

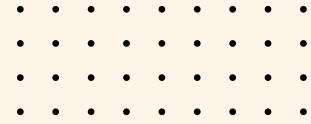


FINAL YEAR PROJECT

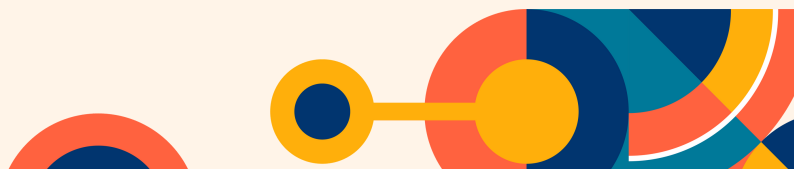
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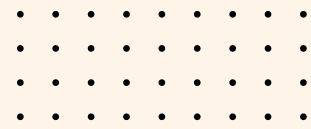
SEMINAR PROCEEDINGS

Department of Computational and
Theoretical Sciences,
Kulliyah of Science,
International Islamic University
Malaysia



FINAL YEAR PROJECT 2023/2024 SEMINAR PROCEEDINGS





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Published by

Department of Computational & Theoretical Sciences,
International Islamic University Malaysia,
Jalan Sultan Ahmad Shah, Bandar Indera Mahkota,
25200 Kuantan, Pahang Darul Makmur, Malaysia.

Website: <https://www.iium.edu.my/kulliyyah/kos/computational-theoretical-sciences>

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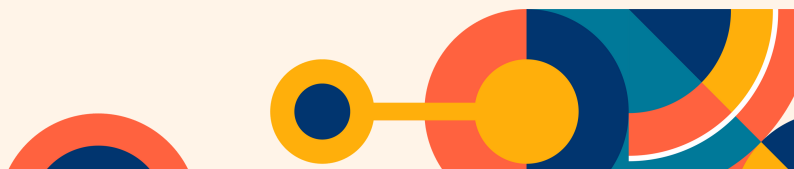




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FINAL YEAR PROJECT COORDINATOR'S FOREWORD

I am honored to present this book, which comprises exemplary final year projects completed by our students. As the coordinator, I'm proud to publish this valuable reference highlighting their talent and innovation. Within these pages, readers will encounter a collection of remarkable projects that underscore the talent, perseverance, and innovation of our students.

The primary aim of this book is to document the exceptional projects undertaken by our students and to provide a valuable resource for future students, faculty members, and researchers alike. I wish to extend my sincere appreciation to all the students who have contributed to this endeavor. Your unwavering dedication to your final year projects, commitment to excellence, and passion for your respective fields have left an indelible impression.

I am confident that the projects featured in this book will serve as a source of inspiration for future students and will lay the groundwork for their own innovative pursuits. Lastly, I would like to express my gratitude to the entire department for their steadfast support in bringing this publication to fruition. Your collective efforts in fostering a collaborative and enriching learning environment have played a pivotal role in achieving this significant milestone.

Dr Hafizah Bahaludin
Coordinator of Final Year Project



EDITOR'S FOREWORD

Welcome to the third issue of the Final Year Project Seminar Proceedings. This time around, the Academic Session 2023/2024, we showcase a book consisting of 11 papers of Mathematical Sciences undergraduate students' final year projects.

The papers in this book cover a whole range of field of interests – Operational Research, Pure Mathematics, Financial Mathematics, Computational Mathematics and Statistics. We would like to take this opportunity to record our congratulations and appreciations to the final year students for their dedications and efforts in their research work.

We are very happy that this third issue finally materialised. This book is the continuation compilation of the final year projects and it is hopeful that this will be a valuable resource references for future students of Mathematical Sciences degree programme of the Department of Computational and Theoretical Sciences, Kulliyah of Science.

