FINAL YEAR PROJECT

2023/2024

SEMINAR PROCEEDINGS

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

FINAL YEAR PROJECT 2023/2024 SEMINAR PROCEEDINGS

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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, Kulliyyah of Science.

Assoc. Prof. Dr Mimi Hafizah Abdullah
Editor

ANALYZING FTSE BURSA MALAYSIA KLCI USING MINIMUM SPANNING TREE AND BETWEENNESS CENTRALITY DURING STATE ELECTIONS

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Abstract: This study investigates the impact of the Malaysian state elections held on 12 August 2023, across Selangor, Kelantan, Terengganu, Negeri Sembilan, Kedah, and Penang, on FTSE Bursa Malaysia KLCI. While previous research has established a link between election uncertainty and increased market volatility, this study would like to explore deeper how elections affect stock correlations. Using the methodology of minimum spanning tree (MST) and betweenness centrality, the research constructs financial networks to identify companies that act as mediators. The focus is on the one month before and one month after state elections, aiming to offer investors valuable insight into stock market stability during this politically important period. The study produced a noteworthy finding: RHBC maintained its dominance before and after the elections, but the level of dominance was decreasing. However, this study has the limitation of data since the state election was just held so recently. Thus, to provide more reliable results, we propose that the data period be extended for future research.

***Keywords*:** Financial networks, minimum spanning tree, betweenness centrality, FTSE Bursa Malaysia KLCI, state elections

INTRODUCTION

During state elections, it is difficult to study the complex network of relationships between companies. To navigate this complexity, the construction of financial networks becomes indispensable. By using methods such as minimum spanning tree, it becomes possible to filter out the important connections from the noise. Yee and Salleh (2018) discovered the convincing stock in the market through an examination of stock behaviours. Therefore, drawing inspiration from the work of Yee and Salleh (2018), this study aims to explore how the Malaysian market acts one month before and one month after state elections. The utilization of top 30 largest companies from FTSE Bursa Malaysia KLCI data has been applied to this study and resulted RHBC maintained as the most dominant company before and after the election, but the level of dominance was decreasing. The level of dominancy has been discovered by using the extent of minimum spanning tree, betweenness centrality. Betweenness centrality measures the dominancy of a company by exploring the shortest path between nodes. It evaluates whether a stock plays a role as an intermediate between many stocks. The higher the value of betweenness centrality, the more important is the stock since it controls the flow of information between many nodes.

METHODOLOGY

MINIMUM SPANNING TREE

The first step of constructing minimum spanning tree network is to calculate the correlation matrices, *C*. Let $C = \rho_{ij}$ be the correlation of $N \times N$ matrix, where *N* is the number of stocks. ρ_{ij} is the correlation coefficient between stocks *i* and *j*, calculated using Pearson's correlation coefficient formula,

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

where the rate of returns of adjusted closing prices is $r_i(t) = \ln P_i(t+1) - \ln P_i(t)$ and $P_i(t)$ is the price of stock i on date t.

Correlation is measured in the scale 1 to -1. The value of correlation 1 indicates correlation as perfectly correlated and -1 as negatively correlated. The correlation coefficient, ρ_{ij} need to be constructed into distance first to transform the correlation matrix to distance matrix. The distance between two stocks i and j can be computed by using the equation,

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

where d_{ij} should satisfy the three basic properties of Euclidean matrix which are,

$$\begin{cases} d_{ij} \geq 0, \\ d_{ij} = d_{ji} \\ d_{ij} \leq d_{ik} + d_{kj} \end{cases} \quad (3)$$

Lastly, to construct the minimum spanning tree financial network, Kruskal's algorithm must be applied. Firstly, two vertices of the two stocks with the smallest distance will connect to an edge. Then, the next edges are added to the spanning in ascending order until all vertices are connected. The vertices will be ignored if its connection forms a cycle. The vertices and edges represent the stocks and the distance between two stocks respectively.

BETWEENNESS CENTRALITY

The betweenness centrality can be evaluated using the following equation (4)

$$C_{Betweenness}(i) = \sum_{j<k} \frac{g_{jk}(i)}{g_{jk}}, \quad i \neq k \neq j \quad (4)$$

where g_{jk} is the total number of shortest path from node j to k and $g_{jk}(i)$ is the number of paths that pass through i.

RESULTS AND DISCUSSION

Based on Figure 1 and Figure 2, RHBC continues to play an important role during both times, but following the election, its centrality value drops from 0.7365 to 0.6108. In addition, following the state election, there are 13 instead of 14, a decrease in the number of companies with zero values, which indicates less mediating effect. This suggests a shift in the dynamics of the network, with no change in the overall connection structure following the state elections and RHBC remaining significant but playing a less mediating role.

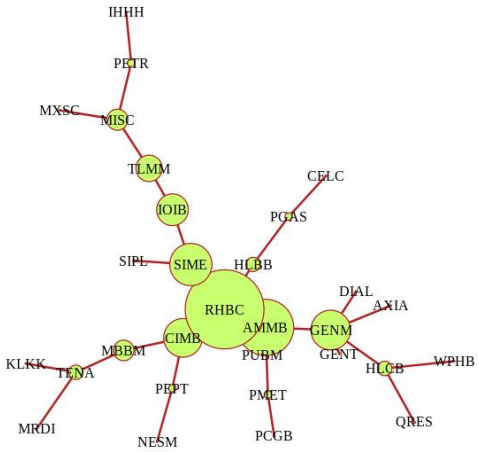

Figure 1. Before state elections.

