CHAPTER 2

LITERATURE REVIEW

This chapter presents the theoretical background about the interest rate risk on common stock return and the concept of growth options. In addition, it represents a number of academic literatures in the area of interest rate sensitivity on stock return and the impact of growth options on stock returns.

2.1 Conceptual and Theoretical Background

Interest rate risk is an area that has received attentions from both academics and practitioners. While duration and convexity frameworks give investors the thorough knowledge of how bond securities returns relate with the interest rate movements, the understanding of how common stock returns and interest rate changes are correlated remains inconclusive.

For the empirical studies, the sensitivity of common stock returns to interest rate changes has gain much attention from researchers (i.e., Flannery, and James (1984), Sweeney, and Warga (1986), Bae (1990), Elyasiani, and Mansur (1998)). However, most of these studies concentrate on financial institution returns (i.e., Akella, and Chen (1990)). For non-financial firms, there are a few empirical studies on the relation between stock returns and interest rate exposure, such as Bartram (2002). Flannery, and James (1984) purpose that the interest rate sensitivity of a common stock should be related to the maturity composition of the firm's nominal assets and liabilities. Sweeney and Warga (1986) purpose the regulation-lag hypothesis. Bartram (2002) hypothesizes that a rise of interest rate will reduce the value of the firm since it increases the expected return. Unfortunately, empirical studies to date have provided us inconclusive results on the interest rate risk

In the theoretical framework, we can track the relation of stock returns and interest rate exposure from the discounted cash flow (DCF) approach. Interest rates affect stock prices through the relevant discount rate, the ability of firms to generate cash flows, and future dividend payment. According to DCF when assuming the constant growth, the stock return is negatively related to interest rate changes.

However, the market value of a firm is comprised of the value of assets already in place and the present value of growth opportunities. These two terms differ from the other in that the latter represent future decisions that the company may potentially make while the former is the results from past decisions. Moreover, the former often includes a few elements of choice for the company, thus making DCF amenable for valuation. By contrast, the latter fundamentally involve the choice of whether or not to undertake the projects. Because the firm is not obliged to undertake all of its future investment opportunities, the value of growth opportunities reflects the value of future investments, which are expected to yield rates of return in excess of the opportunity cost of capital. Thus, growth opportunities can be regarded as call options on real assets where the exercise price is the future outlay needed to acquire assets. It is widely accepted that DCF are not appropriate for valuing assets with the option component.

In recent years, an options analysis of future investment has begun to challenge DCF principles and generated a number of new insights into the valuation of future projects (see, for example, Miles (1986), Pindyck (1988), and Chung and Kim (1997)). For instance, Pindyck (1988) argues that the fraction of market value attributable to the value of capital in place should be only one-half or less for firms with considerable demand volatility. These studies have also shown that the valuation principles for future growth opportunities can be fundamentally different from assets in place.

However, much of this options literature has focused on the pricing of choice elements in projects, rather than on the effects of investment options on a company's susceptibility to interest rate risk. According to a call options formula, the values of options increase when interest rate rises. This is opposite from the discounted cash flow model, which implies that the value decrease as the interest rate rises.

The option analogy further implies that firms with significant growth opportunities should have less interest rate sensitivity than firms with low growth opportunities since the interest rate effect of growth options is contrast to that of asset in place. Also if the effect from growth options dominates the effect from asset in place, high growth firms would have positive relation with interest rate movement. These hypotheses are confirmed by the evidence from Hevert, McLauhlin, and Taggart (1998).

There are many measures of growth opportunities. For example, Capaul, Rowley, and Sharpe (1993) use the ratio of a security's price to its book value (P/BV ratio). The intuition is

straightforward: A security's price represents investors' assessments of future prospects, while its book value represents accountants' representation of its past costs. The greater a company' prospects for future growth, the greater should be the ratio of its future prospects to its embedded costs. Many literatures call stocks having high growth opportunities "growth stock" and stock having low growth opportunities "value stock".

Furthermore, the effect of interest rates on stock returns may depends on the sources of the interest rate change, a real rate change and an inflation shock (see, for example, Flannery and James (1984)). If a future project has little ability to adjust its future cash flows in the face of an inflation-induced increase in interest rate, its value will fall as nominal rates rise. On the other hand, if the project affords the flexibility to adjust prices and costs in such a way that project cash flows remain essentially unchanged in real terms, the value of the growth option can be less sensitive to increases in nominal rates. Therefore it is interesting to study how these two sources affect the above relationship.

