

1 **Event Study Methodology in Business Research: A Bibliometric Analysis**

2 ***Abstract:** This study aims to provide an objective analysis of the state-of-the-art*
3 *and intellectual development of publications related to event study methodology*
4 *in business research. The sample includes 1,219 papers related to event study*
5 *methodology, covering all business disciplines and spanning 34 years from 1983*
6 *to 2016. Through three stages of primary analysis, namely, initial sample,*
7 *citation, and co-citation analyses, we identified the publication trends,*
8 *supplementary techniques, influential publications, and intellectual clusters in*
9 *the area of event study methodology in business. The findings serve as a*
10 *benchmark for the extensive literature related to event study methodology in*
11 *business, and may facilitate the transference of the amassed useful techniques*
12 *among disciplines and the identification of future research directions.*

13
14 **Keywords:** event study methodology; bibliometric analysis; citation/co-citation
15 analysis; quantitative literature review
16

17 **1. INTRODUCTION**

18 Event study methodology, introduced by Fama et al. (1969), is a useful technique for
19 studying the effects of unanticipated events. It is a powerful statistical tool that was initially
20 developed to help scholars investigate the financial influence of corporate changes in finance,
21 accounting, and economics. Researchers can use this tool to determine whether an “abnormal”
22 stock return ensues from the announcement of a certain event, decision, or activity. Event study
23 methodology is attracting an increasing level of academic attentions and, currently, it has
24 already migrated into virtually all business disciplines, including management, marketing,
25 operational management, and management information systems (MIS) (Konchitchki and
26 O’Leary 2011).

27 As scientific fields and their related methods mature, it is common practice for scholars to
28 assess the state-of-the-art changes reported in the extant literature (Platt and Warwick 1995;
29 Ramos-Rodríguez and Ruíz-Navarro 2004). With the proliferation of event study methodology

30 in the context of business, several authors have reviewed the literature from a single
31 disciplinary perspective, such as management (McWilliams and Siegel 1997), marketing
32 (Johnston 2007), and MIS (Konchitchki and O'Leary 2011; Roztocki and Weistroffer 2008).

33 These reviews, although illuminating, retain several research gaps. First, they are
34 exclusively based on the authors' subjective analyses of the works of interest to them, and thus
35 may suffer from various subjectivity problems. Second, none of the related reviews have
36 broken through the scope of a single discipline, yet the amassed knowledge about event study
37 methodology tends to be unbalanced across business disciplines. Therefore, a review of the
38 works related to event study methodology from an overall business perspective may facilitate
39 the transfer of useful knowledge from the experienced to the relatively inexperienced
40 disciplines. However, such a literature review has been neglected to date.

41 Endeavoring to fill in the abovementioned research gaps, our work is the first to apply
42 *bibliometric analysis*, a quantitative technique, to review publications related to event study
43 methodology in business. Bibliometric analysis is a replicable, objective, scientific, and
44 transparent process that minimizes the problems of subjectivity and has been extensively used
45 in prior business studies (e.g., Agarwal 2016; Chen et al. 2012; Pilkington and Meredith 2009).
46 Using bibliometric analysis and taking a business perspective, our investigation is guided by
47 two primary research questions:

- 48 • *What are the state-of-the-art features of event study methodology in business?*
- 49 • *How has event study methodology evolved over time in business?*

50 To answer these research questions, we collected a sample of 1,219 publications from *Web*
51 *of Science (WOS)*. Analysis of the sample consisted of three primary stages: (1) initial sample,
52 (2) citation, and (3) co-citation analyses. The initial sample analysis enabled us to identify
53 publishing trends and supplementary techniques in event study-related research in business.
54 Then, we used citation analysis, a classical bibliometric tool, to explore the influential papers
55 and popularity trends in the focal field. Finally, we used another classical bibliometric tool, co-
56 citation analysis, to explore the research clusters and their evolution in the focal field.

57 We expect this study to contribute to the literature in the following respects.

- 58 (i) As a pioneering effort to review event study-related publications using bibliometric

59 analysis, this study advances previous reviews in this area by overcoming potential
60 subjectivity problems (e.g., self-selection bias).

61 (ii) The information provided on publishing trends and evolution of the publication process
62 will serve as a benchmark for the countless achievements related to event study
63 methodology and provide future scholars with rapid access to useful knowledge.

64 (iii) The summary of supplementary techniques used in the extant event studies may offer
65 useful insights to event study scholars to overcome the potential concerns in their future
66 works. The identification of influential publications offers event study researchers an easy
67 means of identifying the classical event study-related publications.

68 (iv) By shedding light on the key research clusters and their evolution, we present an overview
69 of the numerous publications related to event study methodology in business and
70 presenting a comprehensive event list that should be considered as compounding events in
71 the future event studies.

72 The rest of the paper is organized as follows. Section 2 briefly introduces event study
73 methodology. Section 3 discusses the data collection procedure and Section 4 describes the
74 initial analyses of the sample. Section 5 presents the results of the bibliometric analysis. In
75 Section 6, we draw our conclusions, identify directions for future research, and note the
76 research limitations.

77 **2. BACKGROUND: EVENT STUDY METHODOLOGY**

78 We introduce event study methodology in this section. As numerous articles already
79 provide guidance on the use of the methodology (e.g., Binder 1998; Binder 1985; McWilliams
80 and Siegel 1997; Pynnonen 2005; Srinivasan and Bharadwaj 2004), we do not intend to provide
81 similar detailed information but only present a brief overview of a typical event study research
82 design.

83 Event study methodology was constructed to investigate the influence of unanticipated
84 events on stock prices. A standard event study involves estimating a market model for each
85 firm in the sample and then computing the associated abnormal returns. Based on the efficient-
86 market hypothesis, these abnormal returns can reflect the reaction of the stock market to the
87 arrival of the anticipated event. Table 1 delineates the general steps involved in an event study

88 research (Binder 1998; Binder 1985; McWilliams and Siegel 1997).

89 [Insert Table 1 here]

90 Even if the research design of an event study is properly executed, the following two
91 assumptions must also be valid to yield a precise analysis of the event's financial effects: (1)
92 markets are efficient, and (2) the event is unanticipated. First, the notion of efficient stock
93 market, which refers to "security prices fully reflect all available information" (Fama 1991, p.
94 383), provides a fundamental theoretical assumption for an event study (Fama et al. 1969). As
95 new information is disclosed or announced to the market, investors are expected to use all
96 relevant information and effectively impound such information into the relevant stock price to
97 observe the incremental financial effects of the information. Second, another important
98 assumption for an event study is that the focused event is unanticipated. The stock capital
99 reaction represents investors' expectation adjustment on the firm's future cash flows. If
100 information is leaked before news is made public, investors will react to the new information
101 once the leakage occurs, thereby rendering the reaction at the public announcement just a
102 residual adjustment of investors' expectations. In this situation, power of the relevant statistical
103 tests is reduced.

104 The applications of the event study methodology in business are extensive. As a
105 methodology initially proposed in finance and accounting research, at the earliest stage, event
106 study methodology was used to investigate market responses to certain events, such as
107 regulation enforcement (Carroll and Lamdin 1993; Whinston and Collins 1992). Thereafter,
108 this methodology has been extensively used in other disciplines to investigate how the market
109 reacts in response to a variety of events. For example, management studies have investigated
110 the market impact of certain events, such as director change (Kang et al. 2010; Lee and James
111 2007) and quality certification (Corbett et al. 2005; Hendricks and Singhal 1996). MIS research
112 has focused on certain events, such as IT initiatives (Corbett et al. 2005; Hendricks and Singhal
113 1996), IT outsourcing (Duan et al. 2009), and IT failures (Bharadwaj et al. 2009; Goel and
114 Shawky 2009). In the marketing field, event study methodology has been used to investigate
115 market responses to specific events, such as product recalls (Chen et al. 2009), sponsorship
116 announcements (Cobbs et al. 2012; Miyazaki and Morgan 2001), and brand acquisitions (Wiles

117 et al. 2012). Given the extensive applications of event study methodology in business, the
118 current study attempts to present a literature review of event study-related research from a
119 comprehensive business perspective.

120 **3. SAMPLE COLLECTION**

121 **3.1 Data Collection**

122 We adopted the WOS¹ bibliographic citation database as our data source. Our sample was
123 collected from WOS based on the following criteria:

- 124 (i) To enhance the reliability of the results, we included only articles published in journals
125 and excluded books, doctoral thesis, and scientific congress records because the
126 knowledge in journal articles is relatively well “certified” and passed rigor of peer review
127 process, and thus the use of citations is standard.
- 128 (ii) We used three keywords, “*event study*,” “*event studies*,” and “*event-study*,”² to identify
129 articles, and any published articles containing any of the keywords in the title, abstract, or
130 author keywords were retrieved for further examination.
- 131 (iii) The search spanned the entire period since the appearance of the first publications in the
132 field.
- 133 (iv) According to Myers (2013), the business domain is composed of various subjects, such as
134 economics, business finance, business, management operations research, management
135 science, and MIS; therefore, we adopted similar business components and selected all
136 relevant research areas in the “Web of Science Categories” options in WOS.³

137 Based on the abovementioned search criteria, we obtained 1,236 articles in our initial
138 sample, which were then further filtered.

139 **3.2 Data Cleaning**

140 Note that the initial sample retrieved from bibliographic sources cannot be used directly

¹ As one of the world’s top leading citation databases (Acedo et al. 2006), WOS covers over 10,000 high-impact journals and over 120,000 international conference proceedings. Scholars expect the materials included in WOS to uphold high quality standards. WOS is frequently accepted as the main academic database for investigating contributions to the literature.

² Adding other keywords would have been unwise. Doing so would have caused a surge of irrelevant works in our sample and manually sorting these irrelevant works would have brought with it additional subjectivity problems. Therefore, we excluded other keywords for retrieval. Admittedly, the sample acquired with the three keywords is subject to an inevitable limitation: it does not include event studies that do not specifically mention the use of event study methodology in their title/abstract/keyword contents.

