Estimation of Stock Price: A Case Study of JB Hi-Fi Limited

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ABSTRACT

As a major part of the security market, stock market now has become an important financing channel of most corporations. The pricing researches of stock market have great theoretical and practical significance. Against this background, this paper discusses the calculation process of stock price of JB Hi-Fi Limited and analyzes it by discussing and calculating the relevant financial statistics which would be based on different data resources. Specifically, based on the adjusted stock prices of JB Hi-Fi Limited from 31 May 2012 to 30 April 2017, we calculate the beta coefficient of JB Hi-Fi. Then, we estimate the stock price of JB Hi-Fi using single-stage and two-stage model respectively and compare the theoretical stock price with the actual price. Finally, we provide some recommendations for stock investors.

KEYWORDS
Stock price; Case study; JB Hi-Fi Limited.

INTRODUCTION

The global stock market has been in existence for hundreds of years since its emergence, yet the understanding of it has only grown in recent decades. Over the past long period of time, due to the small size of the stock market, information exchange speed and analysis methods are very limited, that people usually can only make judgment decisions by their personal subjective feelings. With the rapid development of the securities market in recent decades, the standardization of information disclosure and the diversification of information transmission procedures make people come to realize that some effective forecasting methods are needed to provide guidance on market investment decision. Change in stock price is a quite sensitive issue no matter for stock investors or companies that issued stock, it directly concerns their deepest interest. Economics are also interested in changes in stock price, such changes often reflect the economic condition of a country. However, it is not easy to calculate the stock price and grasp the regular pattern of stock price changes. It is too naive to believe that stock price can be calculated by a specific formula, because in the real economic life, stock prices in the stock market are formed under the influence of various factors, rather than calculated according to a formula. However, the view that it is meaningless to use formulas to calculate price is also wrong, the regular pattern of stock price changes can be reflected by some estimation and calculation, which can help explain some problems.

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In real life, very few investors will focus all the investment on a single stock. Based on this, Prof. Harry Markowitz proposed the concept of a portfolio in 1938, and established a modern portfolio theory to measure the combined benefits and risks in terms of the mean value and variance of statistics. It offers the investors ideas on how to establish their own optimal combination according to their risk tolerance to maximize their investment income and break down the risk into systematic and non-systematic risks to guide investors to optimize their investment behavior [1]. Since then, his students, William Sharpe, and Lintner et al. have applied their attention to Harry Markowitz's micro-research to the whole market, simplifying its complex form into a one-way analysis of variance based on the market index, and found that the return of capital assets and risk in equilibrium market conditions is linearly related to the linear relationship, that is the CAPM based on the mean-variance model.

In recent years, a large number of literatures have studied the contributory factor of stock price and its estimation. For example, Cheng, Shou-Hsiung [2] combined support vector machine (SVM) and knowledge mining to build their model, which can be used to study the impact of news on stock prices. The results showed that the stock price prediction results of their model are relatively close to the actual value one hour after news occur. Chang and Liu [3] developed a Takagi-Sugeno-Kang (TSK) type fuzzy rule based system for stock price prediction. Fazel Zarandi et al. [4] presented a type-2 fuzzy rule based expert systems for stock price analysis. The proposed model applies on both technical and fundamental indexes. Chang et al. [5] proposed a novel model by evolving partially connected neural networks (EPCNNs) to predict the stock price trend using technical indicators as inputs.

