Research on the Application of CAPM Model in Investment
Taking Amazon and Costco as Examples

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Abstract. Capital Asset Pricing Model (CAPM) is one of the most important theories in modern finance. As a simple, intuitive risk premium model, The CAPM was primarily developed to study the relationship between expected returns on assets and risk assets in the securities market. Scholars have conducted a lot of empirical research on the applicability of this model in the capital market. CAPM has been proven to be somewhat defective, but it is still widely accepted and recognized and broadly applied in research. In this paper, two representative individual stocks in the U.S. retail industry, namely Amazon.com, Inc. and Costco Wholesale Corporation, are used as examples and the indices of the two stocks from 2017 to 2021 as samples. CAPM is used to conduct regressive analysis and the level of its risk is judged so as to provide investment suggestions and countermeasures.

Keywords: β Coefficient · capital asset pricing model · investment preference · risk · Amazon · Costco

1 Introduction

Capital Asset Pricing Model (CAPM) is one of the most important theories in modern finance. As a simple, intuitive risk premium model, CAPM is mainly designed to study the relationship between the expected rate of return of assets and risk assets in the securities market. Based on the mean-variance theory proposed by Harry Markowitz in 1952 [1], Sharpe (1964) [2], Lintner (1965) [3] and Mossin (1966) [4] proposed the Capital Asset Pricing Model. In the subsequent decades, scholars have conducted a lot of empirical research on the applicability of this model in the capital market. Although CAPM has been proven to be somewhat defective, There are also researchers like Cremers (2001) [5] and Levy (2011) [6] who proved that CAPM still be valid, and it is still widely used in research. CAPM model is simple in concept and has a certain practical value, so it is still widely used in investment decision-making, corporate finance and other fields.

The Capital Asset Pricing Model (CAPM) is selected for empirical analysis. In this paper, two representative individual stocks in the U.S. retail industry, namely Amazon.com, Inc. And Costco Wholesale Corporation, are used as examples, and the indices of the two stocks from 2017 to 2021 as samples. CAPM is used to conduct regressive analysis and calculate the risk coefficient, β. Also, the level of risk is judged according to the value of β so as to provide investment suggestions and countermeasures.

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2 CAPM Model

2.1 Equation

The standard CAPM equation is expressed as follows:

$$E(\mathrm{Ri}) = \mathrm{Rf} + \beta\mathrm{i} * [\ \mathrm{E(Rm)} - \mathrm{Rf}] + \varepsilon\mathrm{i} \tag{1}$$

Where, E(Ri) means the expected rate of return of asset i; Rf means the risk-free rate; Rm means the rate of return in the market; βi means the β coefficient of asset i and E(Rm) − Rf is the market risk premium, which is equal to the expected rate of return of market minus the risk-free rate of return.

2.2 β Coefficient

The β coefficient is used to measure the relationship between the systematic risk of an investment asset and the rate of return of the market portfolio [2]. It is a regression coefficient obtained by using the linear regression model. $\beta = 1.00$, $\beta < 1.00$, and $\beta > 1.00$ each indicate that the risk level of the individual asset is equal to, lower, or higher than that of the entire market portfolio.

3 Company Profile

3.1 Amazon.com, Inc.

In 2021, Amazon.com, Inc. Had net sales of US$ 469.8 billion, up 22% from that of 2020 [7], US$ 386.1 billion; operating income of US$ 24.9 billion, compared to US$ 22.9 billion in 2020; and net profits of US$ 33.4 billion, up 56.41% from that of 2020, US$ 21.3 billion [8].

Amazon's business is mainly divided into two categories, retail business and web service, the former of which remains the main business of Amazon. Currently, Amazon Web Service (AWS) has contributed to most of Amazon's operating profits. In 2021, AWS earned an income of US$ 62 billion for Amazon, with the income growing at a fast speed. Amazon's income arising from advertising has gradually increased. In its annual report 2021, Amazon disclosed income data for its advertising business for the first time, showing Amazon's advertising business brought in a total of US$ 31 billion in income [7].

3.2 Costco Wholesale Corporation

Costco was founded in Seattle, Washington in 1983 and is now the second largest retailer in the world. In 2021, Costco had net sales of US$ 192.1 billion [12], compared to US$ 163.2 billion in 2020 [13]; operating income of US$ 6.708 billion, up 23.42% from that of 2020; and net profits of US$ 5 billion, up 25.11% from that of 2020, US$ 5 billion [12].

Table 1. The Regression Equation Estimation Results Based on Amazon's Data 1 (made by the author)

Regression Statistics	
Multiple R	0.553684455
R Square	0.306566476
Adjusted R Square	0.294610725
Standard Error	0.067487614
Observations	60

Table 2. The Regression Equation Estimation Results Based on Amazon's Data 2 (made by the author)

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.015563971	0.009019906	1.7255136	0.08975972
X Variable 1	1.015360357	0.200514735	5.06376929	4.46E-06

4 Methodology

In this paper, the closing prices of Amazon and Costco from January 2017 to December 2021 [7–16], which last 60 months, are used as the calculation basis. The data is sourced from Yahoo Finance [17].

