Analyzing Trend of Capital Adequacy and Basel Standard using Text Mining Technique

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Abstract

Capital adequacy ratio is widely discussed among the banking institution as they must secure certain amount as required by financial regulator. It represents the percentage of risk-weighted asset and act as the indication of no excess leverage should be hold by them. Therefore the Basel Committee has designed Basel I, Basel II and Basel III for banking institution as a reference to ensure the capital requirement is sufficient in minimizing the operational risk. This study aims to analyze the trend and pattern on capital adequacy and its execution in banking system in Japan after the introduction of Basel Standard. The study covered the 11 years articles published in Nikkei 21 from 2004 to 2014 by using text mining and correspondence analysis as a methodology. RMeCab and MeCab in R statistical tools were used and it leads to present the importance of Basel Standard as guidance in determining the level of capital adequacy ratio.

Key words: Capital Adequacy, Basel Standard, Correspondence Analysis, Text Mining

1. Introduction

Basel standard has been introduced since 1988 and time-to-time the standard was reviewed consequently based on feedback from financial institution. The standard was improved and more risk sensitive. Even though several parties have argued it but the standard is still defined as the secure reference correlated to security risk faced by most of the financial sector.

Basel Standard described capital requirement need to be secured by financial institution to shelter the unseen incoming risk that will interfere their operation. In Japan Basel rules are binding to 16 international active banks that encountered around 56% of the Japanese banking sector assets. Local bank is governed by Financial Services Agency of Japan (JFSA) enforce a marginally modified version of Basel III.

The committee suggested minimum capital requirement need to be fixed at 8% of risk weighted assets (RWA), therefore the definition of capital risk management must be defined specifically by taking into consideration the combination of different types of risk that may affect banking’s operation. Even though the Basel Standards is apply for international bank however capital adequacy is agreed to have a positive relationship with profitability for both to local and international bank [2].

2. Objective of Study

Capital Adequacy always seen as a critical issue discussed by financial institution. It is defined as percentage ratio of a financial institution's primary capital to its assets used as a measure of its financial strength and stability [6]. The study focused on the analysis of text as some indication of extensive discussion that have been done and captured by financial sector. Trend and pattern of discussion about the introduction and execution of Basel Standard to capital adequacy ratio will be studied. Therefore the overall view about the discussion can be concluded effectively.

This research emphasizes on combination of text mining and correspondence analysis. This method
have a limited literature, other than that the existing reference related to analysis on trend of capital adequacy and Basel standard in Japan are mainly published in Japanese language, therefore this article is likely to globally give vast reference to researcher around the world especially to non Japanese speaker.

3. Methodology

In order to close some discrepancy in Basel I, the committee decided to replace it with new accord called Basel II in 2004. Basel II superseded the old standard by introducing a better risk calculation technique by maintaining minimum 8% capital adequacy, it is very crucial to ensure the risk monitoring process is running effectively. To study the level of discussion and execution of Basel standard, text mining is employed in this study.

3.1 Text Mining

Text mining is the study of data enclosed in expected text by transforming text into statistical data. This method is used to study the trend and pattern of discussion about the introduction and execution of Basel Standard (BS) related to Capital Adequacy Ratio (CAR). The study captured the nouns as an importance concept. The articles were analyzed using Text mining technique through R software using RMecab and MeCab. These methods managed to recognized Japanese character and google translator is used in translation process.

The data targeted the news published in Nikkei 21 for the period of eleven years since 2004 to 2014 published in Japanese language. The comprehensive search leads to total of 262 substantial articles. The process of searching the articles is shown in figure 2. In Japan Nikkei is known as one of the biggest media corporation specialized in financial and business news. This research gained data from news published in Nikkei 21, besides Nikkei 21, Nikkei Veritas similarly published professional finance news unfortunately this publication is relatively new. Since this research covered eleven years time from 2004 to 2014, we cannot use for correspondence analysis because Nikkei Veritas is only started their publication in February 2008 as a weekly newspaper.

Besides newspaper, this research declines to consider publication through Web and Television program, this is due to low coverage in term of financial news compare to Nikkei 21, which is reliable and professionally focuses on financial news. Figure 1 shown the comparison of publication of Nikkei 21 and ASAHI newspaper regarding BIS Rules. For the period of eleven years (2004 to 2014) total publication related to BIS Rules for Nikkei 21 is 208 compare to ASAHI newspaper, which only covered 45 publications for the period. Therefore this research concentrated only on Nikkei 21.