Assoc. Prof. Dr Mimi Hafizah Abdullah
Editor



A STUDY ON FTSE BURSA MALAYSIA KLCI USING MINIMUM SPANNING TREE AND DEGREE CENTRALITY DURING STATE ELECTIONS

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Abstract: A financial network comprises nodes that are connected by links to represent the correlation between the stocks. Many researchers have been using the financial network to show the intercorrelation between stocks, especially during major events such as the global financial crisis. Even so, there are too little researchers conducted to observe the consequences of state elections that were held on 12th August 2023 towards the Malaysian Market. Therefore, this paper aims to construct a financial network of the top 30 companies listed in FTSE Bursa Malaysia KLCI. The study analyzed the data one month before and one month after the state elections where it covers from 11th July 2023 until 13th September 2023. The state elections involved six states which were Selangor, Kelantan, Terengganu, Negeri Sembilan, Kedah and Penang. A minimum spanning tree (MST) technique is used to visualize the structure of financial markets. Other than that, the degree centrality method is used to compute the number of connections of the stock where it represents the level of influence of a stock. The findings showed that there are significant differences towards the financial network structure in terms of the main clusters, and the most influential stocks. Before the state elections, there were five main clusters that were formed with one domain node and after the state elections, the clusters group decreased to four with three domain nodes. For future studies, it might be possible to include all stocks that are listed in Bursa Malaysia and adopt a longer period such as covering all state elections that have happened. The results might be more precise since it can exhibit extensive effects within broader industries and more extended periods.

Keywords: Financial network, minimum spanning tree, degree centrality, state election

INTRODUCTION

The relationship between the stocks will help the investors to identify the problems or the difficulties that will be faced by a certain stock market during a certain time. A financial network that consists of the nodes that represent the companies and the edges that represent the relationships between the stocks make it easier for the investors and researchers to analyze the financial markets. In previous research, there are several ways to investigate financial networks. This study use the MST technique where it is known to simplify the financial network by having nodes and edges. The visualization will help the investors to analyze the changes in the relationship between the stocks. The relationship between the stocks can be identified by looking at the correlation of the stocks that leads the investors to understand the relationship in the financial network. With this understanding, we can identify which stock plays the most important role during the state elections. There are several studies that utilize this technique to construct and investigate a financial network which are Bahaludin et al., (2019), Mahamood et al., (2019b), (2019a), and Yee & Salleh, (2018). For a deeper understanding of the financial network, degree centrality method is used to identify the most influential stocks during the period of the study. Degree centrality helps to calculate the number of connections of a stocks. There are studies that investigated the changes in the financial market by using the degree centrality technique (Bahaludin et al., 2019; Mahamood et al., 2019b, 2019a; Yee & Salleh, 2018). In Malaysian Market, there are a lot of studies investing a financial network using MST have been carried out on the general elections. However, there are few studies that investigate the financial network during state elections. Hence, this paper aims to construct a financial network of top 30 companies listed in FSTE Bursa Malaysia KLCI in the duration of one month before and after the state elections.

METHODOLOGY

MINIMAL SPANNING TREE

Firstly, cross-correlation matrices based on the log return of closing prices are calculated. The correlation coefficient, C_{ij} , between the stocks i and j is given by,

$$C_{ij} = \frac{\langle r_i r_j \rangle - \langle r_i \rangle \langle r_j \rangle}{\sqrt{(\langle r_i^2 \rangle - \langle r_i \rangle^2) - (\langle r_j^2 \rangle - \langle r_j \rangle^2)}} \quad (1)$$

where, r_i is the vector of the log-returns.

The log-returns can be computed as $r_i(t) = \ln P_i(t+1) - \ln P_i(t)$ and $P_i(t)$ is the price of stock i on date t . Correlation coefficients obtained within the range of $-1 \leq C_{ij} \leq 1$ indicates that -1 means inversely correlated and 1 means perfectly correlated between stocks. The correlation coefficient between stocks i and j will form the symmetric $N \times N$ matrix. Secondly, correlation coefficients are transformed into a distance matrix. However, correlation coefficients cannot be considered as a distance between two stocks because they do not satisfy the properties of Euclidean metric which are,

$$\begin{cases} d_{ij} \geq 0 \\ d_{ij} = d_{ji} \\ d_{ij} \leq d_{ix} + d_{xj} \end{cases} \quad (2)$$

Thus, the distance between stock i and stock j can be calculated as follows:

$$d_{ij} = \sqrt{2(1 - C_{ij})} \quad (3)$$

Thirdly, financial networks are constructed using the minimum spanning tree based on the distance matrix via a Kruskal algorithm. There are several steps listed in Kruskal algorithm which are, 1) sort the distance between two stocks in ascending order, 2) choose a pair of stocks with the smallest distance and connect them with an edge, 3) choose a second small distance, 4) connect the nearest pair and ignore the pair if it forms a cycle in the network, and 5) repeat the steps until all the stocks are connected in a unique network.

