
A bibliometric study of financial risk literature: a historic approach

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This study probes into the development of financial risk literatures through the perspective of bibliometrics. The research samples were collected from the relevant international financial business bibliographic databases. A total of 2727 entries in a span of 29 years from 1970 to 2009 were collected and the results are summarized as follows: (1) the financial risk literatures under influence of the financial turmoil in Asia achieved substantial growth from 1997 to 1998 and an exponential growth curve during the global financial turmoil from 2007 to 2009; (2) the literatures were mainly journals and articles written in English; (3) the United States ranked first in sector productivity; (4) the author productivity of the financial risks was consistent with the Lotka's Law and (5) the document types of the financial risk literatures were mostly dissertation papers on economics and business.

Keywords: bibliometrics; financial risk; Lotka's Law

JEL Classification: A10

I. Research Motivation

The financial industry has a significant impact on any economy, because financial problems lead to dysfunction of agencies and a negative impact on industrial operation and even the overall economic growth. Take for instance, bank teller Li Sun of the Barings Bank (UK) who engaged in trading of Tokyo stock index futures. He violated the codes for the derivatives, which resulted in a 1.4 billion USD loss which eventually led to its closing down (Tickell, 1996). In 2001, Enron Corporation as a result of complex financial operations and financial leverage, coupled with the push up of share prices, white-washed the financial statements to meet the public's growth forecast for the company. Having incurred

tremendous losses and drastic drops in its stock price, the company closed down. In 2002, 'WorldCom', the largest long-distance phone company in the United States shut down due to the continued decline of the US telecommunications sector and the spread of accounting scandals. Up to 38 billion USD of its profits were inflated, which eventually forced it to file for bankruptcy. In 2002, a foreign exchange trader Rosanna of the United Bank of Ireland, the largest bank in Ireland, traded currency exchange derivatives and concealed a 750 million USD loss (Knights, 2006). In 2008, a trader of Jerome Kerviel (France) incurred a loss of 7.2 billion dollars in a single transaction. In addition, the Lehman Brothers Holding Company filed for bankruptcy following its sub-prime crisis (Swagel, 2009). Also, the Wall Street

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Table 1. Financial risk classification-related literatures

Author/year	A	B	C	D	E	F	G	H	I	J	K	L	M
Bulter <i>et al.</i> (1975)	•	•	•	•	•	•	•						
Lewis and Davis (1987)	•	•	•	•	•			•	•				
Uyemura and Van Deventer (1993)	•			•	•					•	•	•	
Sinkey (1998), Blaschke <i>et al.</i> (2001)	•			•						•	•		
Saunders and Cornett (2002), Cihák (2004)	•			•	•			•		•	•		•
Basel (2001)	•				•								•
Rose and Hudgins (2005)	•	•		•						•		•	•

Source: This research.

Notes: A: Credit, B: Investment, C: Income, D: Liquidity, E: Operational, F: falsity, G: entrust, H: bankruptcy, I: guarantee, J: Interest, K: exchange, L: BIS ratio and M: market.

financial turmoil and the cases of debt crisis in Spain, Portugal and Greece in February 2010 also caused strong financial shocks. If financial risks through interaction give rise to a contagion effect, then financial crisis is likely to result (Bae *et al.*, 2003). The issue of financial risks is therefore an important one at stake.

In terms of bibliometrics-related research, the contemporary researches generally focus on issues related to: classification of library and information (Nicolaisen and Hjørland, 2007), information literacy and reference services (Tsay, 2008), distribution of literatures on psychopathology (Cervantes *et al.*, 2009), travel soul productivity literatures (Barrios *et al.*, 2008), distribution of quality management/engineering literature distribution (Franceschini and Maisano, 2010) and distribution of corporate governance literatures in commerce journals (Durisin and Puzone, 2009), but researches on financial risks are scarce. In order to understand the characteristics and development condition of financial risk-related literatures, this study with the financial risk-related literatures as the study scope aimed at analysing the distribution of information types, countries published and years published. Meanwhile, the financial risk literature growth and journal distribution conditions were also probed into and validated using the Lotka's Law. The findings shall serve as reference for follow-up research and reading. Finally, the author productivity was analysed to determine the productive authors' background and characteristics.

II. Literature Review

The definition of financial risks

In today's business environment, risks and uncertainty have received more attention than ever. And there are many risk-related studies such as

management decision-making, operations, accounting and finance in the academia. The term 'risk' is derived from the Greek word 'riscare.' The Webster's Dictionary defines it as: 'the chance of loss or the perils to the subject matter; *also*: the degree of probability of such loss.' Deventer and Uyemura (1993) on the other hand explained change in net cash flow volumes through the concept of cash flow while Jorion (2001) explained the volatility of book value from the stock perspective. In addition, Zsididin (2003) believed that risks can be considered as the degree of uncertainty which may cause losses or jeopardize decision-making. Schoenherr *et al.* (2008) believed that risks can be considered as events that bring about potential risks or the frequency of events. Juttner (2005) mentioned that in an increasingly complex environment, it is extremely complicated and difficult to understand and assess risks and their impacts on business management.