³ The selected “Web of Science Categories” are economics, business finance, business, management operations research, management science, and MIS, which are closely linked to business area in WOS.

141 for bibliometric analysis (Olensky 2015) because the data inevitably contain errors and
142 inconsistencies. For example, certain publications are included in our initial sample simply
143 because the words “event study” are included in their abstracts, yet they are not in fact related
144 to event study methodology. In addition, authors’ names often appear in different abbreviated
145 formats in different papers. Therefore, data cleaning is crucial to enhance the quality of the
146 sample units and improve the credibility of the bibliometric analysis results (Cobo et al. 2011).

147 However, data cleaning cannot be achieved using software, but must be done manually.
148 Hence, to clean the initial sample in our study, two researchers independently read the abstracts
149 of all sample papers to determine whether the contents related to event study methodology.
150 Synthesizing the judgments of each researcher (the papers identified by both researchers were
151 included, and a further decision process were made if there existed any disagreements), we
152 filtered out the publications not related to event study methodology. We also transferred the
153 information in the sample manually into a standard template to guarantee that abbreviations of
154 the same author/journal/title were consistent across all entries. After data cleaning, the dataset
155 for further analysis consisted of 1,219 articles.⁴

156 **4. INITIAL SAMPLE ANALYSIS**

157 Based on the achieved sample, we firstly proceeded with a set of initial sample analysis,
158 aiming to present an overview of the extensive event study methodology literature to date by a
159 business lens.

160 **4.1 Year of Publication**

161 We first analyzed the publication trend of the identified articles. Figure 1 depicts the
162 publication–year distribution of all sample units from 1983, the earliest year of publication, to
163 2016. Before 1991, publications related to event studies were rare, indicating that event study
164 methodology was not yet widely used in business research. However, the methodology gained
165 in great popularity as the field progressed in the 1990s, although the publication growth rate
166 remained low. The surge in publications observed between 2003 and 2016 reflects a remarkable
167 increase in attention to this methodology within the business research community. Overall,
168 research interest has certainly not been short-lived, but has escalated across the decades.

⁴ The size of our sample is significantly larger than the samples used in the majority of bibliometric analyses; a larger sample is more likely to produce highly representative results with a lower margin of error.

[Insert Figure 1 here]

4.2 Supplementary Techniques

Each event study inevitably involves a series of concerns. An effective prediction can only be achieved in a study if these concerns can be relatively mitigated. In this subsection, we consider a list of potential concerns that are commonly involved in an event study, namely, (1) *small sample size*, (2) *confounding effect*, (3) *contingencies in abnormal returns*, (4) *endogeneity*, and (5) *inefficiency of parametric test*, and we searched for the potential supplementary techniques that may facilitate the amelioration of each concern. The entire business domain specifically provides us with an ideal lens for such an investigation because of the possibility that the application of a certain technique has been constrained within a certain discipline. In particular, we searched for the potential supplementary techniques that can be used in an event study by reading the contents in the abstract and keywords of each sampled paper.

4.2.1 *Small sample size and supplementary techniques*

A relatively large sample should be necessary in an event study under the underlying assumptions of normality; an insufficiently large one may lead to wrong research decisions. However, scholars can hardly collect sufficiently numerous events on occasion owing to the rare occurrences of certain events or ineffective disclosure of some events.

The challenge caused by a finite sample can be mitigated by using bootstrap technique, which does not require normality assumptions that rely on meeting large samples (Barclay and Litzenberger 1988). Therefore, the bootstrap technique can enable the provision of a relatively reliable inference based on a finite sample. An example of an event study that used bootstrap technique is Kurek (2016), which analyzed the market reactions of the information contents of equity block trade transactions of firms constituting the WIG20 index. The aforementioned research adopted normalized conventional and bootstrap methods to mitigate the concern that event study methodology is questionable if the used sample size is relatively small. Gregoriou (2014) improved the standard event study methodology using a wild-bootstrap technique to correct for non-normality, and found that the index additions to the Hang Seng Stock Index can trigger stock market reactions.

198 **4.2.2 *Confounding effect and supplementary techniques***

199 Confounding effect is another primary concern in an event study. Event study
200 methodology is designed to explore the market influence of a specific event. However, if other
201 significant events had occurred at the approaching time of the focal event, the achieved findings
202 through this methodology are questionable owing to the difficulty of determining the true
203 market reaction of the focal event.

204 The most common approach to mitigate confounding effect is through identifying and
205 excluding the observations that are vulnerable to be contaminated by certain confounding
206 events. The commonly considered confounding events include mergers and acquisitions,
207 executive appointments, dividends, restructuring, and divestiture, which have been previously
208 determined to significantly affect market returns. However, such an approach may involve
209 certain limitations. For example, studies (e.g., McWilliams and Siegel 1997) proposed that any
210 announcement released by firms approximately at the event date may relatively engender a
211 tainting effect. Therefore, a considerably comprehensive range of events should be considered
212 in principle as the confounding events in an event study. However, such an approach tends to
213 be practically infeasible because it will markedly reduce the available sample size for analysis.
214 In addition, the selection of confounding events may engender a certain level of selection-bias
215 concern.

216 The Markov-switching model may serve as a supplementary technique to mitigate the
217 confounding effect concern. This method can be regarded a generalization of the mixture of
218 time-independent normal models and allows the mixing probabilities to display time
219 dependence (Timmermann 2000). In event studies, the Markov switching approach can be
220 combined with the traditional market model to solve the contaminating event problem.
221 Moreover, the estimated parameters achieved with the combined model has been empirically
222 proven to be minimally subject to the influence of contaminating events (Aktas et al. 2007).
223 Several event studies have applied this combined model. Castellano and Scaccia (2012)
224 analyzed the credit default swap market reaction of rating events by combining the event study
225 methodology and Markov switching models. Castellano and Ferrari (2019) used the
226 Markov switching regression models to analyze whether price changes in Italian green energy

227 stocks are influenced by financial analysts' recommendations.

228 **4.2.3 Contingencies in abnormal returns and supplementary techniques**

229 Market reactions to the same event tend to vary across contexts. Hence, to further
230 investigate the contingencies of market reaction of certain events, studies have commonly
231 adopted cross-sectional analysis in an event study to provide further comprehensive insights.
232 In a cross-sectional analysis, the independent variables are the moderators specific to the
233 research context, while the dependent variable is cumulated abnormal returns (CARs) over the
234 entire event window. This approach is beneficial for identifying the variations in abnormal
235 returns.

236 Our statistics indicate that two techniques may facilitate the conduct of novel and
237 comprehensive analysis in a cross-sectional analysis. Decision tree (DT)-based analysis
238 represents the first technique. DT analysis is a decision support tool that uses a tree-
239 like graph or model of decisions and their possible consequences. In event studies, DT
240 induction can be used to explore factors that lead to CARs. The major motivations for scholars
241 to use the DT induction approach in event studies are to provide decision makers with an
242 interpretable model consisting of understandable and actionable rules, and to provide additional
243 insights beyond those provided by regression. For example, Andoh-Baidoo and Osei-Bryson
244 (2007) used DT induction to explore the associate between the firm- and attack-characteristics
245 and CARs.

246 The second technique is content analysis, which can be used to study documents and
247 communication artifacts. Events are commonly perceived by the public through
248 announcements, which can present their contents in various formats (e.g., texts, pictures, videos,
249 and audio). Thus, content analysis can be applied in event studies to identify patterns (e.g.,
250 managerial certainty, optimism) in the contents. The identified patterns are predicted to be
251 closely linked to market reactions. A sampled event study that adopted content analysis is
252 Borah and Tellis (2014), which analyzed the choice of and payoff from firms' announcements
253 of make, buy, and ally.

254 **4.2.4 Endogeneity and supplementary techniques**

255 In the cross-sectional analysis of event studies, CARs of firms are often regressed on the

256 observable characteristics to explain the CAR variations. However, the existence of certain
257 unobserved factors that affect firms' event decision and abnormal return tends to raise
258 endogeneity concern and leads to bias in the estimation of coefficients.

259 To correct the biased estimation of the treatment effect in the CAR analysis, a common
260 practice is to mimic the random selection process. To this end, propensity score matching (PSM)
261 can be used for constructing the benchmark group (i.e., control group). Creating such a control
262 group with a background highly similar to the treated group facilitates the reduction of the
263 influence of confounding factors and improvement of the test efficiency in an event study. PSM
264 has been used in several event studies. For example, Warren and Sorescu (2017) used PSM to
265 empirically compare the stock market gains from concurrent new product announcements with
266 those obtained by issuing two separate but similar announcements. Nguyen and Rahman (2015)
267 used the PSM approach in their analysis and found that board compensation has a strong effect
268 in firms that have a high tendency to divest.

269 ***4.2.5 Inefficiency of parametric test and the supplementary techniques***

270 Several event studies have relied on the use of parametric test statistics to calculate
271 abnormal returns, and such an approach requires the essential assumptions on the probability
272 distribution of returns. However, Brown and Warner (1985) proposed that stock prices do not
273 strictly follow the normal distribution. Hence, parametric tests tend to produce misspecified
274 test statistics when the assumption of normality is violated.

275 Non-parametric tests, which are “are well-specified and more powerful at detecting a false
276 null hypothesis of no abnormal returns” (Dutta 2014, p. 137), can be used to overcome the
277 weakness of parametric test. For example, Soongswang (2012) used both parametric and non-
278 parametric test statistics to examine the influence of takeovers of firms traded on the Stock
279 Exchange of Thailand. Chesney et al. (2011) considered three different approaches, namely,
280 an event-study approach, a non-parametric methodology, and a filtered GARCH-EVT
281 approach, and proposed that a non-parametric approach is the most appropriate approach for
282 analyzing the financial impact of terrorism.