2.2 Literature Relates to Interest Rate and Stock Return

2.1.1) interest rate and stock return on specific sector

2.1.2) interest rate and stock returns on overall market

2.2.1 Interest rate and stock return on specific sector

The relation between interest rate movements and common stock returns has been the focus of a considerable amount of research for many years. Most studies focus on the selected sectors, especially financial sector because of their specific characteristics in this sector. Other studies explore the effect of interest rate movements on an overall market. Consequently the empirical results in this area lead to many conclusions, which are inconclusive, to explain why the interest rate movements should affect stock returns.

Except for Sweeney and Warga (1986), all studies in this issue pay attention to the financial institutions only since this sector has particular characteristics such as the large maturity mismatch between assets and liabilities. Most assets of financial institution are nominal assets. In addition, this sector also operates under specific rules and regulations.

Based on the maturity mismatch of bank assets and liabilities, Flannery and James (1984) investigate the relation between the interest rate sensitivity of banking stock returns and the size of maturity difference. The evidence shows that stock returns on financial institutions are negatively correlated with interest rate changes. In addition, the degree of interest rate sensitivity is positively related to the maturity gap between assets and liabilities.

Sweeney and Warga (1986) compare the interest rate sensitivity among industry sectors during 1960 to 1979. According to the evidence, the majority of industry portfolios do not exhibit significant interest rate exposures. Exceptions are the utilities and financial sectors, which show a significant, negative interest rate sensitivity. These findings are explained primarily with the lower pass-though in regulated industries, especially utility sector. Since government always regulates utilities firms, when cost goes up because of the interest rate increase, they cannot raise their selling price without the government permission. This implies that the utility will face lags between rises in its costs before being allowed to raise it output's price; this will reduce the stock's price. This reason is referred to as the regulatory lag hypothesis.

Bae (1990) compares the interest rate sensitivity of stock returns of financial firms with those of nonfinancial firms. The study employs different models of interest rate expectation to classify current, anticipated, and unanticipated changes in interest rates. The results indicate four main conclusions. First, stock returns of nonfinancial firms are not sensitive to any types of interest rate changes. Second, the findings are consistent with those of Flannery and James (1984) in that both current and unanticipated interest rate movements affect adversely stock returns of financial firms. Third, the stock returns are more sensitive to long-term interest rate than short-term interest rate. Fourth, the proceeding conclusions are robust to different models of interest rate expectation.

Akella and Chen (1990) examine the relation between interest rate changes and bank stock returns under different model specifications during 1974 to 1984. The time period is also split into two sub periods: 1974-1979 and 1980-1984 since, in 1979, U.S. government shifted the monetary policy from a stable interest rate regime to a stable money supply regime. The findings reveal that interest rate sensitivity varies across models, being both positive and negative. Supporting Bae (1990) conclusion, Bank stock returns are more sensitive to long-term interest rate than short-term interest rate in most models. In addition, the structural change occurs during

the sample periods, suggesting that the interest rate sensitivity has significantly declined since 1980 in all models.

Recently, the studies of the interest rate sensitivities of financial institutions are of particular interest as they incorporate nonlinearity and interest rate volatility in the model specification. Elyasiani and Mansur (1998) employ the generalized autoregressive conditionally heteroskedastic in the mean (GARCH-M) methodology to investigate the effect of interest rate on bank stock returns. According to the findings, interest rate and its volatility have significant impact on the bank stock return and bank stock return volatility respectively. In addition, like the conclusion of Akella and Chen (1990), there is a structural shift in response to the switch in monetary policy in 1979.

In Thailand, Bunchai (1991) examines the effect of economic factors on financial stock returns. The evidence indicates that the interest rate, yield on government bond, and inflation rate statistically affect the returns of commercial banks but not those of finance companies.

Nattiya (1998) investigates the relation between bank stock returns and market, interest rate, as well as foreign exchanges rate during 1991 to 1998. The interest rate in this study is the repurchase rate (REPO).The study argues that since Thai commercial banks usually borrow money through the repurchase market, the REPO will reflect the cost of banking sector better than the long-term rate. According to the empirical evidence, the relation between bank stock returns and interest rate is unobvious since only some banks exhibits the significant relation in some periods. Bank stock returns are found to be associated to interest rate risk in the large bank sample during the 1991-1997 period but not after July 1997, the period of financial crisis. However, for the medium and small bank sample, there is no significant relation in any period.