Ming-Yuan (2006) emphasized that in the field of financial management, financial globalization and financial risks are always associated with each other. The term financial risk refers to potential loss or unprofitability, or deprivation of the chance for additional revenues, as a result of the outcome that falls short of what is expected in any economic activities of financial institutions.

The classification of financial risks

Despite the researchers' divided views on how financial risks should be classified, the financial risk classifications generally include: Financial Risk, Credit Risk, Market Risk, Operational Risk and so on (Types of Financial Risks, 2011). In this study, the financial risk classification-related literatures are tabulated in Table 1.

In this study, the major risk types such as credit risk, liquidity risk, interest-rate risk, currency risk, operational risk, law's risk, policy risk, etc., are

compiled according to the financial risk classifications in Table 1. They are described as follows.

Credit risk. Also known as default risk, it refers to the risk of loss involved when a transacting party is unwilling to fulfil its obligations.

Market risk. An asset or liability loss as a result of change in interest rates, exchange rates or other prices.

Liquidity risk. Refers to the risk of losing the ability to repay as timely payment through current assets cannot meet payment needs.

Operational risk. Refers to the risk involved due to insufficiencies of an internal control system that leads to ineffective performance and operational negligence.

Law's risk. Refers to the potential risk involved when the operation policy is forced to change in order to comply with the legal norms that have just been amended.

Policy risk. Refers to the risk faced by activity participants following policy change.

Review of the financial risks

The events of financial crisis that took place in the twentieth century include: the rubber crisis of 1910 in Shanghai, the crash of 1929 in New York that led to the Great Depression, the Latin American debt crisis in the 1980s (started in Mexico), the savings and loan crisis in the 1990s (1989 to 1991), the Japanese asset price bubble and collapse in the 1990s, the Black Wednesday of the European Exchange Rate System in Europe (1992 to 1993), the Economic Crisis in Mexico in 1994 (1994 to 1995) that led to opportunistic attacks and debt owed, the Asian financial crisis that caused devaluation (1997 to 1998), the Russian financial crisis in 1998 that devalued the ruble and the Russian debt default, the Argentine economic crisis and the collapse of the banking system that took place from 2001 to 2002, and the global financial crisis and sub-prime crisis that spread throughout Europe and the United States and other financial events (Financial Crisis, 2011).

The Asian financial crisis. The Asian financial crisis took place from July to October in 1997. It started from Thailand, which further had an impact on the currency, stocks and other assets in the neighbouring Asian countries. Also known as the

Table 2. Currency rate changes of Southeast Asian countries

Currency	Currency exchange rate against 1 USD		Price movement (%)
	June 1997	July 1998	
Thai Baht	24.5	41	-40.2
Indonesian rupiah	2380	14150	-83.2
Peso	26.3	42	-37.4
Ringgit (RM)	2.5	4.1	-39.0
Korean won	850	1290	-34.1

Source: Cheetham (1998).

Table 3. GDP changes of Southeast Asian countries

Country	GNP (1 billion USD)		Price movement
	June 1997	July 1998	
Thailand	170	102	-40.0%
Indonesia	205	34	-83.4%
Philippines	75	47	-37.3%
Malaysia	90	55	-38.9%
South Korea	430	283	-34.2%

'Asian financial storm,' Indonesia, South Korea and Thailand suffered the most severe consequences as a result of this financial turmoil and all the South-East Asian countries' currencies depreciated sharply in a short period of time except for the Hong Kong dollar. And the Southeast Asia's monetary system and stock markets eventually crashed (Cheetham, 1998). As shown in Tables 2 and 3, related information indicates that a large number of foreign investments withdrew from the markets and the tremendous domestic inflationary pressure cast a shadow on the region's economic development.

The global financial crisis. Also called the 'World Financial Crisis, Subprime Mortgage Crisis, and Credit Crisis,' as well as 'Financial Tsunami and Wall Street Tsunami' since 2008, this financial crisis broke out on 9 August, 2007 due to the early sub-prime credit crisis, credit spread and a large number of sub-prime mortgages (sub-prime loans). The major issuing agencies in the United States including Fannie Mae, Freddie Mac and Ginnie Mae attracted many corporate investments as its MBS yields issued were on average higher than the US. 10-year government bond yield by 137 basis points. The Lehman Brothers' MBS indexes indicate that regardless of interest rate movements, its indexes have for 10 consecutive years yielded positive returns, even for

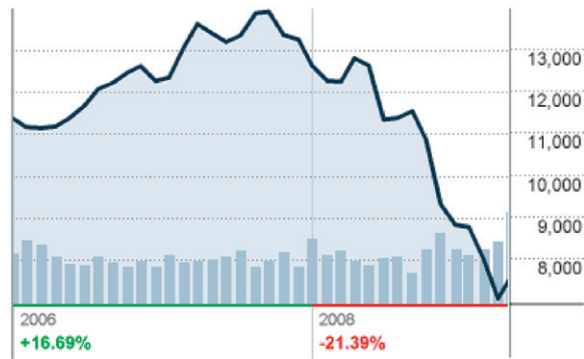


Fig. 1. Dow Jones industrial average

Source: CNN money.