283 **5 BIBLIOMETRIC ANALYSIS**

284 In this section, we used bibliometric analysis to objectively reviews the overwhelming

285 volume of literature related to event study methodology. The literature reviews via bibliometric
286 analysis differ from traditional reviews since they can employ a scientific and transparent
287 process to effectively mitigate the selection bias concern. A basic assumption in a bibliometric
288 analysis is that each citation, which serves as an indicator of previous and present scientific
289 efforts, can indicate an explicit link between the citing and cited articles (Tahai and Meyer
290 1999).

291 Along with the accelerated surge in academic publications and the difficulties to
292 objectively tracking extant works, bibliometric analysis has attracted a growing academic
293 attention to determine influential research, identify related themes, and provide insights for
294 future research in terms of a certain topic or area. For example, Nerur et al. (2008) used co-
295 citation analysis to analyze the overall structure of the strategic management field; they also
296 delineated the subfields that constitute the focal area and investigated the relationships between
297 these subfields. Chen et al. (2012b) focused on Business intelligence and analytics (BI&A) and
298 used bibliometric analysis method to identify research themes and the potential opportunities
299 associated with BI&A research. Fetscherin and Heinrich (2015) used a bibliometric citation
300 analysis to analyze the impact of universities, authors, journals, and articles in the field of
301 consumer brand relationships; they also outlined the related potential research area by using a
302 bibliometric co-citation analysis. Moreover, Wang et al. (2016) employed a bibliometric
303 analysis to reveal the different development stages and identify the major research themes of
304 cloud computing research.

305 Given the two most widely applied bibliometric tools are citation and co-citation analyses
306 (Garfield et al. 1964; Small 1973), both the tools are used in the current study.

307 **5.1 Citation Analysis**

308 Citation analysis can be used to evaluate the influence of a publication by counting the
309 number of times it is cited by other publications (Ding and Cronin 2011), and it also enables
310 scholars to explore crucial articles in their focal fields and to scrutinize how citations change
311 over time (Pilkington and Meredith 2009).

312 **5.1.1 Influential publications**

313 As a common norm, we first used citation analysis to recognize the influential publications

314 related to event study methodology. We counted the number of citations for each sample unit
315 and selected the 20 most frequently cited articles. These publications are considered the most
316 influential publications related to event study methodology in business. As shown in the third
317 column of Table 2, the two most frequently cited references are Brown and Warner (1985) (276
318 citations) and McWilliams and Siegel (1997) (160 citations). Brown and Warner (1985)
319 investigate the properties of daily stock returns and how the specific features of the data impact
320 event studies, while McWilliams and Siegel (1997) provide a literature review of event studies
321 and examine the use of event studies in the area of management.

322 Because early studies have had more opportunities to be cited, we also present the average
323 annual citation count for each publication; the results can be found in column 4 of Table 2.
324 With the exception of Koh and Venkatraman (1991) and Agrawal and Kamakura (1995), nearly
325 all of the publications are ranked the same by citation count and by average annual citation
326 count. Therefore, the impact of the majority of the listed works can be regarded as *permanently*
327 *influential*. Furthermore, the column headed “*focus*” (Table 2), summarizes the contents of the
328 publications to make it easier for researchers to find the influential publications in their fields
329 of interest.

330 [Insert Table 2 here]

331 **5.1.2 Changes in influence**

332 We then used citation analysis to determine how the influence of publications has changed
333 over time. To this end, we longitudinally analyzed the citations by decade (i.e., 1987–1996,
334 1997–2006, and 2007–2016). In Table 3, for each listed publication we provide the citation
335 count followed by the citation growth rate in brackets, which is computed as the citation count
336 during the current decade divided by the count during the previous decade.

337 The results in the fourth column of Table 3 show that during the first decade (1987–1996),
338 the vast majority of the top 20 influential publications had not yet been published. Among the
339 published studies, apart from Koh and Venkatraman (1991), the other influential publications
340 (i.e., Brown and Warner 1985; Campbell and Wesley 1993; Corrado and Zivney 1992;
341 Dyckman et al. 1984; Salinger 1992) all report methodological research in the fields of finance,
342 accounting, or economics.

343 As the sixth column in Table 3 shows, most of the listed influential works were published
344 during the second decade (1997–2006), indicating that event study methodology had entered a
345 period of rapid development. The top two influential publications during this period were
346 Brown and Warner (1985) and McWilliams and Siegel (1997), followed by Subramani and
347 Walden (2001), Koh and Venkatraman (1991), Barber and Lyon (1997), and Agrawal and
348 Kamakura (1995). The focuses of these publications were not limited to finance, accounting,
349 and economics, but already extended to topics in marketing (e.g., celebrity endorsements), MIS
350 (e.g., E-commerce), and management (e.g., joint venture formations). Therefore, during 1997–
351 2006, numerous scholars from management, marketing, and MIS had already started to pay
352 attention to event study methodology, and their works were increasing in popularity.

353 The numbers in brackets in the fifth column of Table 3 show the citation growth rate,
354 calculated by dividing each publication’s citation count for 1987–1996 by that for 1997–2006.
355 The publications with the highest citation growth rates (larger than 400%) are highlighted in
356 bold. The study by Koh and Venkatraman (1991) has the most outstanding citation growth rate
357 of 533%. The study, published in the *Academy of Management Journal*, examines how the
358 market value of parent firms in the information technology sector react to firms’ joint venture
359 formation announcements.

360 Entering the third decade, 2007–2016, as observed in the sixth column of Table 3, each
361 listed publication continues to accumulate citations. During this decade, Brown and Warner
362 (1985) and McWilliams and Siegel (1997) still rank as the top two influential publications, and
363 most of the other listed works retain their popularity. In addition, as shown in the highlighted
364 contents in brackets, the publications with the fastest-growing number of citations are those by
365 Barber and Lyon (1996), Geyskens et al. (2002), Chatterjee and Pacini (2002) Cavusoglu et al.
366 (2004), and Dehning et al. (2003). Their focal events (e.g., Internet channel additions, IT
367 investment) suggest that during this decade, event study methodology became increasingly
368 popular in the areas of marketing and MIS.

369 [Insert Table 3 here]

370 **5.2 Co-citation Analysis**

371 To explore extant knowledge structures or recognize immature research subtopics within

372 a field, it is common practice for scholars to detect intellectual clusters (Price 1963), and co-
373 citation analysis can be used to fulfill this goal. Co-citation occurs when two references are co-
374 cited by another paper. By recording the frequency of co-citing each pair of references, co-
375 citation analysis can evaluate semantic similarity and identify relationships among references.
376 In particular, when two references are co-cited relatively frequently, the two works are highly
377 likely to be semantically related (Small 1973) or share related concepts (White and Griffith
378 1981). We particular conducted a co-citation analysis to (1) identify the knowledge clusters
379 related to event study methodology in business and (2) examine how each cluster evolves over
380 time.

381 **5.2.1 Knowledge clusters formation**

382 Detecting whether any two publications are commonly co-cited helps to identify the
383 knowledge clusters in a field. In a co-citation analysis, it is common practice to select those
384 papers that are deemed to be most important (Braam et al. 1991; Pilkington and Meredith 2009;
385 White and McCain 1998). Following Small (1980), we excluded articles with fewer than 3
386 citations and retained 275 important articles for the co-citation analysis.⁵ We then created a
387 275 by 275 co-citation matrix by forming all possible pairs among the 275 selected documents
388 and counting their co-citation frequencies.

389 After obtaining the co-citation counts for each *pair of references* (henceforth, *pair*), we
390 further mapped co-citation networks by linking similar references to detect the intellectual
391 structures. Traditionally, if a series of references are co-cited frequently, then a “structural
392 knowledge group” can be constructed among them (Pilkington and Meredith 2009). However,
393 as argued earlier, co-citation frequency is highly correlated with citation frequency; that is, two
394 unrelated publications may have a high co-citation frequency because they both have high
395 citation frequencies.⁶ Therefore, instead of the traditional co-citation frequency measure, we
396 adopted the normalized co-citation strength, which is measured using the Jaccard index
397 (Jaccard 1901; Small and Greenlee 1980) to represent the similarity between a pair. The

⁵ Compared with previous bibliometric review papers (e.g., Pilkington and Meredith 2009; Ramos-Rodríguez and Ruíz-Navarro 2004; Schildt et al. 2006; Wang et al. 2016), the inclusion of 275 references in the co-citation analysis is a relatively high number, thus providing a more comprehensive analysis.

⁶ A simple example is that despite the high co-citation frequency between Brown and Warner (1985) and McWilliams and Siegel (1997) (see Table 2), the two publications should not be grouped into the same cluster.

398 normalized co-citation strength (S) is stated as follows:

$$S = \frac{\text{Number of common citations to articles A and B}}{\text{Total citations to A} + \text{Total citations to B} - \text{Cocitation of A and B}}$$

399
400 For any given pair, normalized co-citation strength serves as a measure of the degree of
401 similarity between them (Lampe and Hilgers 2015). Obviously, the minimum link strength (S)
402 is 0, which represents no co-citations, whereas the maximum value of 1 reflects perfect co-
403 appearance.

404 Based on link strength, we assigned clusters using the iterative clustering approach. A co-
405 citation strength (S) value was determined for each pair. Based on the S value of each pair, we
406 iteratively added nodes with high S values to the members of the cluster until the average of
407 the S values was lower than the selected cutoff value. Once a cluster was formatted, the selected
408 reference pairs were excluded from further iterative clustering, and the algorithm reverted to
409 the beginning.

410 Selecting a proper cut-off value is important in the iterative clustering approach. Changing
411 the cut-off value involves a tradeoff between the average pair similarity and number of pairs in
412 a cluster: the higher (or lower) the pair similarity level, the smaller (or larger) the number of
413 pairs in the analysis. Given the lack of a common criterion for selecting a cut-off value in the
414 iterative clustering approach (Schildt et al. 2006), we used the following technique. First, we
415 set several S values (i.e., 0.05, 0.1, 0.15, 0.2, and 0.25) as cutoff candidates. We then selected
416 20 pairs at or nearest to each candidate value. Then, according to the contents of each reference,
417 we manually judged whether each pair should be classified into the same cluster.⁷ If so, the
418 pair was termed a “similar pair (SP).” We counted the number of SPs at each candidate cutoff
419 value. This resulted in 8, 15, 17, 18, and 19 SPs for cutoff values of 0.05, 0.1, 0.15, 0.2, and
420 0.25, respectively. The numbers of pairs remaining were 1255, 713, 390, 274, and 162. A proper
421 cutoff value should satisfy two criteria: (1) the average similarity level of the selected pairs
422 should be high, and (2) the number of selected pairs should be large. Given these criteria, we
423 selected an efficient cutoff value of 0.1, which left us with 713 pairs for the co-citation analysis.