Engle and Rangel studied the stock markets in more than 40 countries and found that macroeconomic policies affected stock market volatility [6]. Henry found that short-term interest rate changes have a significant effect on the variance of stock returns, but this effect is asymmetric, especially when the stock market is in a low return high volatility state [7]. Through empirical research, Antulio N. Bomfim found that statistically the US monetary policy changes will not have a significant impact on the stock price; at the same time in statistics, the US economic report will not play a significant role in the stock market volatility; Participants in the capital markets are sensitive to changes in US macroeconomic policy trends, and every macro policy adjustment will bring obvious volatility to the stock market under the expected effect of this sensitive mind [8]. Based on the Chinese capital market, which is dominated by retail investors, the paper analyzes the dynamic relationship between institutional trading and stock price volatility in the short term from July 1, 2002 to December 31, 2004. It can be concluded that price volatility varies with the difference in agency trading behavior, as well as with the size of the stock purchased; at the same time, the combined actions from transactions of agencies who has timely and accurate information and the ones without it can decide the relationship between the stock price and the stock market volatility. When the former plays a major role, the increase in institutional holdings is conducive to market stability. When the latter dominates, the increase in institutional holdings will cause the capital market to fluctuate. Therefore, it cannot clearly define the institutional holdings and capital markets from the aggregate level fluctuations in the correlation between [9]. Balvers & Huang used the classic CAPM model to study the impact of policy changes on the firm's theoretical price of the stock and found that the purpose of investors to maintain portfolio liquidity was to reduce the cost of future transactions. They argued that changes in
liquidity factors can significantly affect the marginal utility of market participants and the cost of asset transactions. And there are some obvious relations between these two factors and CAPM model. Therefore, it is of great theoretical significance to study the problem by using CAPM model. In the end, they argue that changes in market liquidity can have a real impact on the pricing of stocks and that value firms are more sensitive to liquidity changes. Hence, when macroeconomic policy changes cause liquidity changes and affect the stock market, the company's stock price will appear more obvious fluctuations [10].

JB Hi-Fi Limited is a retail company which involves home entertainment products and all kinds of consumer electronics. It is listed in Australian Securities Exchange (ASX) and identified as retailing in ASX. JB Hi-Fi has been operated for more than ten years and it could be in a stable situation. Therefore, there are adequate data that could be obtained from its database. According to Morningstar, the sales revenue and dividend payment are both at an increasing level. Therefore, we choose this company as a case to analyze.

In this paper, we discuss the calculation process of stock price for JB Hi-Fi Limited and analyze it by discussing and calculating the relevant financial statistics which would be based on different data resources. Specifically, based on the adjusted stock prices of JB Hi-Fi Limited from 31 May 2012 to 30 April 2017, we calculate the beta coefficient of JB Hi-Fi. Then, we estimate the stock price of JB Hi-Fi using single-stage and two-stage model respectively and compare the theoretical stock price with the actual price. Finally, we provide some recommendations for stock investors.

BETA CALCULATION

JB Hi-Fi has been operated for more than ten years and it could be in a stable situation. Moreover, there are adequate data that could be obtained from its database. Therefore, this company can be an ideal case used to calculate its beta coefficient. Beta coefficient is a risk index which states that the sensitivity of a stock's return to the return on the market portfolio. In general, a beta less than 1 indicates that the investment is less volatile than the market, while a beta more than 1 indicates that the investment is more volatile than the market [11].

Data

We use adjusted monthly stock prices of JB Hi-Fi Limited from 31 May 2012 to 30 April 2017 to calculate the beta coefficient of JB Hi-Fi. In order to calculate beta, the five-year period as the sample data period would be sufficient and effective than one year or ten years to eliminate errors. For example, the one-year data only indicates the recent data which could reflect the company’s current position immediately. Thus, it would ignore the effect of business cycle. In addition, ten-year period is too long and it might contain data that are more abnormal. For instance, the data of Global Financial Crisis in 2008 would result in an error. Apart from this, the changes of business strategies or other expectations and development during the ten years could lead to the abnormal data and errors as well. For those reasons, it could be proved that the duration of five years is better than ten years due to fewer fluctuations. Therefore, the appropriate historical data refers to five-year data period.
In addition, the time interval of the dataset is monthly. Monthly interval is sufficient to generate the calculation of beta. Guan, Hansen, Leikam and Shaw (2007) reported that the beta could be more stable with a longer time interval [12]. Moreover, if the duration were five-year period there would be 60 data points that is sufficient enough to calculate beta. In addition, monthly adjusted closing price is used when calculating the return of the company; this is because it considers dividend payments. Although daily interval contains comprehensive data size and sufficient information for the company, it could bring many emergencies that do not happen usually. If those emergencies would be captured in the company, the sample data could not reflect the normal condition of the company and the market. Therefore, it might lead to the potential overestimation of variance. The reason for this view refers that the return of the company would be far away from the average return due to those emergencies so that it might result in an increasing in variance. Thus, monthly interval is better than daily interval.