the lowest 2.1% rate of return in 1999. The MSCI global bond indexes in 1999, 2001 and 2005 on the other hand were negative rates of return. This strategy seemed to have expanded and spread like the domino effect. This crisis resulted in excess housing supply and drastic drops in peripheral housing prices. The result of this was that the houses were in large numbers reclaimed by the courts for auction or they were deserted. In September 2008 (Commercial Times, 2008), the global stock market crashed and the Dow Jones industrial average, Nasdaq, and S&P 500 indexes fell one after another as shown in Fig. 1. The American International Group (AIG), Lehman Brothers (Lehman), Merrill Lynch and other large financial institutions (*The New York Times*, 2008) had lowered credit rating for possession of a number of contract breaches of expired contracts. Consequently, the financial crisis worsened.

Lotka's Law

Bibliometrics is defined as 'the application of mathematical and statistical methods to books and other media of communication' (Pritchard, 1969). The Lotka's Law is one of the three laws in the Bibliometrics (Bradford's Law, Lotka's Law and Zipf's Law). For example, the productivity of authors is tested using Lotka's Law, which states that the number of authors contributing n papers would constitute $1/n^2$ of those contributing one paper and that the proportion of authors contributing only one paper is about 60% of all authors (Hertzler, 1987, p. 159). Thus, about 60% of authors studying in a certain field would publish just one article, 15% two articles, 6.6% three articles and so on. Lotka's Square Law can be defined mathematically as a function $f(n) = C/n^\alpha$, where $f(n)$ is the frequency function and C and α are constants ($C > 0$ and $\alpha > 0$). The number

of authors publishing n papers is determined by the law of diminishing returns (Egghe, 2005, p. 14). Citation and co-authorship analyses measure the impact of authors' contributions and identify their scientific collaboration patterns, respectively (Price, 1970). Scientometricians use co-authorship patterns to predict new trends in scientific fields (Glanzel, 2002).

III. Research Method

In this study, the Bibliometric approach was adopted to discuss the distribution of the productivity of financial risk literatures. On the other hand, financial risks are for profit or nonprofit organizations to determine and control risks and returns. Due to financial integration and economic globalization development, the financial risks have become more complex and diversified and thus the importance of financial risk management is self-evident. In this study, the Web of Science of the Institute for Scientific Information; ISI Web of Science® gives direct access to the three major index databases namely: Science Citation Index Expanded, Social Sciences Citation Index and Arts & Humanities Citation Index, as well as two major chemical information databases namely: Index Chemicus and Current Chemical Reactions. In addition, the impact factor of the Journal Citation Reports (JCR) was adopted for journal review purpose.

In this study, the financial risk literatures from 1970 to 2009 were collected. And the downloaded bibliographic data were entered in the Excel spreadsheet to systematically arrange the literatures as to document type, journal title, book title, language, author's address, SSN and country published, etc. Some data required manual checking and comparison. For instance, some journal titles had to be looked up, because the journals were often folded, reopened, divided, combined or even changed. Thus, *Ulrich's Periodicals Directory* was used to verify the journal title changes to derive at the most accurate statistical data. All the documents from the same journal despite the journal title changes were combined in the statistics and to unify the name, the journal title at the time was used. Finally, through the Excel spreadsheet and SPSS statistical software, the literature data was analysed, tallied and mapped according to the research issues.

The research tools used in this study are three databases, including: Web of Science, Ulrich's Periodicals Directory and JCR. They are described as follows.

Web of science

The index term can be an article, a patent number, a conference proceeding or a book. By searching the literatures cited, the researcher could better understand the research work of a dissertation paper. The literature data obtained from database search including the topic, title, author, editor, language, document type and year published was further analysed and processed for later literature search. The Web of Science also contains records in the columns to assist the researcher analyse and summarize the literatures.

Ulrich's Periodicals Directory

Ulrich's Periodicals Directory is a bibliographic database published by the Bowker Company. It contains 186 100 periodic and nonperiodic publications published by more than 130 000 publishers to provide detailed, diversified and authoritative information updated weekly. This study used the Ulrich's Periodicals Directory to check and correct the journal names and other published information.

Journal Citation Reports

The JCR provides systematized and objective approaches. Targeting important scientific journals around the world, the quantitative approach was adopted for evaluation. It contains nearly 6000 journals that are peer reviewed and highly cited. The JCR provides data such as: Total Cites, Impact Factor; IF, Immediacy Index, Cited Half-life, Citing Half-life, etc. To librarians, the JCR serves as reference for subscribing, deleting, archiving, maintaining and eliminating journals.

