the Journal of Consumer Research, *Journal of Consumer Research*, 15, 492-497.

Long, J. Scott (1997), *Regression Models for Categorical and Limited Dependent Variables*, Thousand Oaks, CA: Sage Publications.

Luijkx, Ruud (1994), *Comparative Log-linear Analyses of Social Mobility and Heterogamy*, Tilburg: Tilburg University Press.

Pecotich, Anthony and James Everett (1990), An Extension of the Citation Analysis of Selected Marketing Journals, *International Journal of Research in Marketing*, 6, 199-204.

Rice, Ronald E., Christine L. Borgman and Byron Reeves (1988), Citation Networks of Communication Journals, 1977-1985, *Human Communication Research*, 15, 256-283.

Salancik, Gerald R. (1986), "An Index of Subgroup Influence in Dependency Networks," *Administrative Science Quarterly*, 31, 194-211.

Vermunt, Jeroen (1997), *LEM: A General Program for the Analysis of Categorical Data*, Tilburg University: Tilburg, The Netherlands.

Wasserman, Stanley and Kathryn Faust (1994), *Social Network Analysis*, New York: Cambridge University Press.

Zinkhan, George M., Martin S. Roth and Mary Jane Saxton (1992), Knowledge Development and Scientific Status in Consumer-Behavior Research: A Social Exchange Perspective, *Journal of Consumer Research*, 19, 282-291.

NOTES

1 If diagonal cells are not separately dealt with, analyses of journal importance, cohesion, and structural equivalence can lead to seriously biased results, in particular when the incidence of self-citations is high and heterogeneous across the various journals in the network. For instance, journals with a high incidence of self-citations may appear more important than journals with a low incidence of self-citations.

TABLE 1
CITATIONS SENT AND RECEIVED IN *IJRM*'S NETWORK, 1981-1995

	Time Period														
	1981-1983			1984-1986			1987-1989			1990-1992			1993-1995		
Journal	S	D	R	S	D	R	S	D	R	S	D	R	S	D	R
IJRM	0	0	0	632	11	1	535	23	6	749	38	61	966	69	109
Eco	35	571	179	33	760	245	21	675	264	27	833	319	8	726	399
EJM	219	29	26	410	75	77	680	53	58	806	126	45	1104	191	84
HBR	2	491	342	3	303	492	0	266	527	2	171	430	0	87	769
IMM	286	97	28	414	174	163	409	219	161	499	193	93	876	262	241
JA	488	47	38	588	167	58	493	119	149	825	232	219	679	241	286
JAR	263	197	359	255	190	482	408	197	457	588	334	374	520	361	474
JBR	472	14	53	659	41	71	1128	55	117	1112	47	126	1975	102	162
JCR	999	408	515	1081	480	668	1097	688	1033	1182	922	1355	1237	1123	1811
JESP	867	248	779	828	274	904	830	204	797	631	185	805	690	205	856
JM	811	414	811	907	419	1296	1171	482	1334	1049	523	1299	1357	678	2281
JMR	956	827	1634	969	704	2146	995	599	2351	1136	573	2196	1463	674	2806
JMRS	99	45	32	119	42	39	325	63	47	250	139	45	213	82	61
JR	281	157	138	379	150	232	368	192	188	398	101	215	477	103	330
JPSP	1667	3352	1761	1938	4358	1935	2035	4419	2258	2113	4624	2467	2390	5394	2358
ManS	418	848	313	439	949	419	478	881	397	525	940	470	739	983	578
MarS	405	10	0	715	214	104	610	226	228	652	241	473	840	313	740
PB	1163	612	991	841	472	1160	1399	615	1168	1844	744	1308	1280	665	1555
PR	265	348	1035	604	407	1051	544	472	1335	379	420	1327	519	630	1312
Psy	55	260	371	100	927	371	63	363	411	112	605	323	97	487	218

Note - S = citations sent to other journals, D = self-citations, R = citations received from other journals; n = 123643.