⁷ If the publications in a pair focused on the same or highly similar topics, then we classified the two publications as belonging to the same cluster.

424 The iterative clustering approach enabled us to identify 17 research clusters among the
425 713 pairs. References in the same clusters are closely linked with each other. To crystallize the
426 framework of each cluster, we plotted the respective intellectual networks for the 17 sub-
427 research fields using the bioinformatic software *Cytoscape*.⁸ Figure 2 presents the cluster
428 intellectual networks. In Figure 2, each reference represents a node and its size reflects its
429 citation frequency; the width of the edge between each pair of references is determined by their
430 similarity, as measured by the Jaccard index (S). If the research fields of a pair are highly similar,
431 then the edge between the pair is thick and heavy. Moreover, by analyzing the abstract contents
432 of each reference in each cluster, we briefly delineate each cluster in Table 4.

433 [Insert Figure 2 here]

434 [Insert Table 4 here]

435 **5.2.2 Knowledge cluster analysis**

436 Next, we considered the features of each cluster, and the findings are presented in Table
437 5.

438 [Insert Table 5 here]

439 The third and fourth columns of Table 5 provide information on the number of
440 publications and main subtopics of each cluster, respectively. The fifth column presents the
441 selected papers on each topic. The densest cluster is V (*IS-related Events*), which is the only
442 cluster closely related to IS and covers several subtopics, such as IT investments (Dehning et
443 al. 2003; Dobija et al. 2012; Im et al. 2001a; Morris and Strickland 2008), security breaches
444 (Goel and Shawky 2009; Hovav and D'arcy 2005), IT outsourcing (Agrawal et al. 2006; Andoh-
445 Baidoo and Osei-Bryson 2007; Duan et al. 2009), and IT governance (Aggarwal et al. 2011).
446 This finding indicates that event study methodology has been extensively used in the IS area,
447 and the subtopics are closely related to one another. Another relatively dense cluster is VII
448 (*Market-related Events*), which is closely related to marketing. Publications belonging to this
449 cluster focus on several interrelated themes, such as sponsorship announcements (Clark et al.
450 2009; Cornwell et al. 2005; Miyazaki and Morgan 2001), celebrity endorser announcements

⁸ Cytoscape (<http://www.cytoscape.org/>) is a bioinformatic software platform that can be used to visualize molecular interaction networks.

451 (Agrawal and Kamakura 1995; Ding et al. 2011), brand acquisition (Lane and Jacobson 1995;
452 Wiles et al. 2012), and channel decisions (Geyskens et al. 2002). Another cluster closely related
453 to marketing is IV (*Product Quality Management*), with major subtopics that include quality
454 certification (Corbett et al. 2005; McGuire and Dilts 2008; Nicolau and Sellers 2002) and
455 quality awards (Adams et al. 1999; Balasubramanian et al. 2005; Hendricks and Singhal 1996).
456 Furthermore, several clusters, namely XI (*Environmental & CSR Events*), XV (*Top*
457 *Management Succession Events*), and VIII (*Strategy Investment Decisions*), mainly contribute
458 to the management field and involve such topics as environmental disasters (Capelle-Blancard
459 and Laguna 2010), environmental certification (Flammer 2013; Gilley et al. 2000), director
460 changes (Bergh and Gibbons 2011; Kang et al. 2010), and strategic alliances (Das et al. 1998)

461 We also provided a statistics of the number of short-/long-event studies in each cluster
462 (please see the last column of Table 5). We found that the application frequencies of short-term
463 event windows in almost all clusters are markedly larger than that of long-term event windows.
464 The possible reason is that the concerns of the confounding effects can be easily alleviated in
465 short-term event studies compared with long-term ones, thereby engendering the relatively
466 accurate prediction in the former context. We also determined that nearly all event studies in
467 certain clusters, such as V (*IS-related Events*), XI (*Environmental & CSR Events*), IX (*Product-*
468 *harm Crisis Events*), and XV (*Top Management Succession Events*), have adopted short-term
469 event windows for their analyses. Therefore, long-term event studies in certain areas (e.g., MIS
470 and marketing) have been rarely used by scholars.

471 Thereafter, we searched the applications of supplementary techniques in different topics
472 based on above clusters. The focused techniques are the ones that we recognized in Subsection
473 4.2. By matching each technique and the specific event type in each cluster (please see Table
474 6), we found that the frequency of using these techniques in the extant event studies is relatively
475 low. Given each of the focal supplementary techniques is applicable for all event types, future
476 event studies may consider the further implications of these techniques to rich and enhance the
477 rigor of their analysis.

478 [Insert Table 6 here]

479 We also make a statistic on the guiding theories in each cluster (please see Table 7). We

480 may note that signal theory is most commonly used in event studies. This theory analyzes the
481 behavior when there exists information asymmetry between two parties, whereby the party of
482 announcers possess more information than the receivers; in the situation, the former ones can
483 choose whether and how to send signals to the latter ones. Signal theory should be regarded as
484 essentially consistent with the basic influential mechanism in an event study. That is, firms’
485 announcements and events can be regarded as a ‘market signal’ to investors; upon receiving
486 the signals, investors tend to update their perceived corporate future performance and outlook,
487 thereby triggering a market reaction. Even for certain events which were unintentionally caused
488 or announced by firms (e.g., law enforcement, terrorist attack), signal theory can also guide the
489 event studies which focus on such events to interpret firms’ endeavor to further benefit or
490 recover from the events. Beyond this, the application frequency of certain theories, such as,
491 organizational learning theory, RBV-based theory, is relatively high in the extant event studies.
492 These theories are commonly used to guide the prediction in a cross-sectional analysis of event
493 studies.

494 [Insert Table 7 here]

495 **5.2.3 ‘Long-run event study’ cluster**

496 Among all the clusters that we recognized, long-run event study is the only cluster that is
497 related to the aspect of methodology. Given that the extant knowledge in this cluster is
498 markedly beneficial for methodologically guiding future long-term event studies, we carried
499 on a serious retrospect in terms of the knowledge accumulated in this cluster.

500 The research in the “long-run event study” cluster has documented that the abnormal
501 returns measured by using a traditional long-run event study methodology were significantly
502 upwardly biased. The reason is that abnormal returns in these studies are commonly calculated
503 by cumulating single-period returns over the entire sample period. Such an approach involves
504 the calculation of “true” returns and upward bias in single-period returns, which are induced
505 by measurement errors. Therefore, Lyon et al. (1999, p. 165) proposed that “analysis of long-
506 run abnormal returns is treacherous.”

507 Studies in the “long-run event study” cluster have reached a consensus that the
508 misspecification in long-run event studies arises from three primary biases. The first bias is

509 *new listing bias*, which is sourced from the inconsistency between sampled firms and firms that
510 constitute the reference portfolio. In particular, sampled firms in long-run event studies are
511 generally tracked for a long post-event history; however, firms that begin trading subsequent
512 to the focal event are also typically included in constituting the index or reference portfolio,
513 thereby engendering new listing bias. The second bias is *rebalancing bias*, which arises because
514 the compound returns of a reference portfolio are typically calculated by assuming periodic
515 rebalancing. However, the returns of sample firms are frequently compounded without periodic
516 rebalancing, thereby generating bias. The third bias is *skewness bias*. Such a bias arises because
517 the distribution of long-run abnormal returns is positively skewed, thereby creating a positive
518 bias in test statistics.

519 To mitigate the recognized types of biases in a long-term event study, studies in the “long-
520 run event study” cluster have proposed a variety of methods as the potential solutions. Conrad
521 and Kaul (1993) suggested a new measure, namely, *buy and hold strategy*, for calculating long-
522 term returns. The aforementioned study proposed that the concept of the measure is consistent
523 with the notion of long-term overreaction, and this measure can also significantly reduce the
524 statistical biases in previous cumulative performance measures. Barber and Lyon (1997)
525 suggested a *control firm method* through matching sample firms to control firms of similar
526 sizes and book-to-market ratios. In the same study, they also suggested to calculate abnormal
527 returns by subtracting the simple buy-and-hold return on a control firm from the simple buy-
528 and-hold return on a sample firm. Kothari and Warner (1997) recommended the consideration
529 of the *bootstrap method*, which is suggested to be more powerful in alleviating potential biases
530 than the control firm method. Rau and Vermaelen (1998) suggested the use of a *calendar-time*
531 *portfolio method*, which is based on the calculation of the mean monthly abnormal returns
532 using calendar-time portfolios and a time-series t-statistic to mitigate the problem of cross-
533 sectional dependence among the sample firms.

534 **5.2.4 Cluster evolution**

535 To achieve the second goal of our co-citation analysis, we conducted an analysis to
536 provide insights into the evolution of each cluster over time. We repeated the iterative clustering
537 approach by using references before 2006 (please see Figures 3 (A)) and 2011 (please see

538 Figures 3 (B)), respectively. Consistent with in Figure 2, in Figures 3 (A) and (B), each
539 reference represents a node, the size of which reflects its citation frequency. The width of the
540 edge between each pair of references is determined by their similarity as measured using the
541 Jaccard index (S). If the research fields of a pair are highly similar, then the edge between such
542 a pair is thick and heavy.

