MODELLING AND FORECASTING VOLATILE DATA BY USING ARIMA AND GARCH MODELS

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A thesis submitted in partial fulfillment of the
requirements for the award of the degree of
Master of Science (Mathematics)

Faculty of Science
Universiti Teknologi Malaysia

JANUARY 2013

To my beloved father, Miswan bin Bibet, mother, Hamidah binti Karimin,
all my siblings, Mohamad Nizam, Nur Azlin, Muhammad Faizal and him,
Muhammad Sayyidi Afiq bin Awang.

ACKNOWLEDGEMENT

First and foremost, all praise to Allah, the Almighty, the Benevolent for His blessings in completing this project.

I would like to express my most sincere thanks to my supervisor, Assoc. Prof. Dr. Maizah Hura binti Ahmad for her guidance and assistance in completing this dissertation report. Her support and assistance throughout the duration of this study really motivate me. I really appreciate all the ideas, knowledge and valuable advice given to me.

My parents, Miswan and Hamidah deserve special mention for their understanding, support, prayers and advice throughout the last one and half years of my Master's study. Thank you also to the rest of my family, Mohamad Nizam, Nur Azlin and Muhammad Faizal for their prayers and love.

Special thanks go to my best friends, Muhammad Sayyidi Afiq, Siti Halimah, Aisyah Radziah, Syafikah Huda, Siti Zaleha and Ezzatul Farhain. I would like to thank them a lot for their concern, help and mental support. They were always with me when I needed someone to share my problems.

Last but not least, I would also like to express my gratitude to anyone who has helped me directly or indirectly in completing this project. They meant a lot to me. Thank you to all of you. Your guidance, co-operation and encouragement will be remembered for the rest of my life.

ABSTRACT

Modelling and forecasting of volatile data have become the area of interest in financial time series. Volatility refers to a condition where the conditional variance changes between extremely high and extremely low values. In the current study, modelling and forecasting will be carried out using two sets of real data namely crude oil prices and kijang emas prices. The models investigated are Box-Jenkins Autoregressive Integrated Moving Average (ARIMA) model and Generalized Autoregressive Conditionally Heteroscedasticity (GARCH) model. In estimating the parameters for the Box-Jenkins ARIMA model, two estimation methods are used. These are Maximum Likelihood Estimation (MLE) and Ordinary Least Squares Estimation (OLS). The capabilities of these two methods in estimating the ARIMA models are evaluated by using Mean Absolute Percentage Error (MAPE). The modelling performances of ARIMA and GARCH models will be evaluated by using Akaike's Information Criterion (AIC) while the forecasting performances of both models will be evaluated by using Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE). The processes of modelling and forecasting will be done by using R and Eviews statistical softwares. As a result of the study, it can be concluded that in terms of parameters estimation of ARIMA models, MLE gives more precise forecast for crude oil prices data while OLS gives more precise forecast for kijang emas prices data. In terms of forecasting performances between ARIMA and GARCH models, it can be concluded that GARCH is a better model for kijang emas prices data while ARIMA is a better model for crude oil prices data.

ABSTRAK

Permodelan dan ramalan data tidak menentu (atau data turun-naik) telah menjadi bidang penting dalam ekonomi dan kewangan. Turun-naik merujuk kepada keadaan di mana perubahan varians bersyarat berlaku antara nilai yang sangat tinggi dan sangat rendah. Dalam kajian ini, pemodelan dan ramalan akan dijalankan dengan menggunakan dua set data sebenar iaitu harga minyak mentah dan harga kijang emas. Model yang dikaji adalah model Purata Bergerak Bersepadu Autoregresi Box-Jenkins (ARIMA) dan model Heteroscedastik Bersyarat Autoregresi Teritlak (GARCH). Dalam menganggar parameter bagi model ARIMA, dua kaedah anggaran digunakan. Kaedah tersebut adalah Anggaran Kemungkinan Maksima (MLE) dan Anggaran Kuasa Dua Terkecil Biasa (OLS). Keupayaan kedua-dua kaedah ini dalam menganggar model ARIMA dinilai dengan menggunakan Min Ralat Peratus Mutlak (MAPE). Keupayaan kedua-dua model dalam permodelan data turun-naik akan dinilai dengan menggunakan Kriteria Maklumat Akaike (AIC) manakala keupayaan dalam ramalan data akan dinilai dengan menggunakan Min Ralat Mutlak (MAE) dan Min Ralat Peratus Mutlak (MAPE). Proses permodelan dan ramalan akan dilakukan dengan menggunakan sofwer R dan Eviews. Hasil kajian mendapati dari segi menganggar parameter bagi model ARIMA, MLE memberi ramalan yang lebih tepat bagi data harga minyak mentah manakala OLS memberi ramalan yang tepat bagi data harga kijang emas. Dari segi permodelan dan ramalan, di antara model ARIMA dan GARCH, dapatlah disimpulkan bahawa GARCH adalah model yang lebih baik bagi data harga kijang emas manakala ARIMA adalah model yang lebih baik bagi data harga minyak mentah.