Chapter 2
Theory and Literature Review

2.1 Theory

2.1.1 Regime switching

A regime is a level of value in time series. Regime switching is the change from a regime to another regime. There are two types of regime switching. The first type is the change from a lower regime to higher regime. In this case, the stock price will increase. The second type is the change from a higher regime to lower regime. The stock price will decrease in this case.

Usually, the regime switching presents a sharp change in a particular part of time series. Many cases are not regime switching (see figure 1). When a stock price climbs steadily, there is no regime switching (middle picture in figure 1). This change can be captured by the time trend. When a stock prices starts to change with a higher speed but not arrive at a constant level, this is also not a regime switching (right picture in figure 1). This change can be captured by the piecewise regression. When the stock price keeps constant over time (flat horizontal line), this is also not a regime switching. The next section will explain the single change point and multiple change points.

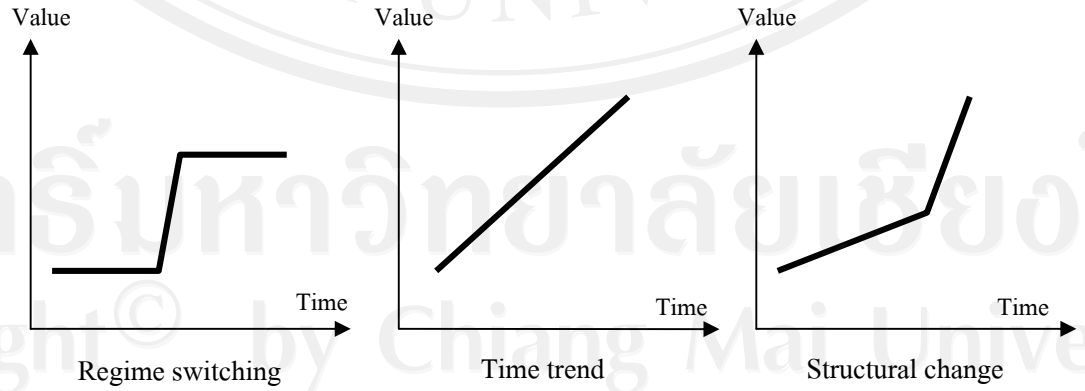

Figure 1 Classification of regime switching and other types of change

(a) Single change point: the external shock

The word "change point" is an interchange of the regime switching. There is a single change point when the stock price suddenly increases from a lower level to a higher level. The phenomenon takes place only once on a particular part of a time series (see figure 2). The reason behind the single change point is the external shock, for example, an increasing interest rate, oil price, and dividend rate.

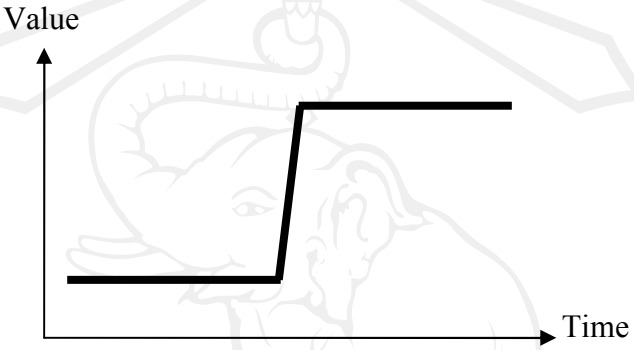

Figure 2 Single change point

(b) Multiple change points: the cyclical behavior

The multiple change points contain more than one change point in a particular part of a time series (see figure 3). It is like fluctuation over time. A reason of this phenomenon is the cyclical behavior. Usually, it occurs in a long time series, e.g. observations over a year or more than a year. It rarely occurs in a short time series.

