

## Chapter 6

### Conclusion

#### 6.1 Summary of the Study

The first purpose of this dissertation applied extreme value methods to the prediction of Malaysian palm oil prices in the future, using monthly futures price data for the 25 year period (July 1986 – June 2011) which is characterized by non-normal distribution caused by extreme events. The results confirmed that the Malaysian palm oil price is characterised by non-normal distribution, thereby justifying the use of EVT. Two principal approaches to model extreme values, the Block Maxima (BM) and Peak-Over-Threshold (POT) models, were used. Both models revealed that the palm oil price will peak at an incremental rate in the next 5, 10, 25, 50 and 100 year periods. The price growth level in Year-5 is estimated at 17.6% and 44.6% in Year-100 using BM approach. Use of the POT approach indicated a growth rate of 37.6% in Year-5 and 50.8% in Year 100, respectively. The key conclusion is that although the POT model outperformed the BM model, both approaches are effective in providing predictions of growth in prices caused by extreme events.

The results could be useful for farmers, exporters, governments, and other stakeholders of the palm oil industry in being highly informed for making strategic plans for the future. We can use these results for forecasting in a better planning strategy to help us know how to maintain balance, with sufficient means, that will keep the production flow of palm oil at a steady rate. Assists policymakers determine the accurate method for producing palm oil and to set a reasonable price to meet with the world market.

The second purpose of this thesis examines the dependence structure of extreme realization of growth rate between palm oil prices and factors affecting, which are soybean oil and crude oil prices. The Bivariate Extreme Value methods were employed for daily palm oil, soybean oil and crude oil prices ranging from July 1988 to January 2012. The findings of this study applied the Bivariate Block Maxima and Bivariate Threshold Exceedances approach to examine the extreme dependence

between the growth rate of palm oil and soybean oil prices, and the growth rate of palm oil and crude oil prices. Based upon this application, the results show that both methods have a similar outcome. The growth rate of palm oil and soybean oil prices has dependence in extremes. However, the growth rate of palm oil and crude oil prices has fairly weak dependence in case of Bivariate Block Maxima and independence in case of Bivariate Threshold Exceedances.

The results could serve as a useful guide to policymakers of the palm oil industry informing strategic planning for palm oil price movement when soybean oil and crude oil prices have been changed. Based on our research we see that the activities affecting the price of palm oil and crude oil have relatively low correlation. This implies to whatever is having an effect in the price of crude oil unlikely to have an impact towards the price of palm oil. Thus, these two natural resources are independent of each other.

Since there has been a recent increase of crude oil price and growing environment concerns, biodiesel has become an important alternative fuel that acts as the lifeblood of the retailing industries that are highly depended on the logistics and transportations to deliver their goods on time. The 2006 period marked the beginning of the price rally and the commercialization of biodiesel worldwide, particularly in Europe and Asian countries (Hameed and Arshad, 2009). It is safe to say that as long as biodiesel keeps on being developed it will lead to a great expectation on creating an impact on the energy crop prices when they are being used as feedstock. Due to this, it is important to make a study that pertains to the future direction of palm oil price.

The last purpose of this thesis uses the extreme value copulas, the Gumbel and HuslerReiss models, to examine the extreme dependence structure between the returns on palm oil futures prices in three future markets. There are the Malaysian futures markets (KLSE), Dalian Commodity Exchange (DCE) and Singapore Exchange Derivatives Trading Limited (SGX-DT). The results demonstrated that both methods have a similar outcome. The returns on palm oil future price among KLSE and SGX-DT have dependence in extreme, whereas the returns on palm oil future price among KLSE and DCE, SGX-DT and DCE do not have dependence.

The results could be beneficial for any person or company wishing to be engaged in the commerce of trading palm oil and for investors who have made an

investment in the exclusive agricultural futures exchange. The expected return for the investors consists of dividend and the return of price variation of capital gain which depends on the stock price at the date that the investors have invested and the last due price. This means that if the investors have to invest in palm oil future price, they should compare the returns with other markets.

## **6.2 Suggestions for Further Study**

This dissertation focuses on EVT to analyze palm oil price. It is a branch of statistics that deals with the extreme deviations from the mean of probability distribution. With regards to the EVT distributed assumption, it is habitually superior to normal distribution in many situations. In addition, the tool has been widely utilized in the field of statistics and has crossed over to other discipline such as environmental science, hydrology, insurance, and finance. More often, EVT has been used to forecast extreme losses in finance and disaster. This thesis has conducted a study that only applies to the forecasting of price in future but not forecasting the value at risk in palm oil prices. In the case of investment, an unstable situation within the stock market along with an investment in the circles of capital can stimulate a great chance of risk thus leading towards to a possibility to a loss in profit which has been caused from the fluctuation of the return in the future. Therefore, a huge risk has some principles for investors to take caution in calculating their decisions to avoid a loss of return. Then there is a theory in developing to avoid risky situations from volatility which has indicated only how much risk will occur between stocks. However, there will be a method developed for measuring risk called Value at Risk (VaR) which can explain the loss of risk in valuation (Jorion, 2002). Therefore, future improvement value at risk of palm oil price should consider the EVT for critical assessment. The fluctuation of energy crop price such as palm, soybean, rapeseed oils and maize surges over time due to an uncertain price of energy crop; there are risks and unreliability for tree-crop farmers, shareholder, traders, and producers. To decrease the risk and uncertainties, there should be some effective risk management strategies. In terms of factor affecting palm oil price, this thesis only used data from soybean oil and crude oil prices. But in the overview, there are many factors that affect palm oil price such as world production of palm oil, demand for biodiesel and

weather variations. Therefore, further study conducted for the future may be interested in using Bivariate Extreme Value, both BM and POT, and Extreme Value Copulas as an approach for finding a much better result with greater efficiency. Moreover, any further research that is interested in finding out on how to make some greater improvement can incorporate an appropriate dependence structure function such as Bivariate Generalized Pareto Distributions (BGPD) type II, galambos copula, tawn copula and tev copulas, for the purpose of obtaining the calculation in the probability of extreme value occurrence with a greater predictive and satisfying outcome.