In this study, the author's affiliated agencies, and productivity were the main targets analysed. The search databases containing financial risk titled literatures written in a span of 29 years from 1970 to 2009 were adopted to search the topic column. The title = 'Financial Risk' or 'Financial crisis' or 'Financial distress' were the keywords in the search and 2727 papers on financial risks written from 1970 to 2009 were obtained. In this study, the bibliographic information obtained using the Web of Science were summarized and arranged through the Excel Software. The various data were further analysed and statistical calculations performed based on the study problems. With the statistical results, the statistical diagrams needed in this study were mapped. Finally, the various data were applied for analysis and discussion.

IV. Empirical Results

The author productivity condition of the financial risk literatures can be divided into: financial risk growth trend, literature citation statistics, subject productivity and individual author productivity. They are analysed as follows.

The growth analysis of the financial risk literatures

With regard to the growth trend of the financial risk literatures, Table 4 shows that prior to 1970, there were only 16 financial risk literatures and this number did not reach 100 until after 1997. Obviously, the financial risk-related issues received little attention back then. The literature growth rate from 1971 to 1995 remained stagnant, but the literatures gradually increased since 1998, reaching at least 100 every year. For instance, the Asian financial storm in 1997 and 1998 gave rise to an explosive growth. In 1998, the number of literatures reached 120 and the rate climbed from 1.55% to 4.33% in 1997, a four-fold increase. The growth rate reached its peak in 1999 with 186 papers or 6.71%. It was also because of the crisis, the researchers began to attach importance to the financial risk issue. From 2000 to 2006, the growth trends increased annually as well. By 2007 to 2008, the global financial crisis resulted in the literature publication rate increase to 8.30%. By 2009, it reached a record high of 622 papers or 22.45%. As shown in Fig. 2 the overall curve shows an exponential growth model.

The statistics of the literature citations are as shown in Fig. 3 which show an upward growth trend yearly. The growth reached its peak in 2009.

The analysis of financial risk literatures in terms of country published and language

Based on the statistics for country published, the United States with the most literatures published ranks first, accounting for 37.43% of all the journals, followed by the United Kingdom of 11.26%. Among the Asian countries, South Korea ranks third with 143 papers (5.16%) and most of the studies cover the impact of the financial turmoil on its economy and trade. For example, Hwang and Im (2009) pointed out that the world demand channel is the most important factor for the recovery of Korea's exports from Global Financial Crisis. Subject to impacts of the Asian Financial Crisis, the Korean government's laws, economic policies and capital management (Kim, 2009; Kim and Chey, 2010) were affected by the Asian Financial Crisis. And Korea's total

Table 4. Distribution of the years the financial risk literatures were published

Year published	Quantity published	Per cent	Year published	Quantity published	Per cent
1970 before	16	0.57	1991	16	0.58
1971	2	0.07	1992	36	1.30
1972	0	0.00	1993	34	1.23
1973	4	0.14	1994	39	1.41
1974	0	0.00	1995	31	1.12
1975	2	0.07	1996	43	1.55
1976	8	0.29	1997	43	1.55
1977	11	0.40	1998	120	4.33
1978	8	0.29	1999	186	6.71
1979	3	0.11	2000	163	5.88
1980	4	0.14	2001	128	4.62
1981	4	0.14	2002	130	4.69
1982	4	0.14	2003	138	4.98
1983	16	0.58	2004	135	4.87
1984	7	0.25	2005	128	4.62
1985	8	0.29	2006	157	5.67
1986	7	0.25	2007	205	7.40
1987	6	0.22	2008	230	8.30
1988	8	0.29	2009	622	22.45
1989	12	0.43	Total	2727	100%
1990	9	0.32			

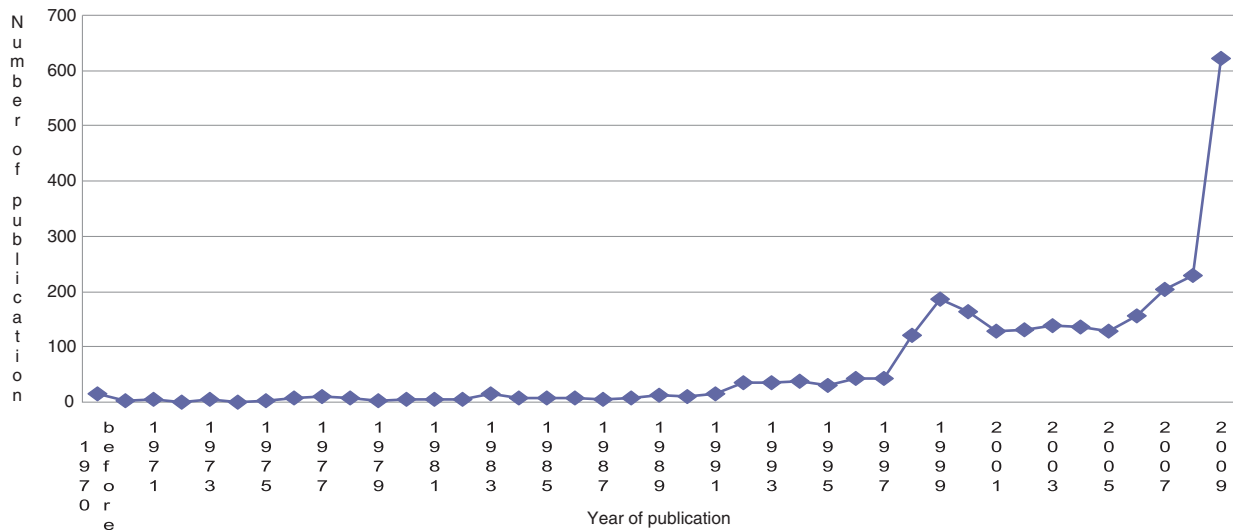


Fig. 2. The growth trend of the financial risk literatures

productivity analysis was largely influenced by the Asian Financial Crisis (Oh *et al.*, 2008). The quantities and percentages are as shown in Table 5.

