CHAPTER 1

Introduction

1.1 The Rationale Background

1.1.1 Introduction of Thai natural rubber

Agriculture is the fundamental industry in Thailand; with 52% of total population are famers in 2013. (World Bank, 2014) However, farmer got relative low income in a long time, which attracted the high attention of the Thai government.

Natural rubber is one of the most important agro-based industrial raw materials in the world. Natural rubber is produced mainly in developing countries; the largest rubber producing region is Asia, which produced about 93.13% of the total natural rubber output in 2013. (IRSG, 2013)

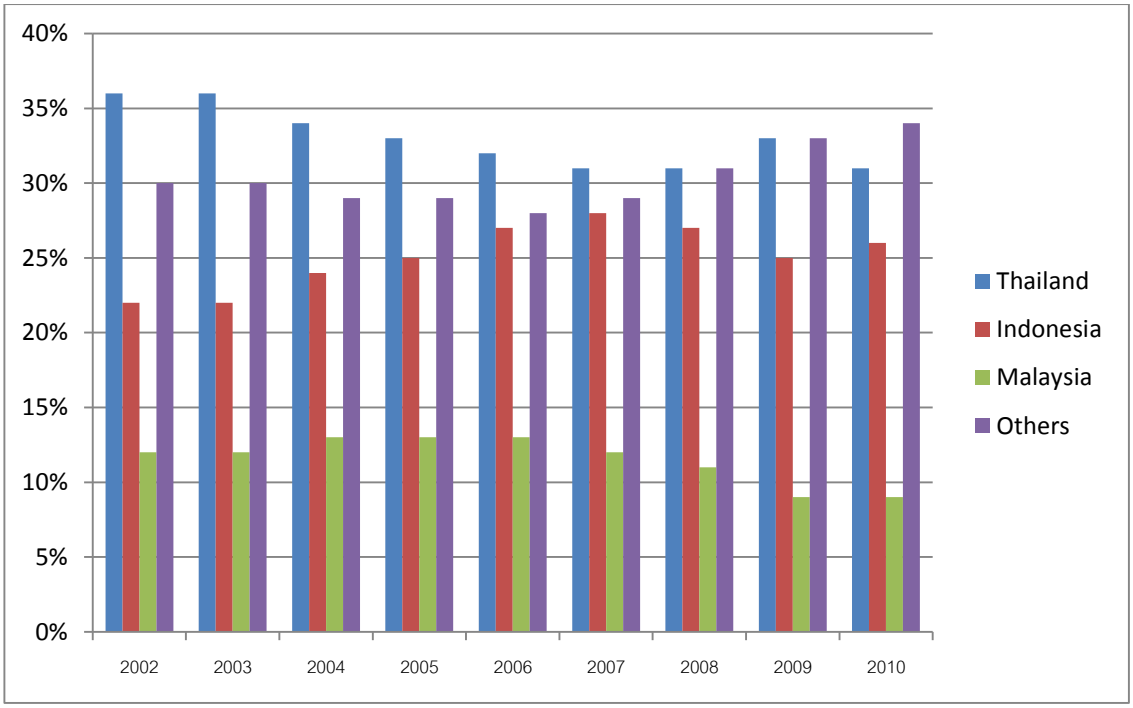
Rubber is a very important agricultural product for Thailand, as well as a vital industrial crop. It is also significant for both of domestic consumption and global market. In particular, Thailand has been the No.1 natural rubber producer for last two decades, as well as the biggest exporter. A large quantity of natural rubber can be produced since the Kingdom has a large number of rubber plantations. Most rubber plantations are in the south of Thailand and are likely to expand further.

Form Table 1.1, Thailand produced more than one third of the natural rubber of the whole world, and followed by Indonesia and Malaysia. Thailand produced more than 1/3 natural rubber in the world since 2002, which can be observed on Figure 1.1. It is extremely obvious that the role of Thai natural rubber is dominant in the natural rubber market in the whole world. Indonesia and Malaysia took the share of 25% and 12% ,respectively. Then, the whole world accounted for 30% of the production. Thereby, Thailand plays an obviously important role in natural rubber production process.