543 [Insert Figure 3A here]

544 [Insert Figure 3B here]

545 Comparisons between Figures 3 (A) and (B) enabled us to scrutinize several trends. First,
546 studies included in clusters I (*Long-Run Event Study*), X (*Regulatory Events*), and VIII
547 (*Strategy Investment Decisions*) in 2005 were observed to be entirely the same as those
548 included in the 2010 clusters. Thus, Clusters I, X, VIII had nearly formatted before 2005 and
549 received limited academic focus from event study scholars between 2006 and 2010.

550 Second, some clusters [e.g., VI (*Disinvestment & Relevant Law Amendment*), XVI
551 (*Horizontal M&A*)] in the same period (i.e., 2006–2010) have moderately developed, which is
552 reflected by the case that the number of studies included in the 2010 clusters has moderately
553 increased compared with that in 2005. In particular, cluster XVI (*Horizontal M&A*) was in its
554 preliminary stage of development in 2006–2010 but eventually developed considerably after
555 2010. By contrast, cluster VI (*Disinvestment & Relevant Law Amendment*) has passed its high
556 development period in the years after 2006.

557 Third, clusters V (*IS-related Events*), VII (*Market-related Events*), and XII (*Foreign*
558 *Exchange Intervention*) from 2005 to 2010 had significantly developed because the number of
559 studies included in each of the clusters in 2010 is significantly higher than those in 2005. Thus,
560 event studies from 2006 to 2010 have considerably focused on IS- and marketing-related events
561 and foreign exchange.

562 Thereafter, we compared Figures 2 and 3 and identified several trends. First, the
563 development of clusters I (*Long-Run Event Study*), X (*Regulatory Events*), and VIII (*Strategy*
564 *Investment Decisions*) from 2011 to 2016 remained sluggish, which was similar to the previous
565 period (i.e., 2006–2010). This result provided additional evidence on the case of scholars'
566 minimal focus after 2006 on improving long-run event study methodology or investigating the

567 market reactions of certain events, such as regulation announcements, industry deregulation,
568 joint ventures, and strategic alliance.

569 Second, several clusters [e.g., IV (*Product Quality Management*), VII (*Market-related*
570 *Events*), and VI (*Disinvestment & Relevant Law Amendments*)] developed moderately from
571 2011 to 2016. The analysis particularly indicated that event study methodology had gained the
572 most interest from marketing scholars from 2006 to 2010.

573 Third, clusters V (*IS-related Events*), XII (*Foreign Exchange Intervention*), IX (*Product-*
574 *harm Crisis Events*), XVII (*Monetary Policy*), XVI (*Horizontal M&A*), and XIV (*Credit Rating*)
575 achieved significant development. This result showed event study scholars' recent considerable
576 focus on certain events, such as product-harm crisis, monetary policy enforcement, IS-related
577 events, and credit rating release. Scholars may consider providing further insights into the
578 related topics.

579

580 **6 Conclusions and Directions for Future Research**

581 This study consists of three parts, namely, initial sample, citation, and co-citation analyses.
582 These three parts enable us to present the following major findings. (1) Business scholars'
583 interest in event study methodology has not been short-lived but has continued to grow across
584 decades. (2) Some techniques (e.g., content analysis, DT induction, Markov switching, PSM,
585 and bootstrapping) are often used to update or complement event study methodology to fulfil
586 diverse goals. Based on our investigations, despite the powerful and effectively features, these
587 techniques have all been used in a constraint scope by the extant event studies. (3) The works
588 of Brown and Warner (1985) and McWilliams and Siegel (1997) are the two most popular
589 publications related to event study methodology in business. (4) Event study methodology
590 entered a period of great prosperity around the turn of the millennium and attracted attention
591 from an increasing number of scholars from management, marketing, and MIS. (5) The recent
592 decade has seen that event study methodology remained its popularity in the areas of marketing
593 and MIS. (6) In general, a total of 17 primary clusters exist in the field of event study
594 methodology in business.

595 These findings and conclusions have a variety of implications. First, this study, as a

596 pioneering effort to review event study-related publications using the bibliometric analysis
597 method, extends the extant related literature reviews by providing additional objective findings.
598 This study is the first to provide researchers with information on publishing trends.

599 Second, considering the unbalanced accumulation of knowledge related to event study
600 methodology across business disciplines, our research may facilitate the inter-disciplinary
601 circulation of useful knowledge. To the best of our knowledge, this study is also the first to
602 present a relatively comprehensive summary of the supplementary techniques related to event
603 study methodology. Future research may consider the use of these supplementary techniques
604 to enrich their designs and improve the rigors of the analysis in their event studies. For example,
605 future researchers may pay the particular attention to using the content analysis method as a
606 complement to event study methodology in their investigations on how the content features of
607 an announcement influence the CAR following the event.

608 Third, the identification of influential publications should allow future event study
609 researchers fast access to the classical publications in their fields of interest. The analysis in
610 this part also suggests that event study methodology is drawing increasing attention from
611 researchers in the areas of management, marketing, and MIS. In addition, future researchers
612 can also achieve a general takeaway of the theories used in prior event studies.

613 Fourth, we present an overview of the extant publications related to event study in
614 business and identify the primary clusters in the focal field. Scholars might choose to focus on
615 recently popular topics related to “environmental and CSR events,” “monetary policy,”
616 “market-related events,” and “cross-border M&A.” In addition, found that the extant long-term
617 event studies paid relatively minor attempt to reduce the potential biases by using the proposed
618 methods. Therefore, future long-term studies may further consider adopting these proposed
619 methods to mitigate the potential biases.

620 Given that the applications of the event study methodology involve variations in its
621 procedures, several studies have reviewed the potential alternatives and issues in conducting
622 an event study. Peterson (1998) reviewed the possible issues and compared the different options
623 involved in each procedure of event studies. Binder (1998) reviewed and appraised historical
624 studies that had investigated and exerted effort to improve the event study methodology,

625 thereby paving the way for future research. Sorescu et al. (2017) discussed the main issues
626 when designing event studies in the marketing research context. In particular, they reviewed
627 how these issues had been designed to be solved in the prior marketing event studies.

628 Our research has a twofold difference with the aforementioned studies. First, the preceding
629 studies have merely focused on the development of an event study methodology rather than the
630 evolution of topics. Alternatively, the present study reviewed the existing event study-related
631 research from a business perspective and clustered these studies to scrutinize the existing
632 knowledge clusters. Such an approach also enabled us to analyze the developing trend of each
633 cluster. Second, the extant studies have merely reviewed the options and procedures that are
634 compulsively involved in event studies. The present study represents an initial attempt to
635 review the potential supplementary techniques (e.g., test analysis, PSM), the applications of
636 which are not compulsive but may help improve the accuracy of or enhance the analyses in
637 event studies.

638 Similar to other studies, our results are also subject to limitations. Our research is
639 primarily subject to certain limitations because of the sample used. Although we are confident
640 that the sample we analyzed was representative, objective, and sufficiently large in relation to
641 event study methodology, certain works could not be identified for two reasons. First, the
642 dataset obtained from WOS was comprehensive but not exhaustive. Some event study-related
643 articles were excluded because the journals were unavailable in the WOS database. Second, a
644 large number of studies that apply event study methodology were not identified because event
645 study methodology was not specified in the title, abstract, or keywords. Such limitations in the
646 sample selection may have resulted in a small amount of bias in our analysis.

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Table 1. General steps of a standard event study

Step	Description	Note
Step 1	<i>Define an appropriate event.</i>	(1) The focal event should have a financial impact, should be unanticipated by the market, and should provide new information to the market.
Step 2	<i>Outline a theory that justifies the financial response to the event.</i>	(1) The theory is used as a basis to present an a priori prediction of the sign of the effect.
Step 3	<i>Identify firm sample involved the event and identify their respect event dates (or the common event day).</i>	
Step 4	<i>Event window selection.</i>	(1) Short event windows involve fewer problems than long ones. (2) If the event window exceeds two days, justification of the selection of the event window should be presented.
Step 5	<i>Reduce confounding effects by eliminating firms that experienced other relevant events during the selected window.</i>	(1) The techniques used to control for confounding effects in the context of a longer window can be used only if justification for the longer window is presented and it is shown to be necessary.
Step 6	<i>Calculate the daily (or cumulative) abnormal returns during the selected window and examine the significance of the abnormal return.</i>	(1) Use the standard methodology as outlined in numerous prior studies (e.g., Binder 1998; Binder 1985; McWilliams and Siegel 1997; Pynnonen 2005; Srinivasan and Bharadwaj 2004)
Step 7	<i>Report the percentage of negative returns.</i>	(1) The binomial Z or Wilcoxon test statistic can be helpful. (2) Bootstrap techniques can be useful for small samples.