According to Tan [4] text mining is believed to have commercial potential higher than data mining because of more hidden indication normally enclose in written way. Limited study had been done using text mining analysis, however most of the researcher agreed that text mining in overview is an interdisciplinary field of activity amongst data mining, linguistics, computational statistics, and computer science [11]. It involve the processes such as text classification, text clustering, taxonomy creation, document summarization and language analysis. Furthermore text mining gives a picture in reading and analyzing information retrieve from comprehensive text and data. Table 1 shows the result of article searched for each year by using a few keywords related to the capital adequacy and Basel Standard.

| Year | Articles |
|------|----------|
| 2004 | 15       |
| 2005 | 13       |
| 2006 | 16       |
| 2007 | 61       |
| 2008 | 26       |
| 2009 | 19       |
| 2010 | 29       |
| 2011 | 44       |
| 2012 | 18       |
| 2013 | 10       |
| 2014 | 11       |
| Total | 262   |

Figure 1 Total publication For Nikkei 21 and Asahi Newspaper in Year 2004 until 2014

Table 1 Number of Selected Article
3.2 Research Flow

The process of extracting articles from Nikkei 21 are began from selecting the related year and keyword such as capital adequacy, Basel I, Basel II and Basel III were key in into search bar. The same process was repeated until 11 year starts from 2004 until 2014. This period of study covered the introduction and execution of the three Basel Standard. The result of number of articles found can be seen in Table 1. In data processing, RMeCab and MeCab are used in order to achieve the objective of the study by analyzing the articles.

MeCab is capable in detecting and reading the Japanese character that is very helpful to non-native speaker. Once the articles are analyzed, two categorical data (year and word) are produced. Google translator from Japanese language to English is used in data filtering. Next step is by screening all the captured words, irrelevant words and character such as numbers, hyphen and others are omitted. Resulting from the filtering and screening process, the study able to capture 56 relevant words as shown in table 3. This is very crucial process as the captured relevant words will be analyzed and the accuracy of the overall result can be done precisely. 56 words captured are then analyzed using correspondence analysis. Summarize of research flow is displayed in figure 2.

4. Analyses and Discussion

By using substantial keyword search, total of 262 articles have been extracted, while 56 relevant words have been recognize. Wide discussion had occurred in 2007 and 2011. The word crisis is specifically referring to the global issues for instance the collapse of Lehman Brothers and subprime issue makes financial and market player more concern on capital adequacy and risk management as appeared in Basel regulation. Basel committee seeks to improve capital adequacy and liquidity risk management by introducing more stringent risk assessment to strengthening their capital [5].

In addition the introduction and execution of Basel standard also attract financial institution to respond to the contents, therefore the word such as stability and recovery are frequently appeared. Furthermore Fukushima earthquake (2011) give massive impact to local banking institution as they started to deeply think on the present percentage of capital adequacy to secure their operational risk.

After Lehman Brothers crisis Europe and China became central issue, as represent in Table 3 and Figure 4, the words Europe and China are steadily appeared at year 2008 and above. The word crisis had appeared the most in 2008. From a substantial word search, exciting discussion about risk management occur in 2008 and 2007, furthermore the discussion about risk had been globally discussed even before the Lehman Brother’s problem.

Risk minimization by combining different type of risk such as operational risk and market risk are among the popular risk minimization debated in Basel III. Realistic words (recovery, stability and crisis) for common discussions related to Basel Standard, credit risk minimization and capital adequacy are strongly found in the result.

4.1 Correspondence Analysis

Correspondence analysis (CA) is used as a tool for data analysis. Limited study is done in analyzing data by using this method. The advantage of using CA is due to precision in analyzing textual data converting into statistical data. Besides that CA is proven to read short texts of high content density [10]. The result from CA is plotted in two-dimensional scatterplot as shown in figure 3.

From figure 3, the trend and pattern of discussion about Basel Standard and capital adequacy are illustrated. Microsoft excel is used to plot each word in X and Y axis.

Figure 2 Research Flow
Figure 3 Two Dimensional Graph of Correspondence Analysis and Canonical Correlation Analysis

From correspondence analysis the study had proven that the data resulted to standard normal distribution where mean is zero and the total variance is equal to 1. CA is analyzed using two-dimensional as it is more precise and accurate. In figure 3, data are reading in one sigma and two sigma. It can be seen that at least 50% level of satisfactory, where the words scattered in the shaded area.

To strengthen the analysis, canonical correlation analysis (CCA) is deployed. CCA is used to measure the linear relationship between two dimensional, furthermore it also connecting cross-covariance matrices. In this study CCA constructed 49.4% contribution rate referring to table 2, and it can be concluded that the plotted words are satisfactory.

From the result, the study can be analyzed in three categories included aggressive sales, government control and market discipline. Aggressive sales era apparently referred to collapse of Lehman Brother due to subprime issue. Lehman Brothers is among the biggest investment company in US and was filed their bankruptcy in 2008. Most of the financial reviewer concludes that the company is the largest victim of US subprime mortgage that boomed around year 2003 and 2004. Housing sale and mortgage demand are growing steadily during the year (2003 and 2004) lead to more mortgage company aggressively lend at the competitive rate.