This study includes 9500 search results of authors distributed throughout 1422 agencies. The top 25 agencies are as shown in Table 6. To classify them as to country, the United States has 16 and among the top five agencies, Work Bank (No. 1), Harvard Univ (No. 2) and INT MONETARY FUND (No. 3) are all located in the USA. Apparently, the United States

has its place in the field of financial risk research. The fourth in rank is South Korea's KOREA UNIV and the fifth is Singapore's NATL UNIV SINGAPORE. If we divide the agencies into government units, colleges/universities and corporations, we can see that the colleges and universities rank the top 21 out of the 25.

In terms of statistics for language published, English accounted for the majority. The statistical table is as shown in Fig. 4.

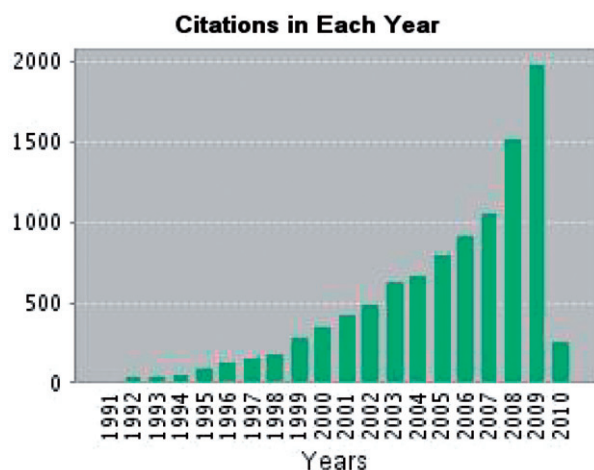


Fig. 3. The statistics of financial risk literature citations

Table 5. Distribution of financial risk literatures published in the various countries

Order	Country published	Quantity	Per cent
1	USA	1037	37.43
2	England	312	11.26
3	South Korea	143	5.16
4	Australia	135	4.87
5	Canada	111	4.00
6	Peoples Republic of China	111	4.00
7	Germany	103	3.71
8	France	67	2.41
9	Singapore	57	2.05
10	Japan	55	1.98
11	The Netherlands	52	1.87
12	Taiwan	48	1.73
13	Turkey	40	1.44
14	Spain	39	1.40
15	Italy	38	1.37
16	Switzerland	35	1.26
17	Brazil	28	1.01
18	Sweden	26	0.93
19	Russia	24	0.86
20	Czech Republic	22	0.79
21	Mexico	22	0.79
22	Scotland	21	0.75
23	Thailand	20	0.72
24	South Africa	19	0.68
25	Israel	18	0.64

The classification of financial risk literature research types

In terms of the classification of the literature research, market risk accounted for the majority (26.09%), followed by credit risk (12.54%) and investment risk (12.07%) as showed Fig. 5. The publication rates from 1994 to 2006 showed a slight upward trend (Fig. 6). But since 2007 the rates have greatly increased, indicating that the financial risk issue has

gained the researchers' attention, most likely due to the financial crisis.

The financial risk literatures in terms of publication types and journal distributions

In terms of the statistical data of the literature publication types, the research articles (journals) accounted for the majority (47.04%), followed by proceedings papers. The relevant quantities and percentages are as shown in Table 7.

With regard to publication of literatures in journals, the research analysis shows that *Journal of Banking and Finance* (JBF) has the highest number of articles of 54 with the JCR IF of 1.293, followed by *Journal of International Money and Finance* (JIMF) with the IF of 1.186. The journal distribution is as shown in Table 8. Two reasons contribute to this higher ratio: (1) The scope of the JBF and JIMF journal titles covers all the financial topics and the financial risk issue is one of the major items; and (2) the JBF and JIMF are published in the United States and it is the country with the most financial risk literature publications. In terms of *Pacific Review*, *Cambridge Journal of Economics*, *Economic and Political Weekly*, *Applied Economics*, *Review of International Political Economy*, *Bulletin of Indonesian Economic Studies*, *World Development* and so on, emphasis is given to economic change, financial institution management and change-related issues. As for the *Asian Survey*, the focus lies in the Asian economy and financial institution-related issues.

The subject types of financial risk literature publications

In regard to the subjects of literature publications, Economics has the highest number of publications, accounting for 41.01% of all the journals, followed by Business and Finance of 14.27%. The related quantities and percentages are as shown in Fig. 7.