Table 1.1: Natural rubber production of main countries from 2002 – 2010 (Thousand/T)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Thailand	2,615.1	2,876.0	2,984.3	2,937.2	3,137.0	3,056.0	3,089.8	3,164.4	3,252.1
Indonesia	1,630.0	1,792.2	2,066.2	2,271.0	2,637.0	2,755.2	2,751.0	2,440.0	2,736.0
Malaysia	889.8	985.6	1,168.7	1,126.0	1,283.6	1,199.6	1,072.4	856.2	939.0
China	527.0	656.0	573.0	510.0	533.0	590.0	560.0	644.0	665.0
Vietnam	331.4	363.5	419.0	481.6	555.4	605.8	660.0	711.3	754.5
India	640.8	707.1	742.6	771.5	853.3	811.1	881.3	820.3	850.8
others	691.9	639.6	790.2	809.7	827.7	872.3	1,113.5	1,053.8	1,203.6
total	7,326.0	8,020.0	8,744.0	8,907.0	9,827.0	9,890.0	10,128.0	9,690.0	10,401.0
Thai/ T	36%	36%	34%	33%	32%	31%	31%	33%	31%
Indo/T	22%	22%	24%	25%	27%	28%	27%	25%	26%
Mala/T	12%	12%	13%	13%	13%	12%	11%	9%	9%

Source: IRSG, July - September 2011.



Source: IRSG, July - September 2011.

Figure 1.1: The ratios of main economies' natural rubber production 2002—2010

Natural rubber industry and rubber products are the one of the significant industries to Thai economy because it creates a large amount of employments and incomes per year. In 2002, there were 106,844 worker employed in 1,518 factories

(Department of Industrial Works, 2002). The total rubber plantation land in Thailand was almost 2,760,690 hectares with rubber production around 2.62 million tons, there was 111,010 hectares in north, 477,456 hectares in northeastern, 330,147 hectares in central, 1,842,078 hectares in South . (Office of Agricultural Economics, 2010)

According to Figure 1.2, Thai natural rubber production is creasing year on year; the whole trend was upwardly, since 1993 to 2013. Meanwhile, the rubber export accounts for a huge amounts and ratios compared with the total natural rubber production, which keeps the similar trend as the rubber production. It is easy to find that, the demand of rubber production is augmenting both in foreign export and domestic consumption.

Source: Rubber Research Institute of Thailand

Figure 1.2: Production of natural rubber of Thailand from 1993-2013 (unit: ton)

The reasons why rubber industry is regarded as an important industry in Thailand is not only the numbers of employment but also the exportation. As for exportation, Thailand is the top producer and exporter of natural rubber in the world. Thailand produced around 3.03 million ton of Para rubber in 2006, which accounted for one third of the global production. The main export markets for Thai natural rubber are Germany, China and Japan. The rubber creates around US$135 billion for export value in 2008. Thailand has been the biggest natural rubber export country since 1990s. (Office of Agriculture and Cooperatives)

The natural rubber generated the national income reached up to 210,000 million baht from producing natural rubber and natural rubber exporting in 2009. However, the

natural rubber for manufacture of higher value added products is low for domestic employing, only about 10% of the rubber was used. On the one hand, the Thai rubber product manufacturing industry is still small with the Small and Medium Size Enterprises (SMEs) as the majority of the manufacturers (90%). (TRA) Those SMEs lack technologies for efficient manufacturing to ensure the standard quality, and they are deficient in information, management skills, marketing abilities and administrative.

1.1.2 Introduction of fractal theory

Commodity price behavior has been a hot issue of economic analysis for a long history. Especially, short term price fluctuations reflect speculative activity on commodity future markets, as well as disequilibrium adjustments on spot markets. It also reflects the risk taking between agricultural producers and industrial purchasers. Meanwhile, the commodity price fluctuation demonstrates the instability of export revenue of commodity exporting developing countries. A significant aspect of analyzing these commodity price fluctuations is measuring whether they behave regularly reflecting demand and supply influences, whether they occur randomly, or whether they testify behavior somewhere in between suggesting nonlinear and irregular patterns.