**Beta calculation**

The security’s beta measures that covariance of stock and market is divided by the variance of market. Thus, the market return is the foundation to calculate covariance and variance of market so that the market rate should be considered. Actually, the market proxy should be used to present the market rate and the examples of market index include S&P 500 index, S&P/ ASX 200 index and all ordinary accumulation index. To be more specific, the S&P 500 index and all ordinary accumulation index cover top 500 companies and more comprehensive. However, the S&P 200 covers top 200 companies. The best market proxy refers to the index that is the most reflective of the company’s position in the market. The market capitalization of JB Hi-Fi is 2.65B which is higher so that the S&P/ASX 200 index could cover this company [13]. Therefore, the S&P 500 is too comprehensive and the S&P/ASX 200 index is more suitable for JB Hi-Fi.

The risk-free rate refers to the returns with zero systematic risk [14]. For instance, the government bond and cash rate. While the government bond might be affected by inflation and default risk, thus the 100% risk free rate does not exist actually [15]. Therefore, it is necessary to consider the credit rating, which measures the possibility of default risk for a bond or an asset. Hence, the higher credit rating the lower possibility of default risk. For example, Commonwealth Government’s bond which has AAA credit rating could be recognized as risk free. Also, the risk-free rate involves cash rate, 5-year treasury bond rate and 10-year treasury bond rate. To be more specific, cash rate is the basic rate in the market and could reflect the market condition immediately [16]. While, the 5-year treasury bond and the 10-year treasury bond would take expectation of the future inflation rate into account by government. However, the period of ten years does not match the sample data period which refers to five years data period. In addition, the yield would rise with longer period and risk-free rate might be overestimated due to the consideration of inflation. Instead, the 5-year treasury bond is the best one which could match with the 5 years data period as the risk-free rate.

Beta can be calculated as follows:
\[ \beta_{im} = \frac{\sigma_{im}}{\sigma_{m}^2} \]  

(1)

Where \( \sigma_{im} \) is the covariance with market, and it is given by:

\[
\sigma_{im} = \frac{\sum_{t=1}^{n} \left[ (r_i - \bar{r}_i) - (r_f - \bar{r}_f) \right] \times \left[ (r_m - \bar{r}_m) - (r_f - \bar{r}_f) \right]}{n-1} = 0.000617491
\]

(2)

And \( \sigma_{m}^2 \) in Equation (1) is the variance of market, the formula is:

\[
\sigma_{m}^2 = \frac{\sum_{t=1}^{n} [(r_m - \bar{r}_m) - (r_f - \bar{r}_f)]^2}{n-1} = 0.00118182
\]

(3)

Hence, \( \beta_{im} = \frac{0.000617491}{0.00118182} = 0.522 \). The beta of JB Hi-Fi is greater than zero and less than one, so it indicates that the return of JB Hi-Fi is less sensitive to the market risk. Furthermore, the relationship between the return of JB Hi-Fi and the return of market is presented in Figure 1.

The official beta of JB Hi-Fi is 0.56 that is higher than 0.522 which comes from the above calculation. There are several reasons for the difference between official beta and the calculated beta. Firstly, the different market index could be considered as Reuters selects S&P 500 index, whereas the S&P/ASX 200 index is used in this report. Therefore, the beta would be different because of the different market index proxy. Moreover, the different risk-free rate proxy could be one of those reasons. Since, Reuters apply the American government bond yield as the risk-free rate. While, this report uses the commonwealth government bond. Thus, the calculated beat is different from the official beta in Reuters.

Figure 1. The relationship between the return of JB Hi-Fi and the return of market.
DISCOUNT RATE

According to Chrysafis (2012), the Capital Asset Pricing Model (CAPM) refers to a tool which can be used to calculate the discount rate [17]. The CAPM is based on Markowitz’s modern portfolio theory, so there are five assumptions that should be indicated when using the model [18].

The mean and standard of return is assumed to express the risk of the company. While, it requires that the return is normally distributed, if the risk of company could be measured by the mean and standard deviation of the return.

The assumption for CAPM aimed at those investors who are risk averse and rational. When investors consider the asset value, they would focus on the company’s condition and the future development of it, while the personal emotion of certain company would be given up and without bias. If there exists a risk level, the investors could demand the highest return to mitigate risk.

It can be assumed that investors have the same expectations about the market.

All investors would choose the asset with the highest return and least risk. It also refers to the highest sharp ratio.