Table 2 Canonical Correlation Analysis

| Year | Canonical correlation as per R | Eigen Value Sq. of (1) |
|------|-------------------------------|------------------------|
| 1    | 0.411                         | 0.169                  |
| 2    | 0.339                         | 0.115                  |
| 3    | 0.287                         | 0.082                  |
| 4    | 0.239                         | 0.057                  |
| 5    | 0.208                         | 0.043                  |
| 6    | 0.191                         | 0.037                  |
| 7    | 0.152                         | 0.023                  |
| 8    | 0.140                         | 0.020                  |
| 9    | 0.131                         | 0.017                  |
| 10   | 0.111                         | 0.012                  |
| 11   | 0.000                         | 0.000                  |
| Total| 0.574                         | 0.283                  |

49.4%

However due to some mistake made by Mortgage Company which easily give out mortgage without complete documentation or low creditworthiness lead to the subprime bubble. Lehman Brothers acquired five mortgage companies and it seems a big mistake resulted to the failure to the company. This problem also been blamed to Basel II which is too tight to be implemented, because of that the Basel Committee introduce Basel III which is more risk sensitive.
Market discipline by definition is price system where the prices are set by sellers and consumer according to law of supply and demand without any intervention by government. Adegbite [3] agreed that macroeconomic stability act as a major factor in financial steadiness, it is crucial in maintaining stable price and insuring that public sector deficits are marginal and external debt is sustainable. Bank with greater capital adequacy ratio will absorb higher level of unpredicted losses before becoming insolvent.

5. Conclusion

Information gathered from related articles make it possible to conclude that the result has captured a tendency to anticipate the changes in global issue related to credit risk management raised in Basel Standard. We could not access to clear conclusion although a thorough study has been conducted. However an interesting trend and pattern of words appears give a general view about how far the discussion and whether it gives enormous impact to Japanese people.

This study agreed that in determining the level of capital need to be secured by any deposit taking institution, macroeconomic indicators such as inflation, economic growth and employment rate need to be considered as the indicators will significantly affected on risk management process [8].

Other than that, the analysis done through correspondence analysis and text mining are expected to give massive reference in future.