The distribution of author productivity of financial risk literatures

With regard to the distribution of author productivity of financial risk literatures, there are a total of 2727 financial risk literatures and 2058 authors. In terms of the authors' literature productivity, 70.84% of the authors that published only one literature, followed by two authors that published more than nine literature articles and the authors that published eight articles. Table 9 shows that most of the authors have low productivity and few are highly productive.

Table 6. Analysis of the productivity of financial risk literature agencies

Order	Institution name	Country	Count	Per cent
1	WORLD BANK	USA	58	2.0939
2	HARVARD UNIV	USA	48	1.7329
3	INT MONETARY FUND	USA	41	1.4801
4	KOREA UNIV	South Korea	35	1.2635
5	NATL UNIV SINGAPORE	SINGAPORE	33	1.1913
6	AUSTRALIAN NATL UNIV	Australia	32	1.1552
7	CITY UNIV HONG KONG	HK	32	1.1552
8	UNIV CALIF BERKELEY	USA	31	1.1191
9	New York UNIV	USA	27	0.9747
10	NATL BUR ECON RES	USA	25	0.9025
11	NBER	USA	24	0.8664
12	CORNELL UNIV	USA	23	0.8303
13	YONSEI UNIV	South Korea	22	0.7942
14	UNIV OXFORD	England	21	0.7581
15	UNIV PENN	USA	21	0.7581
16	COLUMBIA UNIV	USA	20	0.7220
17	CHINESE UNIV HONG KONG	HK	19	0.6859
18	UNIV CAMBRIDGE	England	19	0.6859
19	RUTGERS STATE UNIV	USA	19	0.6859
20	UNIV CHICAGO	USA	19	0.6859
21	MIT	USA	18	0.6498
22	SEOUL NATL UNIV	South Korea	18	0.6498
23	UNIV ILLINOIS	USA	18	0.6498
24	UNIV MARYLAND	USA	18	0.6498
25	UNIV MICHIGAN	USA	18	0.6498

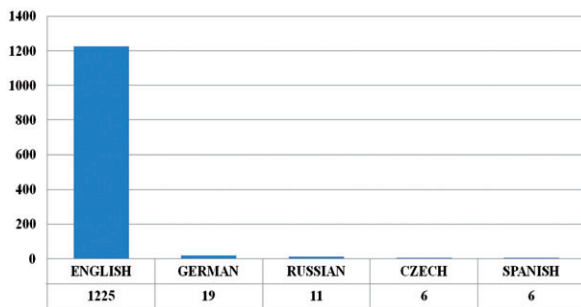


Fig. 4. Distribution of financial risk literatures in terms of language published

In terms of the author productivity characteristics, Munoz, E. and Wise, L. had the most publications (10 articles), followed by Goldstein, J. (eight articles). The authors' publications are as shown in Table 10.

The application and validation of the Lotka's law

Based on the calculated results in Table 11, the least square equation in Equation 1 below was used to obtain the slope *n* value of -3.40048 which is the index according to the Lotka's Law is as follows:

$$n = \frac{N \sum XY \sum - \sum X \sum Y}{N \sum X^2 - (\sum X)^2} \quad (1)$$

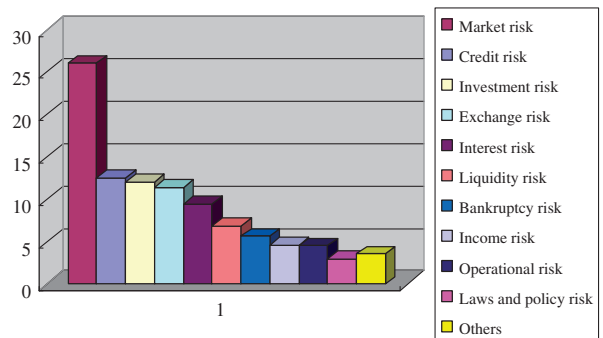


Fig. 5. Distribution of the various types of financial risk literature publications

$$c = \frac{1}{\sum_1^{p-1} \frac{1}{x^n} + \frac{1}{(n-1)(p^{n-1})} + \frac{1}{2p^n} + \frac{1}{24(p-1)^{n+1}}} \quad (2)$$

p = 9, *x* = 0, 1, 2, 3, 4, 5, 6, 7, 8

The *c* value obtained from Equation 2 is 0.8645% or 86.45%. It indicates that the number of authors with one published financial risk literature article accounts for 86.45% of the total number of authors. In this study, with the published literatures serve are the abscissa and the number of authors in percentages are the ordinate, the author productivity logarithmic