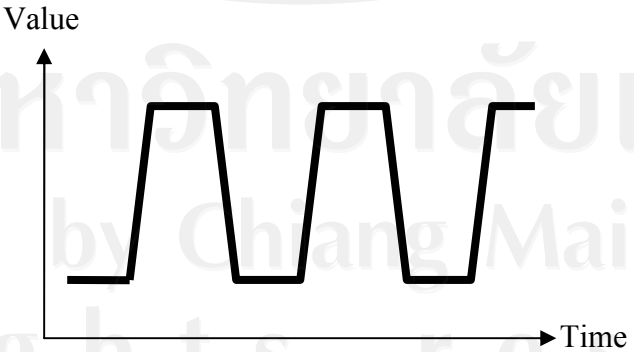

Figure 3 Multiple change points

2.1.2 Dividend and factors that drive the dividend

Dividend is a payment made by a company to its shareholders. A company can pay dividend once or more than once a year. Before paying the dividend, the company must announce the XD dates to notify investors that they will not receive the dividend when they purchase the securities on the XD dates. The dividend income is subjected to 10 percent tax. The amount of dividend depends on the earning per share (EPS) and the dividend payout ratio as follows:

(a) Earning per share (EPS)

EPS is the net profit over all shares that are issues by a company. It increases when the company earns more income or reduces more costs. It indicates the growth of the company. A good company should have a steady increase of EPS over time.

(b) Dividend payout ratio

Dividend payout ratio is a portion of earning per share that will be distributed to shareholders. Usually, a company will pay 50 percent of its EPS for the dividend. In this case, the dividend payout ratio is 0.5. The rest of the earning per share will be reserved for the company's investment capital.

However, some companies set the dividend independently from the EPS and dividend payout ratio. They may fix the dividend per share at a constant amount.

2.2 Literature review

Several models are potential to detect the regime switching such as traditional time series models, fuzzy model, and Markov switching model.

Wu and Chang (2001) mentioned the existence of structure changes among many economic time series. The structural changes create change points in the series of data. They used the threshold autoregressive (TAR) model to capture the change point. They applied genetic algorithm to estimate parameter d and r for the TAR. Their models separates the time series into several regions, each follows a different AR model as a subsystem with respect to the change points considered. Manopimoke (2011) also applied genetic algorithm to assist regime-switching models.

Fuzzy model is an innovative method to detect the regime switching of time series. Kumar and Wu (2001) are pioneers of using the fuzzy model to detect the change points and periods in time series. The model works by decomposing a time series Y_t into k clusters to find the regression coefficient of each cluster. They compared the slope and intercept of each pair of the regression lines. By hypothesis testing, the difference between either slopes or levels of two consecutive lines suggests a change point. Huarng, Yu and Sole Parellada (2011) also used fuzzy logic to predict the regime switching of monthly tourism series.

Markov switching model is another famous model. Kim, Piger and Stratz (2003) used the model to detect the change of the regime of time series. Cai (1994) combined Markov switching model with ARCH. Ismail and Isa (2008) apply the same model to identify regime switching in Malaysian stock market.

Traditional time series models also detect the regime switching. Marcucci (2005) uses GARCH models to forecast stock market volatility with regime switching. Wu and Chen (2006) used partial cumulative sum to detect trends and changing periods for non-linear time series.

Jann (2000) used genetic algorithm to detect multiple change-point. This is the first paper that identify clearly that he uses genetic algorithm for the detection of the change point of a time series. Li and Lund (2012) also used genetic algorithm to detect multiple change point of a times series of climate data. For economic data, Sudtasan and Suriya (2012) used genetic algorithm to detect the regime switching in stock prices before the year end. They mentioned that the method is quite successful in the detection of regime switching and the profit from purchasing the stock according to the suggestions. However, the authors warned that the strategies that were suggested by the method may not guarantee the repeated positive profits for all years.

Considering previous studies on detection of regime switching and change points using variety of quantitative methods, this study propose to use genetic algorithm to directly detect the regime switching. It is quite similar to Sudtasan and Suriya (2012) but it improves many features such as a better crossing over process and clearer criteria to detect the regime switching. It differs from Jann (2000) and Li and Lund (2012) that it uses a shorter time series to detect the regime switching in a

particular part of the series. Moreover, it focuses on detection of a single change point rather than multiple change points.

Investors in stock market may find this model useful when they aim at making profit in a short term, i.e. not more than 50 days in an investment. Moreover, the model is good for investors who trade the stocks not so frequently; they wait for a few good opportunities in a year that the investment is reasonable enough.