DEGREE CENTRALITY

Centrality measures are employed for further analysis of the financial network. This study uses the degree centrality method to analyzed the financial network deeper. Degree centrality represents the total number of stocks that is connected to a stock i . The calculation of degree centrality is as follows:

$$C_{Degree}(i) = \frac{\sum_j A_{ij}}{N-1} \quad (4)$$

where $A_{ij} = 1$ if the stock i and j is connected and 0 otherwise.

RESULTS AND DISCUSSION

Figure 1 represent the network of top 30 companies listed in FTSE Bursa Malaysia KLCI one month before state elections. In general, Figure 1 clearly shows that five main clusters were formed which are dominated by Sime Darby (SIME), Hong Leong (HLBB), AmBank (AMMB), Genting (GENT), and CIMB Group (CIMB). Based on the figure, the shortest distance is between GENT and GENM which is 0.55302. Other than that, largest cluster consist of SIME, SIPL, IOIB, TLMM, MISC, MXSC, PETR, and IHHH. The figure also shows that the stocks with the largest size of node is GENM. This indicates that GENM is the most influential stock in the network before the state elections. Meanwhile, Figure 2 represent the network of top 30 companies listed in FTSE Bursa Malaysia KLCI one month after state elections. In general, the main clusters decreased from five before the state elections to four clusters after the state elections. As depicted in the figure, the clusters are dominated by IOIB, PGAS, AXIA, and CIMB. It is also shown that the shortest distance RHBC – AXIA. Other than that, the largest group consists of CIMB, GENT, GENM, TLMM, MBBM, AMB, HLBB, PUBM, PETR, CELC, MRDI, and QRES. The figure shows that the stocks with the largest size of node increased from one to three which are CIMB, RHBC, and SIPL. This indicates that they are the most influential stocks in the network after the state elections.

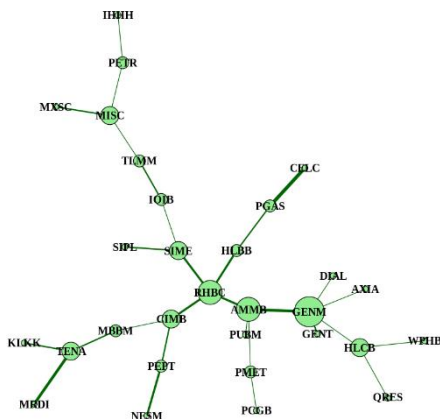


Figure 1. Financial network before state elections.

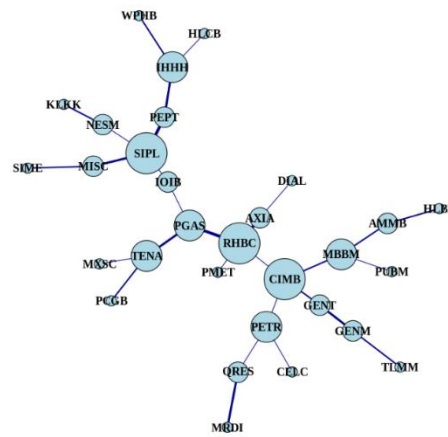


Figure 2. Financial network after state elections.

CONCLUSIONS

This paper shows the correlation between the top 30 companies listed in FTSE Bursa Malaysia KLCI. The correlations were analysed by using MST technique and degree centrality method. These methods help to identify the most influential stock by constructing the financial network. The results shows that GENM is the most influential stock before the state elections and SIPL, CIMB, and RHBC are the most influential stocks after the state elections. Above all, this paper helps the investors to get the overview of the situation of the financial network before and after the state elections. It also helps the investors to make a better investment strategy based on their priority.