Table 2. Influential works

Rank	Article	Focus	Citation Count	Average Annual Citation Count
1	<i>Brown and Warner (1985)</i>	Methodology: statistical properties of daily stock returns	276	8.6
2	<i>McWilliams and Siegel (1997)</i>	Literature review: management area	160	8
3	<i>Barber and Lyon (1997)</i>	Methodology: Long-run abnormal stock returns	46	2.3
4	<i>Subramani and Walden (2001)</i>	Announcements of E-commerce	42	2.6
5	<i>Koh and Venkatraman (1991)</i>	Announcements of Joint venture formations	40	1.5
6	<i>Lyon et al. (1999)</i>	Methodology: Long-run abnormal stock returns	38	2.1
7	<i>Barber and Lyon (1996)</i>	Methodology: accounting-based measures	36	1.7
8	<i>Agrawal and Kamakura (1995)</i>	Announcements of celebrity endorser	31	1.4
9	<i>Das et al. (1998)</i>	Announcements of strategic alliances	30	1.6
10	<i>Dyckman et al. (1984)</i>	Methodology: factors influence the methodology ability	27	0.8
11	<i>Chatterjee et al. (2001)</i>	Announcements of newly created CIO positions,	26	1.6
12	<i>Campbell and Wesley (1993)</i>	Methodology: misspecification in NASDAQ samples	26	1.1
13	<i>Geyskens et al. (2002)</i>	Announcements of internet channel additions	26	1.7
14	<i>Chatterjee and Pacini (2002)</i>	Announcements of IT infrastructure investments	25	1.7
15	<i>Im et al. (2001b)</i>	Announcements of IT investments	24	1.5
16	<i>Lane and Jacobson (1995)</i>	Announcements of brand extension	24	1.1
17	<i>Salinger (1992)</i>	Methodology: standard errors	22	0.9
18	<i>Cavusoglu et al. (2004b)</i>	Announcements of IT security breach	22	1.7
19	<i>Corrado and Zivney (1992)</i>	Methodology: sign test	22	0.9
20	<i>Dehning et al. (2003)</i>	Announcements of transformational IT investments	22	1.7

Table 3. Changes of influence of the influential publications

Rank	Article	Focus	By Decade		
			Citation Count (1987–1996)	Citation Count (Improved%) (1997–2006)	Citation Count (Improved%) (2007–2016)
1	<i>Brown and Warner (1985)</i>	Methodology: statistical properties of daily stock returns	36	75(208%)	163(217%)
2	<i>McWilliams and Siegel (1997)</i>	Literature review: management area	0	40(N/A)	119(298%)
3	<i>Barber and Lyon (1997)</i>	Methodology: Long-run abnormal stock returns	0	13(N/A)	31(239%)
4	<i>Subramani and Walden (2001)</i>	Announcements of E-commerce	0	16(N/A)	26(163%)
5	<i>Koh and Venkatraman (1991)</i>	Announcements of Joint venture formations	3	16(533%)	21(131%)
6	<i>Lyon et al. (1999)</i>	Methodology: Long-run abnormal stock returns	0	11(N/A)	26(236%)
7	<i>Barber and Lyon (1996)</i>	Methodology: accounting-based measures	0	6(N/A)	30(500%)
8	<i>Agrawal and Kamakura (1995)</i>	Announcements of celebrity endorser	0	13(N/A)	18(139%)
9	<i>Das et al. (1998)</i>	Announcements of strategic alliances	0	12(N/A)	18(150%)
10	<i>Dyckman et al. (1984)</i>	Methodology: factors influence the methodology ability	4	11(275%)	11(100%)
11	<i>Chatterjee et al. (2001)</i>	Announcements of newly created CIO positions,	0	10(N/A)	16(160%)
12	<i>Campbell and Wesley (1993)</i>	Methodology: misspecification in NASDAQ samples	4	12(300%)	10(83%)
13	<i>Geyskens et al. (2002)</i>	Announcements of internet channel additions	0	5(N/A)	21(420%)
14	<i>Chatterjee and Pacini (2002)</i>	Announcements of IT infrastructure investments	0	5(N/A)	20(400%)
15	<i>Im et al. (2001b)</i>	Announcements of IT investments	0	7(N/A)	17(242%)
16	<i>Lane and Jacobson (1995)</i>	Announcements of brand extension	0	9(N/A)	15(166%)
17	<i>Salinger (1992)</i>	Methodology: standard errors	4	6(150%)	12(200%)
18	<i>Cavusoglu et al. (2004b)</i>	Announcements of IT security breach	0	4(N/A)	18(450%)
19	<i>Corrado and Zivney (1992)</i>	Methodology: sign test	1	5(500%)	16(320%)
20	<i>Dehning et al. (2003)</i>	Announcements of transformational IT investments	0	5(N/A)	20(400%)

Table 4. Cluster descriptions

ID	Cluster^a	Topic Descriptions
I	<i>Long-run Event Study</i>	This cluster focuses on “long-run event studies” and addresses certain methodological concerns by applying long-term event windows. In certain circumstances, it takes a long time for the effects of events to be revealed to investors, and thus many studies analyze the long-run behavior of firm performance after such events.
II	<i>Cross-border Merger and Acquisition (M&A)</i>	Cross-border M&A activity has grown at a fast pace. This cluster of empirical studies focuses on the influence of cross-border M&A announcements on acquirer firms. Specifically, cross-border M&A is riskier than domestic M&A and involves more complicated procedures.
III	<i>Events Related to Insider Trading</i>	This cluster of studies focuses on insider trading. An important strand of research within the extensive literature on insider trading focuses on the determinants of insider trading profitability.
IV	<i>Product Quality Management</i>	This cluster of studies provides empirical evidence to support the relationship between product quality management and share prices and reflects the effects of quality certifications on companies.
V	<i>IS-related Events</i>	The events investigated in this cluster are related to the information systems (IS) field.
VI	<i>Disinvestment & Relevant Law Amendments</i>	This category of articles focuses on the influence of firm withdrawal decisions or relevant law amendments. Recently, the effect of divestment/withdrawal on portfolio performance has received much attention. In addition, certain law amendments, such as antitakeover amendments, have a dramatic impact on firm withdrawal/divestment strategies.
VII	<i>Market-related Events</i>	In marketing, researchers use event study methodology to estimate the overall financial impact of certain marketing strategies. This category of articles evaluates the influence of marketing-related events on a firm’s financial performance.
VIII	<i>Strategy Investment Decisions</i>	This category of decisions focuses on uncertain paybacks or current resource outflows. Hence, any important firm investment reduces current earnings and augments a corporation’s future performance uncertainty. This category of papers focuses on detecting the influence of strategic investment decisions on firm performance.
IX	<i>Product-harm Crisis Events</i>	This cluster of studies is used to investigate the impact of events related to product-harm crises on firm performance, such as defective tires, contaminated children’s jewelry, unhygienic food products, and tainted toothpaste.
X	<i>Regulatory Events</i>	In examining market reactions to regulatory announcements, event study methodology is frequently used to check for patterns of abnormal positive and negative returns that might be consistent with regulations. These studies are strongly related to economics and detect the impact of particular regulatory events after the implementation of a regulatory package.
XI	<i>Environmental & CSR Events</i>	Corporate social responsibility (CSR) plays an increasingly important role in business. It is described as a set of actions that aim to bring social good beyond the explicit pecuniary interests of firms. Such actions are not required by law. In particular, environmentally responsible business practices are important elements of CSR. This body of research focuses on the detection of capital market reactions to firm environmental or CSR events.
XII	<i>Foreign Exchange</i>	Foreign exchange intervention refers to the intervention of a national primary monetary authority (e.g., a central bank) in the

	<i>Intervention</i>	value of the national currency by building cash reserves of that currency. This action is intended to protect the value of a country's currency. This cluster of studies aims to analyze the effectiveness of government intervention in the exchange rate.
XIII	<i>Bank Loan Announcements</i>	Fama (1985) indicates that banks are distinct from firms because banks have a comparative cost advantage over other intermediaries in monitoring loans. This group of studies examines the effects of loan agreements or renewal announcements on the equity price of firms.
XIV	<i>Credit Rating</i>	“Credit ratings for sovereign and corporate bond issues have been produced in the United States by rating agencies such as Moodys and Standard and Poors (S&P) for many years” (Hull et al. 2004, p. 2790). Analysts and commentators often use ratings as descriptors for the creditworthiness of bond issuers. This group of papers examines the effect of credit ratings.
XV	<i>Top Management Succession Events</i>	The importance of the CEO in influencing the strategic direction of a firm is a basic assumption in the strategic management literature (Lorange 1980). An extensive scientific literature has evolved on the determinants of top management turnover and stock price reactions to such turnover events because of the key economic role played by top corporate managers. This strand of studies contributes to the debate by examining firm performance changes engendered by top management succession.
XVI	<i>Horizontal M&A</i>	Horizontal M&As occur between firms that operate in the same space because competition tends to be high and synergies and potential gains in market share are significant for merging firms in such an industry. This is the second cluster related to M&A and it focuses mainly on the horizontal type.
XVII	<i>Monetary Policy</i>	Modern monetary policy entails more than just changing a specified target rate. Instead, central banking has evolved into the art of shaping market expectations across the term structure of interest rates, which affects the economic agents' investment decisions and real economy. This cluster of articles examines the influence of events related to monetary policy.

Table 5. Information for each cluster

ID	Cluster	Number of Article	Main Subtopic	Selected Papers	Number of Short- / Long-run Event Studies
I	<i>Long-Run Event Study</i>	7	- Long-run event study methodology research	<i>Long-run event studies:</i> Barber and Lyon (1997); Rau and Vermaelen (1998); Lyon et al. (1999); Brav (2000); Cowan and Sergeant (2001); Conrad and Kaul (1993); Kothari and Warner (1997)	0 / 7
II	<i>Cross-Border M&A</i>	7	- Cross-Border M&A announcements	<i>Short-run event studies:</i> Aybar and Ficici (2009); Chen and Young (2010); Gubbi et al. (2010); Bhagat et al. (2011); Mulherin and Simsir (2015); Arslan and Simsir (2016) <i>Long-run event studies:</i> Zhu and Jog (2012)	6 / 1
III	<i>Events Related to Insider Trading</i>	5	- Insider trading related laws	<i>Short-run event studies:</i> Buyschaert et al. (2004); Black and Kim (2012); Litvak (2007) <i>Long-run event studies:</i> Wintoki (2007); Wisniewski and Bohl (2005)	3 / 2
IV	<i>Product Quality Management</i>	10	- Quality certification	<i>Short-run event studies:</i> McGuire and Dilts (2008); Nicolau and Sellers (2002); McGuire and Dilts (2008); Beirao and Cabral (2002) <i>Long-run event studies:</i> Corbett et al.(2005)	4 / 1
			- Quality awards	<i>Short-run event studies:</i> Adams et al. (1999); Balasubramanian et al. (2005); Hendricks and Singhal (1996); Hendricks and Singhal (1997); Przasnyski and Tai (2002);	5 / 0
V	<i>IS-related Events</i>	28	- IT investment	<i>Short-run event studies:</i> Dobija et al. (2012); Im et al. (2001a); Morris and Strickland (2008); Posnikoff (1997); Roztocki and Weistroffer (2009); Dardan et al. (2006); Subramani and Walden (2001); Chatterjee et al. (2002); Meng and Lee (2007)	9 / 0
			- IT outsourcing	<i>Short-run event studies:</i> Duan et al. (2009); Agrawal et al. (2006)	2 / 0