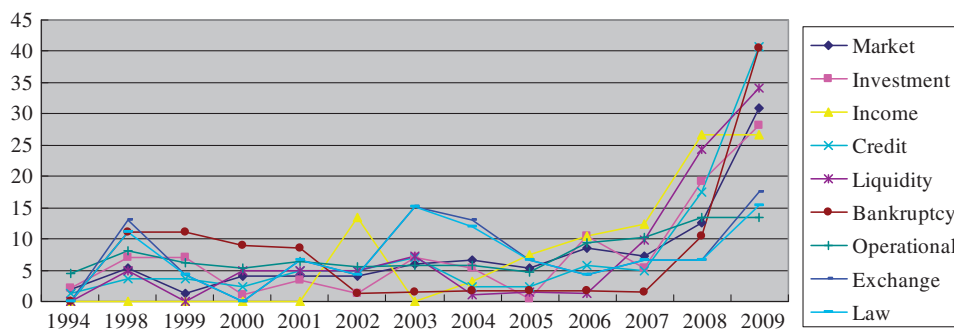


Fig. 6. The Distribution of the financial risk literatures in terms of year published

Table 7. The publication types of the financial risk literatures

Literature type	Quantity published	Per cent
Article (Journal)	604	47.04
Proceedings paper	414	32.24
Book review	120	9.35
Editorial material	83	6.46
News item	19	1.48
Review	19	1.48
Meeting abstract	17	1.32
Correction	4	0.31
Letter	4	0.31
Total	1284	100.00

distribution was plotted, as shown in Fig. 8. In Fig. 8, the left to right slope is the straight line of the expected values and the small points are the distributions of the values observed. However, the distribution points of the authors are slightly deviated from the straight line of the expected values. The overall distribution curve is still in a straight line like the Lotka graph, indicating that the finding is consistent with the Lotka’s Law.

The Kolmogorov–Smirnov test conducted to validate the Lotka’s Law

This study further probed into whether the author productivity distribution is consistent with the Lotka’s Law. The Kolmogorov–Smirnov Test was conducted to verify whether the Lotka’s Law is applicable for use in this study and the procedures are as follows:

- (1) List the observed values and expected values, and tally the cumulative percentages.

- (2) Obtain the absolute value from the cumulative observed values and expected values.
- (3) Using the equation $\frac{1.63}{\sqrt{\text{Total No. of authors}}}$, calculate the critical value (Coles statistical value) of the study results. If the maximum absolute value (D_{\max}) obtained from the difference between the observed value and expected value is lower than the critical value, it means the Lotka’s Law is applicable for the observed results in this study. On the contrary, if the value is higher, it means the results are not consistent with the Lotka’s Law. The $n = 3.2537$ and c value 0.8645 in this study are substituted in the equation $c(1/x^n)$ to obtain the authors’ expected value based on the Lotka’s Law. Table 12 after validation using the Kolmogorov–Smirnov Test shows the D_{\max} value of 0.0230 and the critical value of 0.0359 ($1.63/\sqrt{2058} = 0.0359$). Since the critical value is higher than the maximum absolute value (i.e. the difference between the observed value and expected value), the observed results are said to be consistent with the Lotka’s Law. In other words, the Lotka’s Law is applicable for researches on author productivity of financial risk management-related literatures.

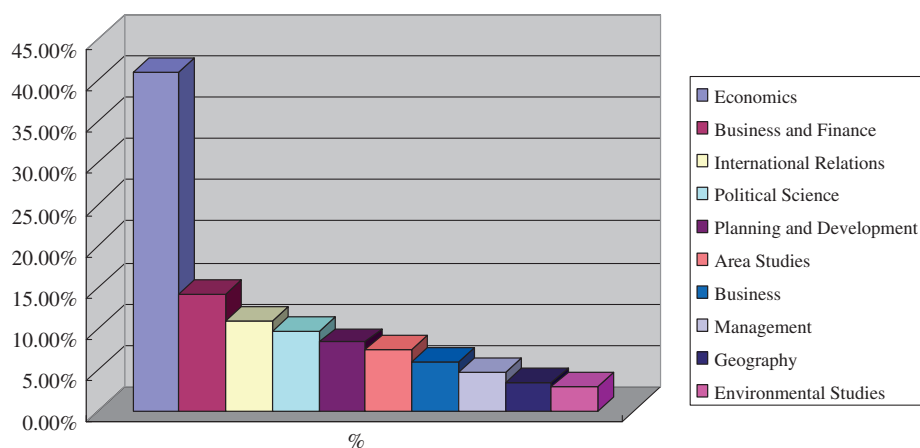
V. Conclusion

In this study, the financial risk literatures were analysed using the Lotka’s Law to determine the author productivity and validated literature distribution. The study results are consistent with the Lotka’s Law and Kolmogorov–Smirnov Test findings. The related study findings are as follows:

- (1) The financial risk literatures under the influence of Asian financial crisis showed

Table 8. The distribution of financial risk literature journals

Journal name	Count	Per cent	Issue year	5-year JCR (I.F)
<i>Journal of Banking and Finance</i>	54	1.9516	1977	1.293
<i>Journal of International Money and Finance</i>	51	1.8432	1982	1.186
<i>Pacific Review</i>	38	1.3733	1988	1.022
<i>Cambridge Journal of Economics</i>	33	1.1926	1977	0.767
<i>IDS Bulletin-Institute of Development Studies</i>	30	1.0842	2003	0.365
<i>World Development</i>	28	1.0119	1973	1.392
<i>Economic and Political Weekly</i>	25	0.9035	1966	N/A
<i>Applied Economics</i>	24	0.8674	1969	0.777
<i>Asian Survey</i>	24	0.8674	1961	N/A
<i>Bulletin of Indonesian Economic Studies</i>	24	0.859	1998	1.116
<i>Review of International Political Economy</i>	23	0.8312	1994	0.739