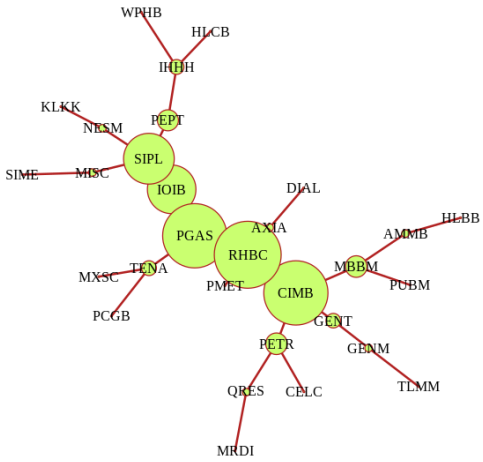

Figure 2. After state elections.

CONCLUSIONS

To sum up, this research offers an in-depth study of the stock prices of the FTSE Bursa Malaysia KLCI one month before and one month after state elections. This study employs innovative methods like minimum spanning tree (MST) and betweenness centrality to understand the complex relationship between companies and state elections. Constructing financial networks offer an alternative viewpoint on the interdependence of companies included in the FTSE Bursa Malaysia KLCI. This provides investors, traders, and market participants important information on creating their strategies for investing during the intensity of the state election.

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A STUDY ON

FTSE BURSA MALAYSIA KLCI USING MINIMUM SPANNING TREE AND BETWEENNESS CENTRALITY DURING STATE ELECTIONS

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1 ABSTRACT

This study investigates the stock price dynamics of the FTSE Bursa Malaysia KLCI in the months before and after the state elections, using the minimum spanning tree (MST) and betweenness centrality approach. The main objective is to **build financial networks** that include companies listed in the FTSE Bursa Malaysia KLCI. In doing so, this study aims to shed light on the complex **relationships** among these companies and their susceptibility to **changes in the political and economic landscape during Malaysian state election periods.**

2 INTRODUCTION

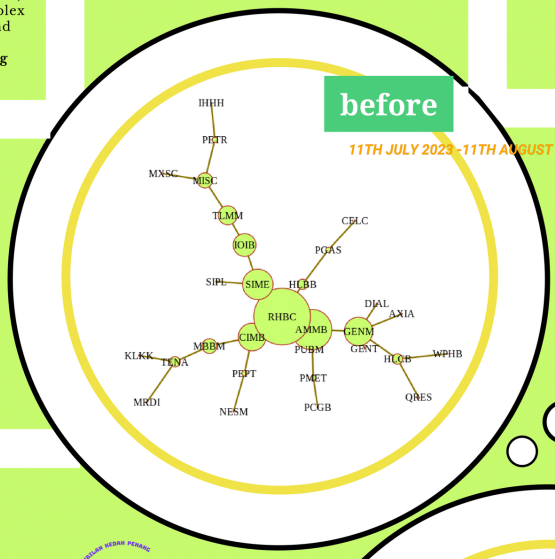
- Difficult to study complex networks during state elections.
- Construct a MINIMUM SPANNING TREE to illustrate

3 PROBLEM STATEMENT

- Focus should shift toward understanding how state elections impact stock correlations.
- Uncertain relationship between stocks before and after state elections

4 OBJECTIVES

- To **construct financial networks** of the companies for FTSE Bursa Malaysia.
- To identify the companies that act as **mediators** for the financial network.



OUTCOME:

- The result indicates structural changes in the stock market due to state elections.
- Help investors, offering valuable insights to estimate stoxk market stability.

5 METHODOLOGY

DATA COLLECTION → DATA OF 30 COMPANIES LISTED ON FTSE BURSA MALAYSIA KLCI

CORRELATION COEFFICIENT → $C_{ij} = \frac{\langle r_i r_j \rangle - \langle r_i \rangle \langle r_j \rangle}{\sqrt{\left(\langle r_i^2 \rangle - \langle r_i^2 \rangle\right) - \left(\langle r_i \rangle - \langle r_i \rangle\right)^2}}$

DISTANCE MATRIX → $D_{ij} = \sqrt{2(1 - C_{ij})}$

Minimum Spanning Tree

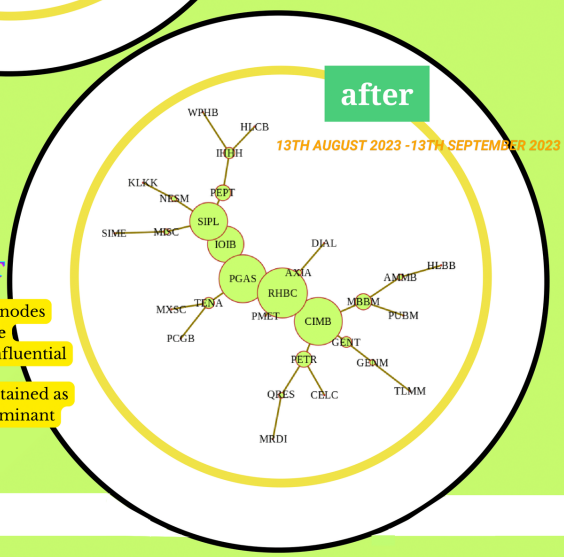
BETWEENNESS CENTRALITY → $C_{Betweenness}(i) = \sum_{j \neq k} \frac{g_{jk}(i)}{g_{jk}}$

**State elections on 12th August 2023*

6 RESULT

#1 the number of bigger nodes increased, shows **more companies** become influential

#2 RHBC maintained as the most dominant company



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