2.2.2 Interest rate and stock returns on overall market

While most literatures pay attention on how interest rates affect returns on specific sectors because of their particular characteristics, a number of studies in this field focus on the effect of interest rate on the whole stock market and/or individual securities. For example, Chen, Roll, and Ross (1986), Raknuch (1997), and Ajchara (2001) investigate the effect of interest rate factors on stock market indices. Other studies (Kulvara (2000) and Bartram (2002)) focus on the relation between interest rate and individual stock return without paying attention to particular

firms. In addition, most studies base their hypotheses on the discounted cash flow (DCF) model, which expects that interest rate factor has a negative effect on stock returns.

Chen et al (1986) explore a set of economic variables influencing stock market returns during the 1958-1984 period. Based on DCF model, Chen et al (1986) argue that the economic factors, which influence stock returns, are those that change either discount factors or expected future cash flows. The empirical results show that the differences between long-term and short-term interest rates as well as the inflation rate are economic factors, which negatively affect market returns. However the effect of these two variables is found to be insignificant in some sub periods.

Recently, the literature of the interest rate risk has been expanded to consider the nonlinear relation and factor volatility. For example, Flannery et al (1997) investigate the interest rate exposure in U.S. securities. The study allows both market and interest rate risk factors to change over time by employing the generalized autoregressive conditional heteroskedasticity (GARCH) models. The empirical results provide weak evidence that security returns are significantly influenced by a time-varying interest rate risk factor in the full period but not in some sub-periods.

Bartram (2002) studies the interest rate exposure of German nonfinancial stock since interest rate risk affects the value of nonfinancial firms due to changes in the cash flows and the value of their assets and liabilities. Consistent with Bae (1990) and Akella and Chen (1990), the empirical results illustrate that nonfinancial corporations are more sensitive to the long-term interest rate than short-term interest rate. Moreover, most nonfinancial stocks exhibit the nonlinear interest rate exposure but not linear exposure.

For the studies in Thailand and other Asian markets, Raknuch (1997) examines the impact of economic factors on market returns in Southeast Asia – Indonesia, Malaysia, Philippines, Singapore, and Thailand. Similar to Chen et al (1986), this study bases on the discounted cash flow framework to hypothesize that interest rate should has negative impact on market returns and the empirical supports this hypothesis. Except for Philippines market returns, all market returns in Asia countries are found to be negatively affected by interest rate and/or inflation rate.

Unlike the previous literature, which studies the direct effect of interest rate on stock returns, Kulvara (2000) investigates the linkage between interest rate and stock volatility, which

indirectly affects security return. The government bond yield is used as the long-term interest rate proxy. The empirical evidence shows that interest rate is quite volatile in the 1981-1987 and 1998-1999 period. It also concludes that among eighteen industries, banking sector is the only one industry in Thailand that its return volatility is significantly and positively related to interest rate factor.

More recently, Ajchara (2001) examines the relationship between Thai stock market return and macro variables by employing cointegration analysis to test the long-term relation. The results reveal negative relationship between Thai market return and inflation. An explanation is that investors usually recognize the drop in real free cash flow subsequent to a rise in inflation. It is possible that such increase in price level or inflation may also raise the nominal required rate of return on equity in the stock valuation model and cause stock prices to fall. However, the relation between market return and savings deposit rate is found to be positive, thus contrasting to the hypothesis from discounted cash flow model. However, the study argues that the savings deposit rate may not be served as a good proxy for the risk-free rate.

In summary, although the relation between interest rate and stock returns have been investigated by a consider amount of studies, The extent of interest rate sensitivity of stock returns is an unsettled issue in term of both size and sign. A number of studies (Flannery and James (1984), Chen et al (1986), Elyasiani and Mansur (1998) and etc.) agree that interest rate sensitivity of stock returns is negative and the degree of sensitivity is higher for longer-term interest rate than short-term interest rate (Akella and Chen (1990) and Bae (1990). However, other studies (Ajchara (2001), and Bartram (2002) find that interest rate sensitivity varies from negative to positive across samples and time periods. These dissimilarities in findings of the extant studies have attributed to differences in the choice of interest rate variables, sample period, and model specification.