The beta may not change with time.

According to the Reserve Bank of Australia (RBA) 2017, the average risk-free rate \( r_f \) is 2.20%, which is the average rate for 2017. And according to the previous section, beta(\( \beta \))=0.522. Thus, based on the formula of CAPM, the discount rate \( r_i \) of JB Hi-Fi is \( r_i = r_f + \beta \times (r_m - r_f) = 2.20\% + 0.522 \times 6.5\% = 5.593\% \).

STOCK PRICE

To determine the current stock price with a constant growth rate, the constant growth discounted dividend model could be applied, which also refers to Gordon growth model and derived from the present value of a growing perpetuity. Thus, this model could assume that the company would operate indefinitely. While it may not be exactly due to the bankrupt companies, however, the credit rating could be used to select the company which could be operated constantly because of higher credit rating.

According to the Gordon model, the stock price could be calculated by:

\[
 p_0 = \frac{Div_1}{r_i - g}
\]  

(4)

Since the dividend is paid semi-annually, thus the dividend for 2017 is not paid completely so far. Therefore, the \( Div_1 \) should be calculated from \( Div_0 \). The formula of \( Div_1 \) refers to

\[
 Div_1 = Div_0 \times (1 + g)
\]  

(5)

Furthermore, the growth rate and the discount rate should be change to its effective rate for semi-annually separately.

Discount rate \( r_i \) (semi) = \((1 + 5.593\%)^{\frac{1}{2}} - 1 = 2.758\%

Growth rate \( g \) (semi)= \((1 + 5\%)^{\frac{1}{2}} - 1 = 2.470\% \)
According to ASX (2017), the interim payment of dividend is 0.72 per share on 23 February 2017 [19]. Thus $\text{Div}_0 = 0.72$, Then $\text{Div}_1 = 0.72 \times (1 + 2.47\%) = 0.74$ and $p_0 = 0.74/(2.758\% - 2.47\%) = 256.94$.

However, the current price is 23.09 on 30 May 2017, which is lower than the price calculated $p_0$ [19]. Therefore, the 5% constant growth rate is not reasonable for JB Hi-Fi Ltd. Moreover, those calculations can prove that the unreasonable growth rate would overestimate the stock price. Additionally, JB Hi-Fi Ltd is not a growth company that refers to the company still in a growth stage. According to the annual report of JB Hi-Fi Ltd in 2016, it indicated that the company would update itself by expanding stores and convert existing stores to JB Hi-Fi HOME. While it may have stable development in the future. Therefore, it is better to apply the two-stage rather than single growth model. Meanwhile, it explains that the calculated price is different from the actual price due to the unappropriated growth rate.

**TWO-STAGE MODEL**

The two-stage model would be used to value the non-constant growth. In this case, the dividend growth rate ($g$) with 5% is expected to apply for five years and the inflation rate is expected to apply for the period that is longer than five years as the new growth rate in the second stage. According to Australian Bureau of Statistics, the inflation rate refers to 2.1%. While, the dividend payments are semi-annual, thus the effective rate should be calculated.

(1) The inflation rate (semi) = $\left(1 + 2.1\%\right)^{\frac{1}{2}} - 1 = 1.04\%$

(2) The formula is given by:

$$PV = \frac{\text{Div}_1}{(1+r)^1} + \frac{\text{Div}_2}{(1+r)^2} + \ldots + \frac{\text{Div}_H}{(1+r)^H} + \frac{P_H}{(1+r)^H}$$  \hspace{1cm} (6)

$$P_H = \frac{\text{Div}_{H+1}}{r - g}$$  \hspace{1cm} (7)

Therefore, (1) $r$ refers to the discount rate with 2.758% semi-annually. (2) $g$ refers to the growth rate at the forecast inflation rate with 1.04% semi-annually. The calculation process is shown in Table 1.