TABLE 2
EVOLUTION OF IMPORTANCE, COHESION AND STRUCTURAL EQUIVALENCE IN *IJRM*'S CITATION NETWORK, 1981-1995: MODEL SELECTION

Model		*df*	L^2	*BIC*
1.	S, R, P	1918	254654	232165
2.	SP, RP	1766	247021	226314
3.	SP, RP, SR	1405	5815	-10659
4.	SP, RP, D	1746	99856	79384
5.	SP, RP, D, RC(1) 6a	1727	23690	3441
6.	SP, RP, D, RC(1) 5a	1708	21609	1582
7.	SP, RP, D, RC(1) 6a, RC(1) 5a	1689	12444	-7360
8.	SP, RP, D, RC(2) 6a, RC(1) 5a	1672	13255	-6350
9.	SP, RP, D, RC(1) 6a, RC(2) 5a	1655	9273	-10132
10.	SP, RP, D, RC(2) 6a, RC(2) 5a	1637	8420	-10774
11.	SP, RP, DP, RC(2) 6c, RC(2) 5e	1109	3605	-9398
12.	SP, RP, DP, RC(2) 6b, RC(2) 5b	1541	7154	-10914
13.	SP, RP, DP, RC(2) 6b-linear, RC(2) 5b-linear	1553	7282	-10927

Note – S, R, P, and D and their interactions refer to log-linear parameters for Sending, Receiving, Time Period, and the Diagonal, as in equation 1. RC(M) denotes log-multiplicative terms, where RC is Row-Column model, and M is the number of dimensions. The number and letter following RC(M) indicates the specific model as in Clogg and Shihadeh (1994), with: 6 = symmetric, 5 = asymmetric, a = homogeneous (across time), c and e = heterogeneous, b = partially heterogeneous. 'Linear' means that the intrinsic association parameter is specified to follow a linear trend over time.

TABLE 3
JOURNAL IMPORTANCE IN *IJRM*'S NETWORK: 1981-1995.

	Importance per time period ($u^R + u^{RP}$)					
Journals	81-83	84-86	87-89	90-92	93-95	Mean
IJRM	****	-5.09	-3.58	-1.39	-1.06	-2.78
Eco	.15	.43	-.57	-.58	-.82	-.45
EJM	-1.94	-1.91	-2.47	-2.87	-2.57	-2.35
HBR	.84	.26	.05	-.08	-.15	.18
IMM	-2.02	-1.19	-1.58	-1.88	-1.84	-1.70
JA	-1.39	-1.81	-1.30	-1.26	-1.19	-1.39
JAR	.71	.01	-.22	-.65	-.65	-.16
JBR	-.56	-1.14	-.84	-.82	-.94	-.86
JCR	2.28	1.66	1.87	1.99	2.05	1.97
JESP	1.10	.63	.28	.19	.21	.48
JM	2.33	1.87	1.67	1.59	1.73	1.84
JMR	3.39	2.73	2.59	2.41	2.39	2.70
JMRS	-1.20	-1.87	-1.88	-2.05	-2.10	-1.82
JPSP	2.59	2.22	2.07	2.06	2.01	2.19
JR	.49	.13	-.33	-.43	-.26	-.08
ManS	1.46	.77	.57	.60	.54	.79
MarS	-14.04	-.66	.33	.57	.74	-2.61
PB	2.24	1.63	1.42	1.43	1.42	1.63
PR	1.89	1.32	1.26	1.07	1.01	1.31
Psy	1.57	.90	.65	.08	-.55	.55