**Fig. 7. The subject types of financial risk literature publications****Table 9. The distribution of author productivity of financial risk literatures**

No. of articles	No. of authors	No. of authors (%)	No. of literature articles	No. of literature articles (%)	Cumulative literature articles (%)
1	1577	85.43	1577	70.84	70.84
2	202	10.94	404	18.15	88.99
3	49	2.65	147	6.60	95.60
4	9	0.49	36	1.62	97.21
5	3	0.16	15	0.67	97.89
6	1	0.05	6	0.27	98.16
7	1	0.05	7	0.31	98.47
8	2	0.11	16	0.72	99.19
9	2	0.11	18	0.81	100.00
Total	1846	100.00	2226	100.00	

Table 10. The distribution of financial risk literature authors

Authors	No. of articles published	Per cent
Munoz, E.	10	0.77
Wise, L.	10	0.77
Goldstein, J.	8	0.62
Sterman, H.	7	0.54
Chalfin, D.	3	0.23
Chater, N.	3	0.23
Cohen, J.	3	0.23
Diebold, F. X.	3	0.23
Friedman, R.	3	0.23
Margolis, I. B.	3	0.23
Nagurney, A.	3	0.23
Rzeczynski, M. S.	3	0.23
Santomero, A. M.	3	0.23
Schubert, R.	3	0.23
Stewart, N.	3	0.23
Vlaev, I.	3	0.23

Table 11. The analysis of the authors and productivity of financial risk literatures

No. of literatures (x)	No. of people (y)	$X = \ln x$	$Y = \ln y$	XY	XX
1	1822	0.00	3.2605	0.0000	0.0000
2	191	0.30	2.2810	0.6867	0.0906
3	35	0.48	1.5441	0.7367	0.2276
4	5	0.60	0.6990	0.4208	0.3625
5	2	0.70	0.3010	0.2104	0.4886
7	1	0.85	0.0000	0.0000	0.7142
9	1	0.95	0.0000	0.0000	0.9106
13	1	1.11	0.0000	0.0000	1.2409
Total	2058	4.99	8.0856	2.0546	4.0349

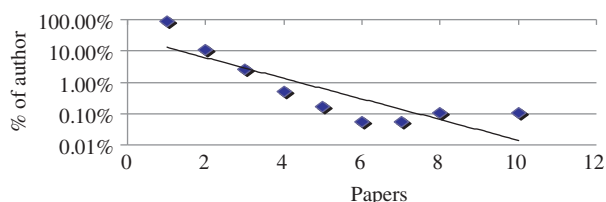


Fig. 8. The distribution of author productivity of financial risk literatures

Table 12. The distribution of percentages of financial risk management literature authors

No. of literatures published	No. of authors	The author's observed value (%)	The author's expected value	The cumulative author's expected value	The absolute value (the difference between the commutative value the cumulative expected value)
1	1822	88.53	0.8645	0.8645	0.0209
2	191	9.28	0.0906	0.9551	0.0230 (D_{max})
3	35	1.70	0.0242	0.9793	0.0158
4	5	0.24	0.0095	0.9888	0.0088
5	2	0.10	0.0046	0.9934	0.0051
7	1	0.05	0.0015	0.9950	0.0041
9	1	0.05	0.0007	0.9956	0.0039
13	1	0.05	0.0002	0.9958	0.0042

considerable growth from 1997 to 1998. And during the global financial tsunami from 2007 to 2009, the exponential growth curve was observed.

- (2) The journals and dissertation papers comprise the main data type particularly JBF (1.95%) and JIMF (1.84%). And this study finding shows that the scope of the journals covers the financial risk issues. In terms of the countries the literatures were published, the United States and the United Kingdom are the major publishing countries and the publications are mostly in English. They have continued to achieve steady growth since the mid-1990s.
- (3) In terms of publishing agencies, the tertiary institutions comprise the majority. Among them, the US World Bank, Harvard Univ and Intl Monetary Fund rank the top three.
- (4) In terms of analysis of financial risk literature classifications, 'market risk' accounted for the majority (26.09), followed by credit risk (12.54%). Obviously, they are of great industrial and academic importance. From the sequence diagram of the various types of financial risk literatures published, Fig. 6 shows that in 2007 the financial risk literatures showed exponential growth. Financial risks are not only the core issue in the industries, but are also of great interest to the academia. Apparently, the industries and academia have attached greater importance to financial risk-related issues than ever.
- (5) In terms of author productivity, most of the authors have only published one financial risk literature article and their research fields are majorly Economics (41.01%), followed by Business and Finance (14.27%) and others such as International Relations, Political

Science, Planning and Development, Area Studies, Business, Management and so on.

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