			-	IT initiatives	<i>Short-run event studies:</i> Dehning et al. (2004); Lin et al. (2007); Jeong and Stylianou (2010); Aggarwal et al. (2011);	4 / 0
			-	Security/Operational breaches	<i>Short-run event studies:</i> Goel and Shawky (2009); Hovav and D'arcy (2005); Ko and Dorantes (2006); Hovav and D'Arcy (2004); Bharadwaj et al. (2009); Benbunan-Fich and Fich (2004); Kannan et al. (2007); Gillet et al. (2010); Cavusoglu et al. (2004a); Yayla and Hu (2011); Cummins et al. (2006); Andoh-Baidoo and Osei-Bryson (2007)	12 / 0
			-	CIO announcement	Chatterjee et al. (2001)	1 / 0
VI	<i>Disinvestment & Relevant Law Amendments</i>	5	-	Disinvestment	<i>Short-run event studies:</i> Meznar et al. (1998); Posnikoff, 1997 <i>Long-run event studies:</i> Holl and Kyriazis (1997)	2 / 1
			-	Antitakeover amendments	<i>Long-run event studies:</i> Mahoney and Mahoney (1993); McWilliams et al. (1993)	0 / 2
VII	<i>Market-related Events</i>	15	-	Sponsorship announcements	<i>Short-run event studies:</i> Clark et al. (2009); Cornwell et al. (2005); Miyazaki and Morgan (2001); Cobbs et al. (2012)	4 / 0
			-	Celebrity endorsement announcements	<i>Short-run event studies:</i> Agrawal and Kamakura (1995); Ding et al. (2011); Leeds et al. (2007)	3 / 0
			-	Brand acquisitions	<i>Short-run event studies:</i> Lane and Jacobson (1995); Wiles et al. (2012); Raassens et al. (2012)	3 / 0
			-	Channel decisions	<i>Short-run event studies:</i> Geyskens et al. (2002); Swaminathan and Moorman (2009)	2 / 0
			-	Advertising	<i>Short-run event studies:</i> Joshi and Hanssens (2009); Wiles et al. (2010)	2 / 0
			-	Giant entry	<i>Short-run event studies:</i> Gielens et al. (2008)	1 / 0
VIII	<i>Strategy Investment Decisions</i>	4	-	Joint ventures	<i>Short-run event studies:</i> Koh And Venkatraman (1991); <i>Long-run event studies:</i> Park and Kim (1997)	1 / 1
			-	Strategic alliances	<i>Short-run event studies:</i> Das et al. (1998); Woolridge and Snow (1990)	2 / 0

IX	<i>Product-harm Crisis Events</i>	6	-	Bovine spongiform encephalopathy (BSE) outbreak	<i>Short-run event studies:</i> Henson and Mazzocchi (2002)	1 / 0
			-	Product recalls	<i>Short-run event studies:</i> Chen et al. (2009); Lo et al. (2009); Thomsen and Mckenzie (2001); Jin and Kim (2008); Zhao et al. (2013)	5 / 0
X	<i>Regulatory Events</i>	8	-	Industry deregulation/regulation announcements	<i>Short-run event studies:</i> Levy and Gunthorpe (1994); Austin (1993); Sawkins (1996); Whinston and Collins (1992); Carroll and Lamdin (1993); Dnes et al., (1998); <i>Long-run event studies:</i> Coutts et al. (1995); Ries (1993)	6 / 2
XI	<i>Environmental & CSR Events</i>	14	-	Environmental management	<i>Short-run event studies:</i> Takeda and Tomozawa (2008); Gilley et al. (2000); Flammer (2013); Becchetti et al. (2012); Oberndorfer et al. (2013); Cheung (2011); Cañón-De-Francia J. (2009); Yamaguchi (2008)	8 / 0
			-	Environmental disasters	<i>Short-run event studies:</i> Gunthorpe (1997); Gupta and Goldar (2005); Capelle-Blancard and Laguna (2010)	3 / 0
			-	Environmental certification	<i>Short-run event studies:</i> Paulraj and De (2011); Consolandi et al. (2009); Scholtens and Dam (2007)	3 / 0
XII	<i>Foreign Exchange Intervention</i>	10	-	Foreign exchange interventions	<i>Short-run event studies:</i> Morel and Teiletche (2008); Fatum and Hutchison (2006); Fratzscher (2009); Fatum and Hutchison (2003); Fratzscher (2008); Thompson (1994); Thompson (1993); Demirer and Kutan (2010) <i>Long-run event studies:</i> Edison et al. (2006); Mink and De (2013)	8 / 2
XIII	<i>Bank Loan Announcements</i>	7	-	Bank loan announcements	<i>Short-run event studies:</i> Aintablian and Roberts, (2000); Ongena and Roscovan (2013); Bailey et al. (2011); Maskara and Mullineaux (2011); Demirer and Kutan (2010); Focarelli et al. (2008) <i>Long-run event studies:</i> Spiess and Affleck-Graves (1995)	6 / 1
XIV	<i>Credit Rating</i>	13	-	Credit rating changes	<i>Short-run event studies:</i> Abad-Romero and Robles-Fernández (2007); Choy et al. (2006); Jorion and Zhang (2007); Galil and Soffer (2011); Jorion et al. (2005); Norden and Weber (2004); Abad-Romero and Robles-Fernandez (2006); Afonso	11 / 2

					et al. (2012); Bannier and Hirsch (2010); Behr and Güttler (2008); Brooks et al., (2004) <i>Long-run event studies:</i> Steiner and Heinke (2001); Brealey and Kaplanis (2004)	
XV	<i>Top Management Succession Events</i>	4	-	Director changes	<i>Short-run event studies:</i> Kang et al. (2010); Lee and James (2007); Johnson et al. (2005); Bergh and Gibbons (2011)	4 / 0
XVI	<i>Horizontal M&A</i>	8	-	Horizontal M&As	<i>Short-run event studies:</i> Fridolfsson and Stennek (2010); Cox and Portes (1998); Warren-Boulton and Dalkir (2001); Mullin et al. (1995); Clougherty and Duso (2009); McAfee and Williams (1988); Duso et al. (2010); Duso et al. (2011)	8 / 0
XVII	Monetary Policy	13	-	Monetary policy shocks	<i>Short-run event studies:</i> Glick and Leduc (2012); Swanson (2011); Bredin et al. (2007); Thorbecke (1997); Krishnamurthy and Vissing-Jorgensen (2011); Rosa (2011a); Sack (2004); Rosa (2011b); Neely (2015) <i>Long-run event studies:</i> Craine and Martin (2008); Leon and Sebestyen (2012); Rosa (2011c); Wright (2012);	9 / 4

Table 6. Supplementary techniques used in clusters

ID	Cluster	Bootstrap	Markov-switching	Decision tree (DT) analysis	Content analysis	Propensity score matching (PSM)	Non-parametric
I	Long-run Event Study						
II	Cross-border M&A	Bhagat et al. (2011)					
III	Events Related to Insider Trading						
IV	Product Quality Management						Martínez-Costa and Martínez-Lorente (2003)
V	IS-related Events			Andoh-Baidoo et al. (2012)	Agrawal et al. (2006)	Li et al. (2013)	
VI	Disinvestment & Relevant Law Amendments						
VII	Market-related Events						
VIII	Strategy Investment Decisions						
IX	Product-harm Crisis Events				Borah and Tellis (2014)		
X	Regulatory Events				Rhee and Fiss (2014)	Nanda and Ross (2012)	Chesney et al. (2011)
XI	Environmental & CSR Events						Ramiah et al. (2016)
XII	Foreign Exchange Intervention	Morel and Teiletche (2008)					Fatum and Hutchison (2006)
XIII	Bank Loan Announcements						
XIV	Credit Rating		Castellano and Scaccia (2012)				
XV	Top Management Succession Events						Bloom and Jackson (2016)
XVI	Horizontal M&A						Soongswang (2012)

Table 7. Theories used in clusters

ID	Cluster	Theory
I	Long-run Event Study	Nil
II	Cross-border M&A	incomplete contract theory; organizational learning theory; institutional theory; resource-based view
III	Events Related to Insider Trading	Nil
IV	Product Quality Management	organizational learning; signaling theory
V	IS-related Events	signaling theory; resource-based theory (RBT); organizational learning theory
VI	Disinvestment & Relevant Law Amendments	Nil
VII	Market-related Events	signaling theory; institutional theory; normal accident theory; high reliability theory; habituation-tedium theory
VIII	Strategy Investment Decisions	behavioral theory
IX	Product-harm Crisis Events	agency theory; signaling theory; prospect theory; attribution theory,
X	Regulatory Events	Nil
XI	Environmental & CSR Events	organizational ecology theory; development of theory; stakeholder theory; instrumental stakeholder theory
XII	Foreign Exchange Intervention	Nil
XIII	Bank Loan Announcements	Nil
XIV	Credit Rating	agency theory
XV	Top Management Succession Events	upper-echelons theory; resource-dependence theory; signaling theory; token status theory
XVI	Horizontal M&A	signaling theories; organizational learning theory; resource-based view; transaction cost theory
XVII	Monetary Policy	Nil