TABLE 4

COHESION AND STRUCTURAL EQUIVALENCE IN *IJRM*'S CITATION NETWORK

	Cohesion		Structural equivalence			
	Dimension 1	Dimension 2	Dimension 1		Dimension 2	
Journals			Sending	Receiving	Sending	Receiving
IJRM	-.08	.03	-.03	.04	.03	.11
Eco	-.00	.29	-.62	.22	-.46	.21
EJM	-.19	-.43	-.06	.16	-.19	-.16
HBR	-.12	-.29	-.18	-.13	-.34	-.20
IMM	-.29	-.06	.02	-.59	-.12	.17
JA	-.19	.01	.16	-.26	.44	.05
JAR	-.28	.14	.12	-.39	.31	.14
JBR	-.10	-.24	-.02	.07	-.05	-.11
JCR	-.03	.05	.06	-.05	.26	.09
JESP	.41	-.15	.58	.23	.16	-.30
JM	-.12	-.14	-.02	-.02	.00	-.06
JMR	-.05	.07	.00	.03	.04	-.02
JMRS	-.13	.00	-.03	-.05	-.06	-.07
JPSP	.44	-.31	.38	.26	.17	-.43
JR	-.11	-.10	.00	-.02	.05	.11
ManS	-.01	.19	-.16	-.05	-.39	-.16
MarS	-.10	.50	-.04	-.04	-.12	.09
PB	.35	-.03	-.10	.11	.10	-.01
PR	.39	.14	-.12	.05	.14	-.13
Psy	.21	.32	.00	.43	.00	.68
Intercept	ψ_0 = 41.75	ψ_0 = 11.57	ϕ_0 = 30.91		ϕ_0 = 15.77	
Linear trend	ψ_1 = .72	ψ_1 = -.49	ϕ_1 = 3.42		ϕ_1 = 2.38	