2.3 Literature Relates to Growth Options

2.2.1) the existence of growth options

2.2.2) growth options and systematic risk

2.2.3) growth options and interest rate risk

2.3.1 The existence of growth options

The concept of growth options can be tracked to the study of Myers (1977). Myers (1977) is one of the first literatures, which raise the argument that the market value of a firm is comprised of the value of assets in place and the present value of growth opportunities. The present value of growth opportunities reflects the value of future investments, which are expected to yield rates of return in excess of the future cost of capital. Similar to call options, growth opportunities give a firm the right to undertake the real assets, which are worth more than the invested amount. Therefore, the value of growth opportunities can be regarded as the value of the call options on real assets, or a "growth options".

Later, Kester (1984) compare the present value of the firms' current earning stream and the market value of the firms. The evidence shows that the value of earning stream is about half of the market value. Given that the present value of earning stream represent the value of assets in place, Kester (1984) argue that the value of growth opportunities is half or more of the market value of equity for many firms.

More recently, Pindyck (1988) describes how growth options arise. The growth options are the result of a patent on a production technology, ownership of land and natural resources, managerial resources, reputation, or market position. All of which may have been built up over time, enable a firm to productively undertake specific investments that other firms cannot do. In addition, the study proposes the theoretical model to estimate the value of growth options. The model shows that the value of growth options is positively associated with a firm's demand volatility. Especially if demand volatility is 0.2, which would not be unusual, half of the firm's market value is accounted by the value of its growth options, supporting Kester (1984) evidence.

2.3.2 Growth options and systematic risk

A few literatures are devoted to study the link between growth options and systematic risk. The main assumption in these studies is that the present values of assets in place and growth opportunities are estimated by the discounted cashflow and option pricing models respectively. For example, Mile (1986) proposes that the systematic risk of growth options is always higher than that of assets in place since the former is an option written on the latter. Later, Chung and Charoenwong (1991) examine the effect of a firm's growth opportunities on its systematic risk.

The empirical results show that a positive relation exists between the firm's equity beta and various measures of growth opportunities, thus supporting Mile (1986) argument.

2.3.3 Growth options and interest rate risk

While most studies, which investigate the relation between stock return and interest rate, rely on the discounted cash flow framework to explain how stock return is linked to interest rate, a few studies argue that discounted cash flow model is inappropriate to explain the relation between stock return and interest rate. The main idea of these studies comes from Myers (1977) argument that the market value of a firm is comprised of the value of assets in place and the present value of growth opportunities. If growth opportunities are analogous to call options, an option pricing model implies that their values would increase with interest rates. This behavior is the opposite from the discounted cash flow model, which decrease in value as the rate rise.

Hevert, McLaughlin, and Taggart (1998a) investigate the role of growth opportunities as the determinant of the interest rate sensitivity on common stock returns. Because of their option-like characteristics, growth opportunities alter the basic relation between stock returns and interest rate. Therefore, returns on high-growth portfolio, measured by the book-to-market ratio, would react differently from those on the low-growth portfolio to interest rate movement.

The empirical results also support their conjecture. Returns on the high-growth portfolio react positively to interest rate increases. Conversely, returns on the low-growth portfolio react negatively to interest rate increases.

Later work, Hevert et al (1998b) show that the effect of growth option in determining interest rate sensitivity depends on the firm's ability to "flow through" interest rate changes. If a firm has little ability to adjust its cash flows in the face of an inflation-induced increase in interest rate, the value of growth options will fall as nominal rate rise. On the other hand, if a firm can remain its cash flows unchanged, the value of growth options will be less sensitive to increase in nominal rates, Therefore, the magnitude and sign of the growth option's interest sensitivity depends on the firm ability to adjust the future cash flow to interest rate change.

In Thailand, Surang (1998) employs stock returns on Thai listed companies from 1992 to 1998 to investigate the impact of growth options on equity duration. The study uses the minimum loan rate (MLR) instead of yield on long-term government bonds as the proxy of risk free rate. The results seem to be inconsistent with Hevert et al (1998a)'s argument. Returns on high-growth

portfolio have the negative relation with interest rate changes while those on low-growth portfolio have no significant relation with interest rate movement. The study argues that perhaps MLR is not a good representative of risk-free rate. Moreover, the interest rate did not move so much during the sample period.

For the robustness test, the study divided the sample into two subperiods, and changes interest rate variables (repurchase rates, and saving rate). However, the conclusions are mixed, depending on the sample periods, and interest rates.