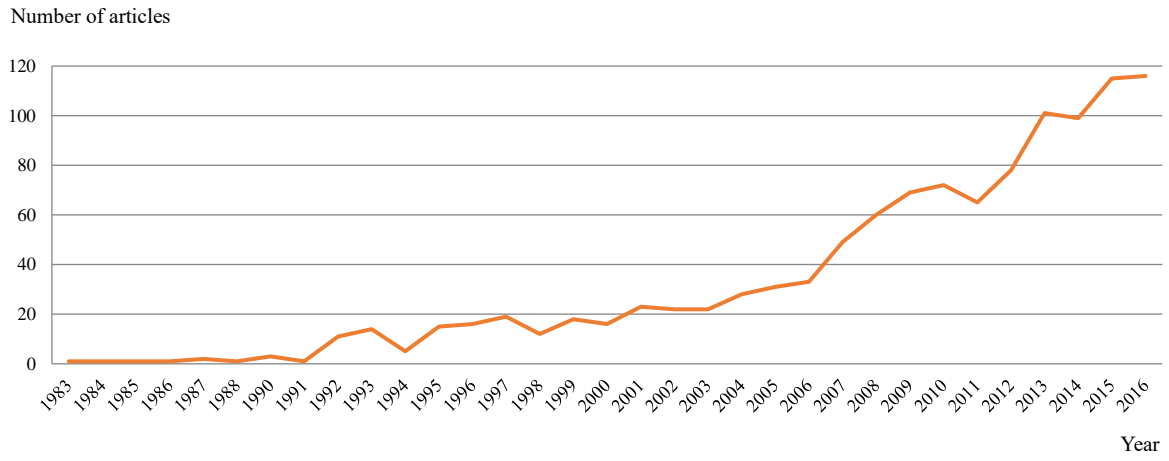


Figure 1. Publication-year distribution

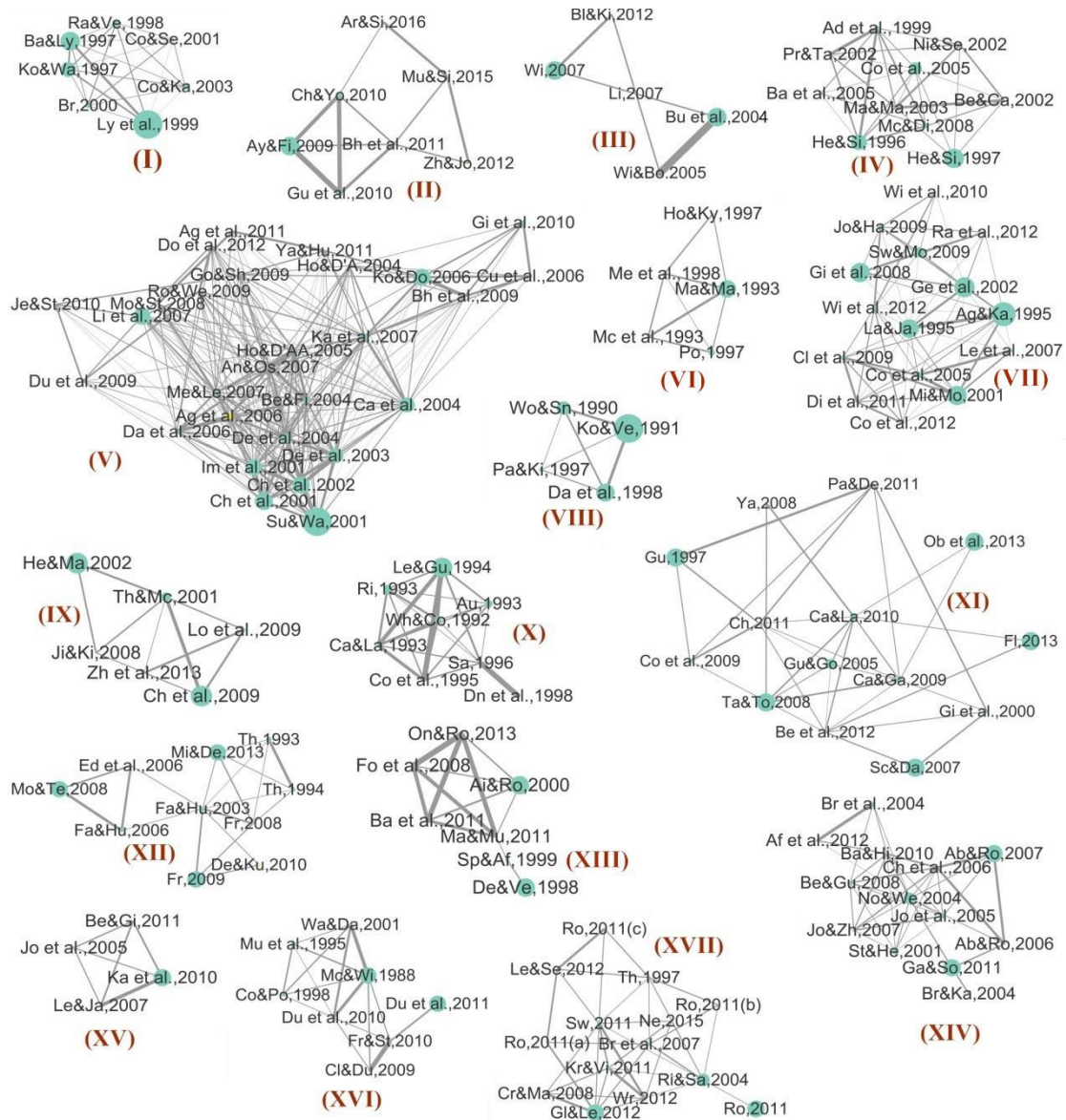


Figure 2. Research clusters⁹

⁹The cluster labels in Figure 3 are consistent with those presented in Table 5.

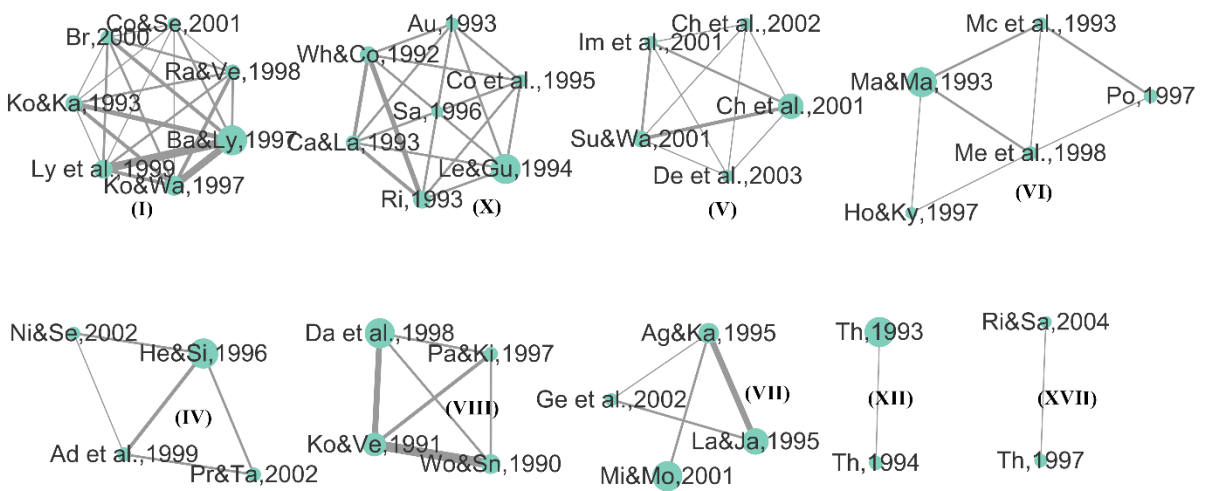


Figure 3 (A). Evolution of research clusters (to 2005)

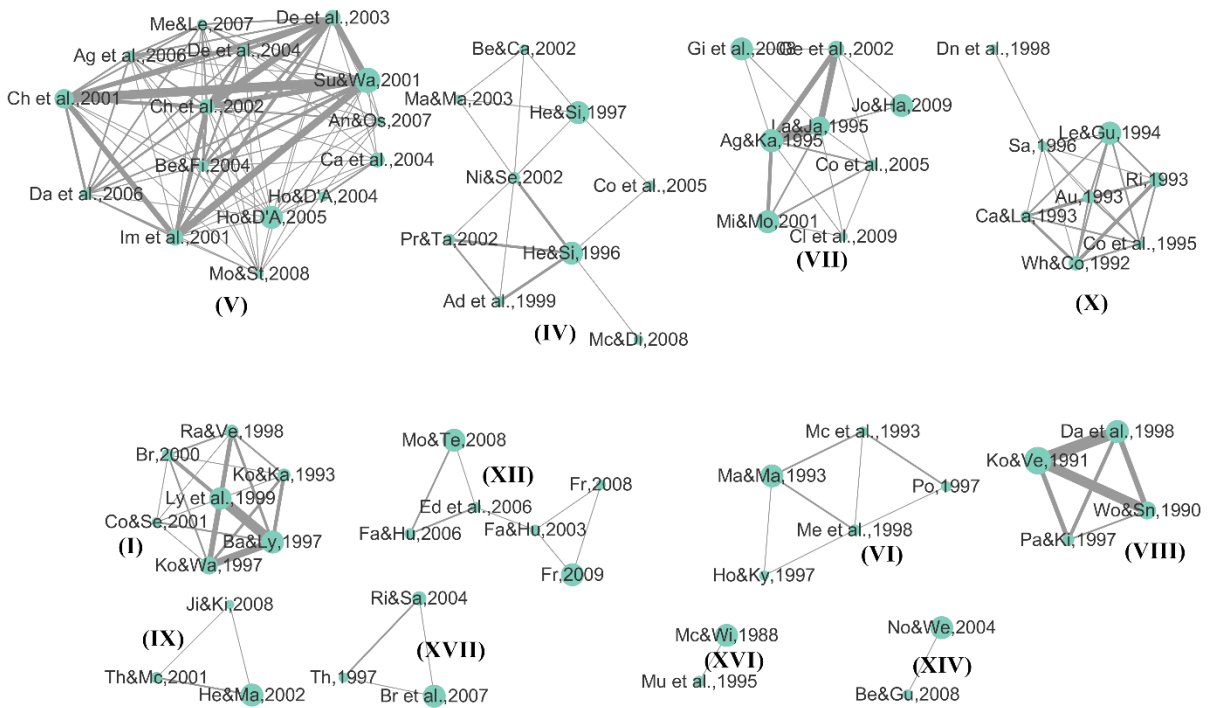


Figure 3 (B). Evolution of research clusters (to 2010)IS