FIGURE 1
COHESION IN *IJRM*'S CITATION NETWORK

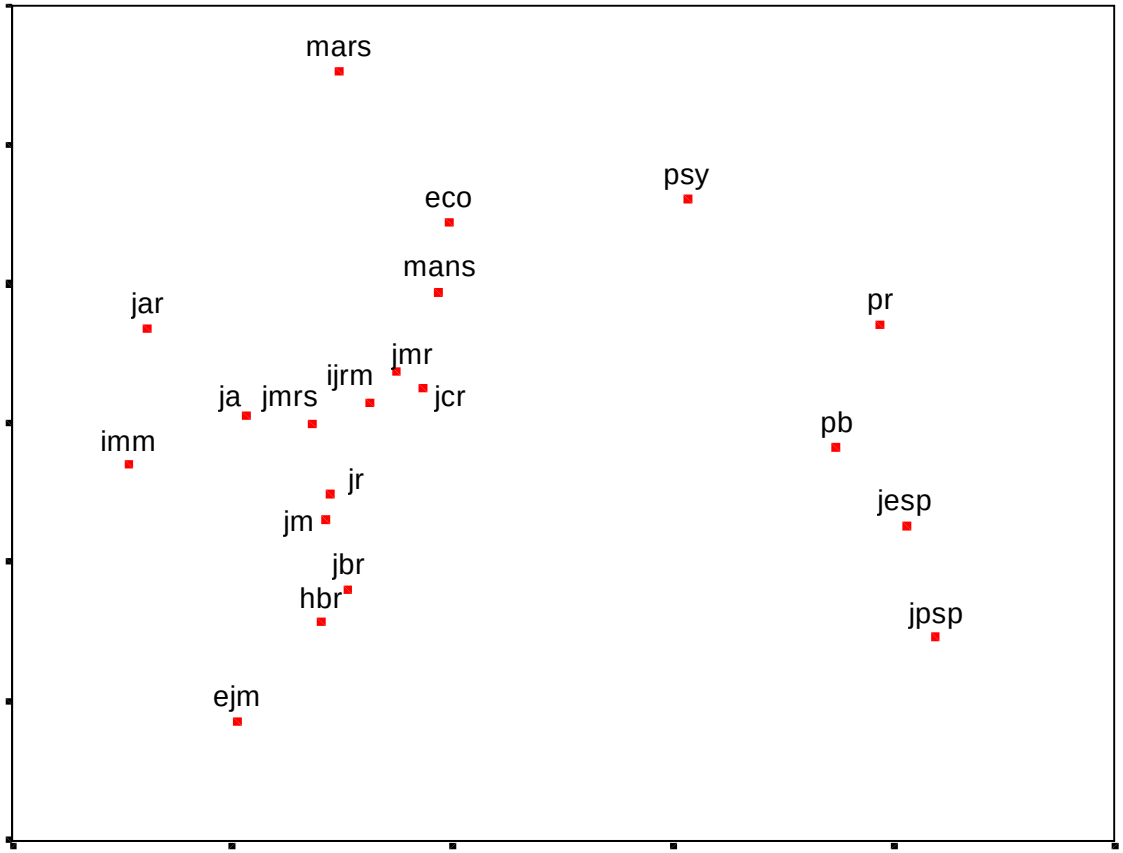

FIGURE 2
STRUCTURAL EQUIVALENCE IN *IJRM*'S CITATION NETWORK:
SENDING PATTERNS