The capital market theory has been dominated by the linear paradigm for a long time. However, more and more evidences have manifested that the commodity prices are not entirely in line with classical theories. A number of researches have shown that nonlinear dynamics exist in most financial and economic time series. Recent theoretical and empirical cases showed that commodity prices can be generated in a nonlinear fashion. More and more scholars discarded the efficient market hypothesis (EMH) , EMH believes that financial markets are “informationally efficient” and price can reflect an accurate and timely information at that time, one cannot yield the price returns consistently. In other words, EMH implies that the price changes are predictable and their processes are entirely random walk. However, the applicability was questioned because the rational assumptions are contrary to the real financial phenomenon.

Fractal theory was introduced to be a new branch of nonlinear science in 1960s. However, nonlinear situation caught people’s eyes in 1980s. Fractal theory was used to analyze the fragmental, irregular or non-smooth situation in nonlinear system. As its characteristics, such as long term memory and self-similarity, fractals can better illustrate the characteristics and the complex behaviors of the financial market when

compared to the effective market hypothesis, certainly, it is more general. Hence, the fractal theory can be applied extensively.

The famous French mathematician Mandelbrot coined the term ‘fractal’ from Latin root ‘fractus’, which means broken, rough and irregular characteristics to describe the shape of objects. The roughness and irregularity can be illustrated at all scales, which differs fractals from Euclidean shapes. Mandelbrot proved that the concept of fractals is not only a mathematical concept but also has a rigorous relationship with the real life.

From integer dimension to fractal dimension or non-integer dimension that describes the irregular parts are similar to the whole, which is the most notable discovery. This notion of dimension from integers to real numbers is the most remarkable leap from translational invariance to continuous scale invariance.

In 1967, Benoit Mandelbrot first published a paper in science, ‘How Long Is the Coast of Britain? Statistical Self-Similarity and Fractional Dimension’. Mandelbrot discusses the self-similar curves with Hausdorff dimension between 1 and 2. However, ‘fractal’ is not used at that time although these curves are great examples of fractals.

The concept of fractal analysis has been spread so many fields, such as physics, mathematics, chemistry, biology, sociology, medicine and economics. Mandelbrot has developed a fractal approach aimed at investigating self-similar structures in the time series. For example, a series that possesses a fractal structure will describe characteristics that not occurred in linear processes. In addition, the fractal series always display long term cycles which are not periodic and confirm different wavelengths at different intervals for the same series. Fractal analysis was employed in economics when Mandelbrot measured the cotton price changes in an open market in 1963. He found that a chart of cotton price change seems similar to another one at different time series. It was a basic idea of fractals in his mind that scale invariance could be used to estimate the complex phenomenon in real life. Economics has then become one of the potential applications of the fractal theory. Kouassi et al.(1998) have demonstrated that people can use fractional time series models to improve predictive performance over that of other time series models.

Due to the economic significance of Thai natural rubber, its price dynamics and characteristics is thus a crucial point for appropriate modeling of price dynamics. In

conjunction with the possibility of nonlinear behavior in price movement, the application of fractal theory to investigate the dynamic characteristics of the Thai natural rubber price becomes highly rationale.

1.2 Objectives of the study

1.2.1 To determine the Hurst exponent.

1.2.2 To analyze and identify the dynamic characteristics of the Thai natural rubber price via the Hurst exponent.

1.2.3 To analyze the market efficiency of the Thai natural rubber price via the fractal theory.

1.3 Advantages of the study

1.3.1 The Hurst exponent of the Thai natural rubber price is known.

1.3.2 The dynamic characteristics of the Thai natural rubber price are identified. Important information regarding the characteristics of pure randomness or long-memory with persistence/anti-persistence is obtained. For mathematical modeling purpose, an appropriate model can be selected, i.e. Brownian or fractional Brownian motion. Based on further parametric study of the selected mathematical model, the price movement can be known and thus the related price policy planning.

1.4 Scope of the study

The research is limited to the case of fractal only, i.e. no multi-fractal analysis. The data 2272 observations of daily Thai natural un-smoked rubber price from 21 April 2003 to 7 July 2014 from Thai Rubber Association (TRA) are used in the study.

1.5 Organization of the study

This study includes five parts; chapter 1 gives an introduction of Thai natural rubber price and the history of fractal theory. The theoretical foundation and literature review are given in chapter 2. Followed by research and methodology, which expresses the details of R/S analysis in chapter 3. Last two parts are empirical results (chapter 4) and conclusions (chapter 5).