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## Appendices

Table 3 Frequency Tables of Frequent Words

| Word               | Y04 | Y05 | Y06 | Y07 | Y08 | Y09 | Y10 | Y11 | Y12 | Y13 | Y14 |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Window-dressing    | 12  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Amendment          | 9   | 6   | 17  | 0   | 1   | 1   | 4   | 1   | 3   | 0   | 0   |
| Solicitation       | 9   | 9   | 11  | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Settlement         | 4   | 4   | 0   | 1   | 0   | 2   | 2   | 2   | 1   | 0   | 0   |
| Improvement        | 16  | 9   | 2   | 13  | 9   | 4   | 6   | 4   | 0   | 4   | 1   |
| Enforcement        | 3   | 8   | 9   | 3   | 3   | 2   | 1   | 3   | 0   | 2   | 1   |
| Derivative         | 2   | 0   | 10  | 1   | 0   | 1   | 2   | 2   | 0   | 4   | 0   |
| Assets             | 4   | 12  | 15  | 40  | 9   | 23  | 9   | 9   | 19  | 4   | 14  |
| System             | 5   | 7   | 6   | 27  | 2   | 13  | 17  | 14  | 16  | 6   | 13  |
| Rules              | 21  | 3   | 0   | 3   | 1   | 5   | 23  | 2   | 22  | 2   | 10  |
| Management         | 14  | 9   | 24  | 75  | 2   | 7   | 7   | 4   | 10  | 2   | 1   |
| Investment         | 13  | 34  | 76  | 73  | 31  | 8   | 34  | 26  | 6   | 8   | 15  |
| Trend              | 0   | 0   | 2   | 9   | 2   | 2   | 2   | 1   | 1   | 2   | 1   |
| Price              | 1   | 0   | 12  | 20  | 15  | 8   | 6   | 11  | 2   | 16  | 4   |
| UFJ                | 1   | 1   | 0   | 6   | 5   | 2   | 0   | 6   | 3   | 0   | 0   |
| Adequate           | 3   | 1   | 1   | 10  | 9   | 8   | 1   | 10  | 0   | 2   | 0   |
| Credit union       | 0   | 0   | 4   | 11  | 8   | 8   | 6   | 5   | 0   | 1   | 0   |
| Rating             | 9   | 1   | 0   | 29  | 5   | 9   | 6   | 4   | 0   | 0   | 0   |
| Stock prices       | 1   | 0   | 1   | 17  | 4   | 4   | 5   | 4   | 4   | 0   | 7   |
| Environment        | 2   | 1   | 1   | 13  | 6   | 5   | 3   | 5   | 0   | 6   | 0   |
| Audit              | 2   | 0   | 1   | 5   | 4   | 0   | 0   | 1   | 1   | 0   | 0   |
| Monitoring         | 2   | 4   | 1   | 3   | 2   | 16  | 4   | 20  | 0   | 2   | 3   |
| Directed by        | 8   | 9   | 2   | 22  | 7   | 38  | 35  | 34  | 17  | 42  | 5   |
| Association        | 1   | 1   | 6   | 2   | 4   | 1   | 3   | 6   | 5   | 1   | 0   |
| Capital            | 22  | 22  | 9   | 54  | 23  | 47  | 35  | 86  | 37  | 13  | 35  |
| Implementation     | 11  | 5   | 2   | 30  | 5   | 19  | 11  | 13  | 4   | 6   | 2   |
| Bubble             | 1   | 0   | 16  | 5   | 2   | 3   | 20  | 2   | 4   | 28  | 10  |
| Policy             | 9   | 7   | 5   | 53  | 11  | 44  | 15  | 71  | 13  | 18  | 17  |
| Asia               | 2   | 0   | 0   | 1   | 3   | 9   | 3   | 17  | 4   | 0   | 0   |
| Necessary          | 9   | 36  | 19  | 75  | 14  | 33  | 32  | 50  | 18  | 9   | 15  |
| Evaluation         | 2   | 18  | 7   | 46  | 10  | 12  | 24  | 28  | 10  | 2   | 5   |
| Loan               | 2   | 9   | 10  | 48  | 22  | 14  | 10  | 31  | 5   | 4   | 2   |
| Profit             | 2   | 12  | 6   | 47  | 17  | 3   | 40  | 30  | 12  | 1   | 10  |
| Discussion         | 0   | 4   | 0   | 14  | 4   | 10  | 35  | 20  | 6   | 4   | 12  |
| Growth             | 0   | 2   | 2   | 17  | 15  | 10  | 10  | 64  | 4   | 22  | 7   |
| Lending            | 0   | 5   | 8   | 20  | 1   | 3   | 11  | 8   | 5   | 2   | 0   |
| Bankruptcy         | 0   | 1   | 1   | 20  | 13  | 12  | 10  | 8   | 10  | 18  | 4   |
| Bank               | 23  | 58  | 43  | 96  | 35  | 61  | 89  | 140  | 92  | 94  | 56  |
| International      | 21  | 7   | 2   | 28  | 14  | 15  | 23  | 47  | 29  | 38  | 10  |
| Deficit            | 0   | 0   | 0   | 6   | 22  | 11  | 6   | 19  | 1   | 3   | 0   |
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|               | Y04 | Y05 | Y06 | Y07 | Y08 | Y09 | Y10 | Y11 | Y12 | Y13 | Y14 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| China         | 0   | 2   | 3   | 10  | 1   | 12  | 2   | 22  | 11  | 4   | 0   |
| Capital       | 0   | 2   | 4   | 0   | 1   | 0   | 3   | 4   | 2   | 0   | 0   |
| Basel         | 13  | 0   | 0   | 1   | 0   | 2   | 8   | 7   | 24  | 3   | 3   |
| EUR           | 2   | 0   | 3   | 3   | 0   | 4   | 1   | 18  | 9   | 0   | 0   |
| Europe        | 1   | 5   | 1   | 10  | 1   | 6   | 18  | 20  | 14  | 8   | 0   |
| Recovery      | 2   | 0   | 2   | 7   | 4   | 7   | 6   | 24  | 6   | 5   | 2   |
| Countries     | 1   | 0   | 0   | 3   | 2   | 9   | 31  | 35  | 7   | 14  | 4   |
| IMF           | 1   | 0   | 0   | 1   | 3   | 6   | 0   | 22  | 2   | 2   | 0   |
| Strategy      | 1   | 0   | 1   | 19  | 8   | 6   | 5   | 4   | 3   | 2   | 1   |
| Ratio         | 3   | 5   | 2   | 37  | 12  | 14  | 11  | 16  | 17  | 0   | 1   |
| Japan         | 8   | 15  | 5   | 21  | 22  | 14  | 56  | 48  | 19  | 10  | 14  |
| Crisis        | 3   | 2   | 1   | 7   | 21  | 34  | 132 | 82  | 31  | 45  | 26  |
| Regulation    | 30  | 26  | 35  | 34  | 9   | 84  | 175 | 90  | 119 | 94  | 72  |
| Earthquake    | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 11  | 0   | 1   | 0   |
| disaster      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 7   | 0   | 0   | 0   |
| FRB           | 1   | 0   | 0   | 2   | 0   | 0   | 4   | 4   | 3   | 14  | 5   |

Figure 4 Three Dimensional Graph of Most Frequent Word