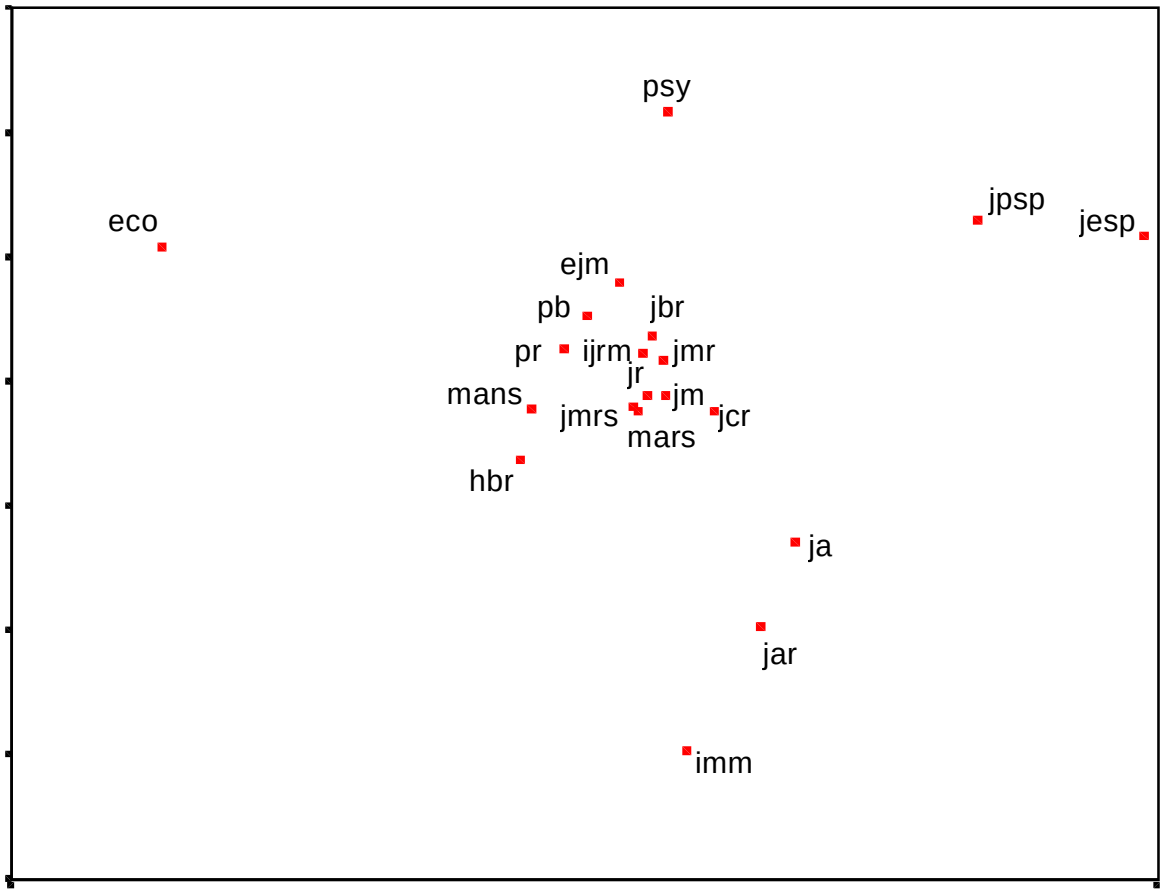
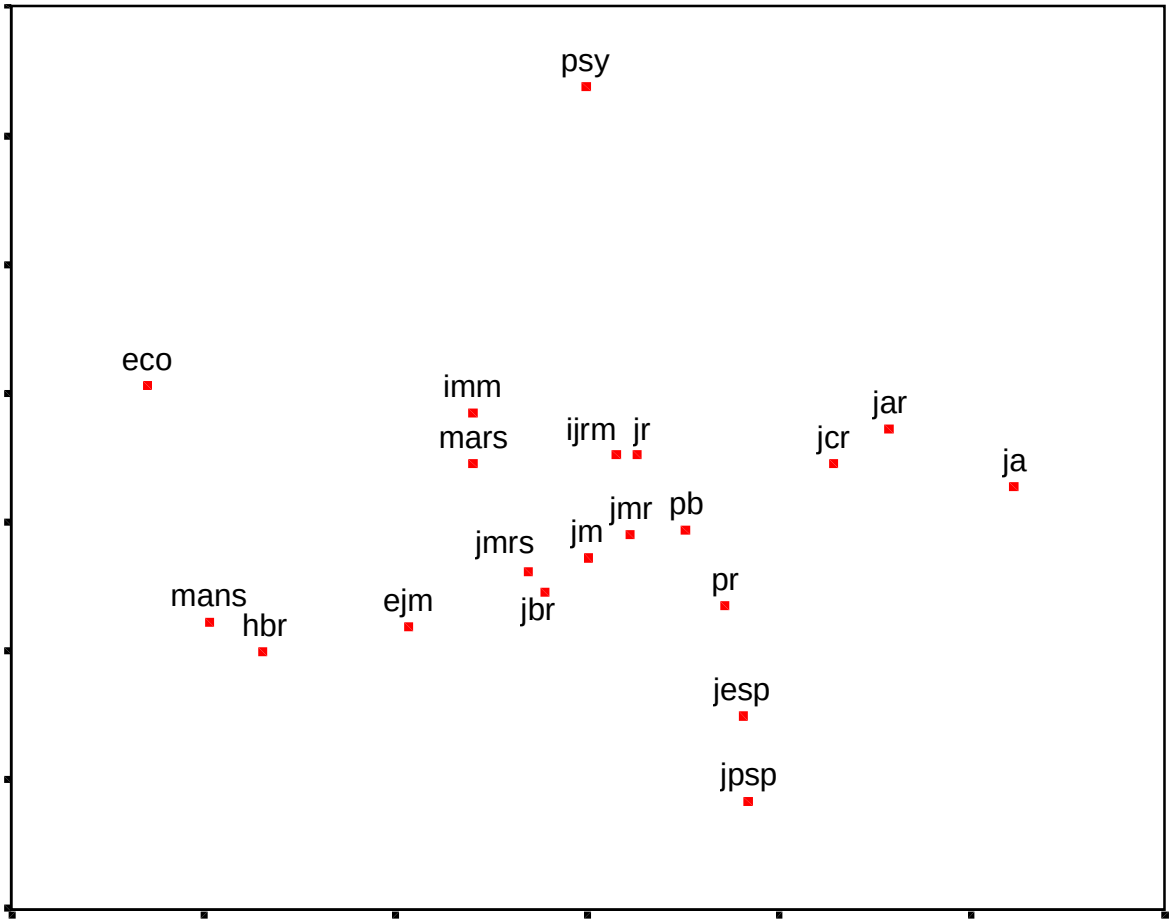
FIGURE 3
STRUCTURAL EQUIVALENCE IN *IJRM*'S NETWORK:
RECEIVING PATTERNS