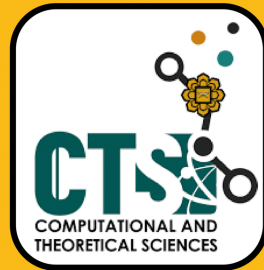
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A STUDY ON FTSE BURSA MALAYSIA KLCI USING MINIMUM SPANNING TREE AND DEGREE CENTRALITY DURING STATE ELECTIONS

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ABSTRACT

This paper investigate the **impact of state elections** towards the financial market. The data that was analyzed is from the **top 30 companies listed in FTSE Bursa Malaysia KLCI**. Minimum spanning tree and degree centrality methods are used to construct the financial network. It also help to identify which stocks are the most influential stocks before and after the state elections. This paper finds that state elections have impacts towards financial market in terms of **structure and most influential stock**



INTRODUCTION

- **State elections** was held on 12th August 2023. The state elections causes the stock markets to fluctuate.
- **Minimum spanning tree** is used to visualize the financial network before and after the state elections.
- **Degree centrality** technique is used to determine the most influential stock
- Duration of the study is **one month before and one month** after the state selection (from 11th July until 13th September)

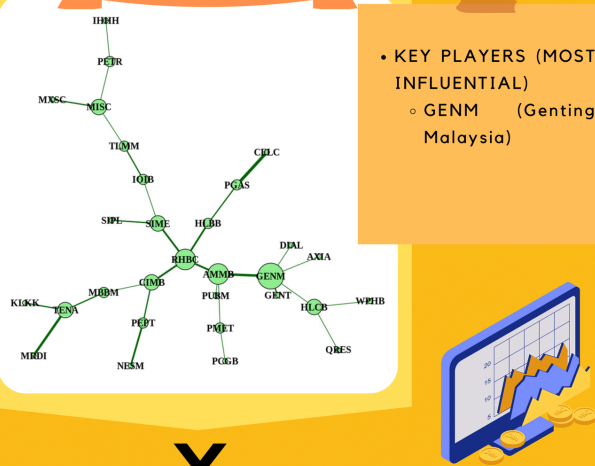
PROBLEM STATEMENT

- 1. The **uncertain relationship** between the stocks before and after is due to the state elections.
- 2. By Bilal Ahmad Memon (2020), **elections give impact towards the financial market**

OBJECTIVES

- 1. To **construct** two financial networks of FTSE Bursa Malaysia KLCI **before and after the state elections** respectively.
- 2. To **identify** the most influential stocks in the financial network before and after the state elections.

BEFORE STATE ELECTIONS



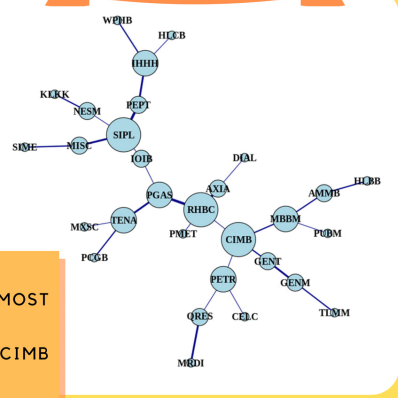
METHODOLOGY

1. Data collection and data cleaning.
2. Compute the correlation coefficient.
3. Calculate the distance matrix.
4. Construct MST using Kruskal's Algorithm
5. Compute the degree centrality.
6. Information extraction (Degree Centrality)

DATA

1. Malaysian state elections.
 - a. 12th August 2023
2. **One month before** state elections
 - a. 11th July 2023
3. **One month after** state elections
 - a. 13th September 2023
4. Companies
 - a. **Top 30 companies** listed in FTSE Bursa Malaysia KLCI.
5. Sources
 - a. Investing.com
 - b. Yahoo Finance

AFTER STATE ELECTIONS



CONCLUSION

- The results indicates that a structural changes in the financial networks are due to the state elections.
- The results can help the investors acknowledge the situation of the financial market in the duration of state elections thus give them the more informed and prudent judgement for investment strategy

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- Memon, B. A., Yao, H., & Tahir, R. (2020). General election effect on the network topology of Pakistan's stock market: network-based study of a political event. *Financial Innovation*, 6(1). <https://doi.org/10.1186/s40854-019-0165-x>



e ISBN 978-629-97106-2-2



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