<table>
<thead>
<tr>
<th>Date</th>
<th>Dividend period</th>
<th>Dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017, 1st</td>
<td>$\text{Div}_0$</td>
<td>0.72</td>
</tr>
<tr>
<td>2017, 2nd</td>
<td>$\text{Div}_1$</td>
<td>$0.72 \times (1 + 2.47%) = 0.7378$</td>
</tr>
<tr>
<td>2018, 1st</td>
<td>$\text{Div}_2$</td>
<td>$0.72 \times (1 + 2.47%)^2 = 0.7560$</td>
</tr>
<tr>
<td>2018, 2nd</td>
<td>$\text{Div}_3$</td>
<td>$0.72 \times (1 + 2.47%)^3 = 0.7747$</td>
</tr>
<tr>
<td>2019, 1st</td>
<td>$\text{Div}_4$</td>
<td>$0.72 \times (1 + 2.47%)^4 = 0.7938$</td>
</tr>
<tr>
<td>2019, 2nd</td>
<td>$\text{Div}_5$</td>
<td>$0.72 \times (1 + 2.47%)^5 = 0.8134$</td>
</tr>
<tr>
<td>2020, 1st</td>
<td>$\text{Div}_6$</td>
<td>$0.72 \times (1 + 2.47%)^6 = 0.8335$</td>
</tr>
<tr>
<td>2020, 2nd</td>
<td>$\text{Div}_7$</td>
<td>$0.72 \times (1 + 2.47%)^7 = 0.8541$</td>
</tr>
<tr>
<td>2021, 1st</td>
<td>$\text{Div}_8$</td>
<td>$0.72 \times (1 + 2.47%)^8 = 0.8752$</td>
</tr>
<tr>
<td>2021, 2nd</td>
<td>$\text{Div}_9$</td>
<td>$0.72 \times (1 + 2.47%)^9 = 0.8968$</td>
</tr>
<tr>
<td>2022, 1st</td>
<td>$\text{Div}_{10}$</td>
<td>$0.72 \times (1 + 2.47%)^{10} = 0.9190$</td>
</tr>
<tr>
<td>2022, 2nd</td>
<td>$\text{Div}_{11}$</td>
<td>$0.9190 \times (1 + 1.04%)^1 = 0.9286$</td>
</tr>
</tbody>
</table>
Hence,

\[ PV = \frac{D_{\text{iv}_{11}}}{r - g} \times \left[ 1 - \left( \frac{1 + g}{1 + r} \right)^{10} \right] + p_0 = 147.7817 \] (8)

Therefore, the current stock price is approximately equal to 147.78. Under the constant dividend growth model, the stock price is 256.94. However, the current stock price is 147.78 under the two-stage model, which is lower than that in the constant dividend growth model. Thus, it can be proved that the two-stage model is more appropriate for JB Hi-Fi Ltd.

**CONCLUSION**

This paper indicates the calculation process of stock price for JB Hi-Fi Ltd. In addition, there are some introductions for single-stage and two-stage model. Because of the stock price analyzing of JB Hi-Fi Ltd., the investors would clearly acquaint the company’s condition and make decisions about buying or selling the stock of JB Hi-Fi Ltd. For the shareholders of JB Hi-Fi Ltd., those investors could sell the stock to get return or shareholders could keep it to expect more return in the future. While, for the other investors who do not hold the stock of JB Hi-Fi in the market, it suggests buying some stocks of JB Hi-Fi Ltd. According to Morningstar (2017), the increasing dividend payment per share and the increasing sales revenue recently illustrate that JB Hi-Fi Ltd. performed more and more better [20]. Therefore, the fluctuation of the stock price tends to be gentle and the stock of the company will be less risky. Thus, the stock of JB Hi-Fi Ltd. is more value to buy.

The stock price calculation for this study is based on the CAPM model. However, as described in this article, the CAPM requires five strict assumptions that limit the accuracy of its application and forecasting, which is the limitation of this study. Over the past decade, securities analysis technology has developed some new trends. The progress of computer technology can integrate the variety of analysis, forecasting theory and statistical, information technology, optimization algorithm closely, so that the securities analysis can develop to the quantitative, technical and complex direction. The research on technical analysis of western financial theory mainly focuses on two aspects: 1) seeking statistical support for the existence of price movement; 2) studying the rules of trading based on technical analysis and obtaining more direct empirical support. For instance, the statistic discovery of fat tail phenomenon on the securities gains makes some researchers use fractal and chaos theory to explain the price behavior of securities, and get very good results. At the same time, Bayesian statistics, neural network, artificial intelligence and other engineering methods are gradually used in a variety of investment software and automated trading system.

**REFERENCES**