The formula for calculating the rate of return of an individual stock:

$$\text{Ri} = \frac{\text{closing price of this month} - \text{closing price of the last month}}{\text{closing price of the previous month}}$$

All returns are in U.S. dollars, including dividends and capital gains, and are not continuously compounded. The market is the returns on a regional value-weighted market portfolio minus the one-month U.S. T-bill rate [18].

4.1 Amazon

The data obtained is subject to OLS least square linear regression on Amazon's five-year data through the excel software. The results can be obtained as Table 1 and Table 2.

As Table 1 shows, the R-Squared value of 0.3065 represents the portion of the variation in the Amazon excess return explained by the market risk-free. It shows that 30 percent of the total variation is explained by the market risk-free. The value of the intercept is 0.0155 which shows that the Capital Asset Pricing Model predicts 1.5% market risk. However, this value of intercept is insignificant because the p-value is 0.089, which is higher than 0.1, indicating that the CAPM model is valid. The coefficient of the X Variable 1 represents the CAPM beta estimate. It measures the stock risk in relation to the overall market where the market represents unsystematic risk and the beta estimate

Table 3. The Regression Equation Estimation Results Based on Costco's Data 1 (made by the author)

Regression Statistics	
Multiple R	0.443823989
R Square	0.196979734
Adjusted R Square	0.183134557
Standard Error	0.046480316
Observations	60

Table 4. The Regression Equation Estimation Results Based on Costco's Data 2 (made by the author)

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.017609282	0.006212223	2.83461847	0.006304311
X Variable 1	0.520898142	0.138099241	3.77191169	0.000382344

represents the systematic risk. The beta value is 1.015 which is greater than 1 and implies a higher level of risk and volatility as compared to the stock market. The risk-free rate shows the return an investor expects from a completely risk-free investment. The determinants of a beta coefficient may include the nature of the business, operating leverage, and financial leverage.

Therefore, the significant tests of the Capital Asset Pricing Model are the R-squared which measures the rate of return for the general market, the beta estimate values of the stock, and the general free rates. Other significant tests include testing the relation between the beta coefficient and the expected return. The beta coefficient value of 1.01 estimates the excess market return during the stipulated period of time for Amazon. In this case, it is 5 years.

According to the CAPM theory, the higher the asset risk, the higher the expected rate of return. This also confirms the validity of the beta coefficient and the general model. The p-value of 0.0004 which is less than 0.1 also confirms that the beta coefficient value of 1.015 is statistically significant in the model.

4.2 Costco

The data obtained is subject to OLS least square linear regression on Costco's five-year data through the excel software. The results can be obtained as Table 3 and Table 4.

From Table 3, the R square represents the percentage of the variation of the cost of the excess return explained by the market rate free. The value is 0.196 which is 19% and therefore, the model is not fit for the estimation. As explained above, the value of the intercept is 0.0176, which shows that the model only predicts 1.7% of the market risks. This is true as the p-value is 0.006 which is below 0.1. This means that Amazon

recognizes the expected return would be greater than that required for the systematic risk involved. Amazon would buy the stock which would later raise its price and lower its expected return. If the value of the intercept which is alpha would have been negative, then Amazon would have sold its stock causing the market price to fall further increasing the market expected return. The beta coefficient value is 0.5208 which is less than 1.00 showing that the individual stock has less unavoidable risk than the market overall. When $\beta = 1.00$, the stock market excess return changes proportionally to the market portfolio excess return. When $\beta > 1$, the changes in excess returns are greater than the changes in excess returns of the market portfolio. Stocks with a β greater than 1 are regarded as aggressive, while those with a β less than 1 are regarded as conservative. In general, higher returns on a portfolio require individual βs greater than 1.00.

4.3 Result

Featuring simplicity and operability, CAPM plays an important role in asset pricing, investment risk analysis, and stock return forecasting. Generally speaking, when the stock prices in the stock market are forecasted to rise and there is not much difference in the valuation advantage, investors will choose stocks with a larger β coefficient because $\beta > 1$ indicates the rate of return of this type of securities will be higher than the average rate of return in the market. In this case, investors can gain larger returns. On the contrary, when the stock prices are forecasted to decline, investors will choose stocks with a smaller β coefficient because $\beta < 1$ indicates that the decline in the rate of return of this type of security is smaller than the average decline in the market so as to avoid the loss caused by the decline in stock price.

Based on the above analysis of the β value and the conclusions drawn, the estimated β coefficient of Amazon.com, Inc., 1.015, is larger than 1, indicating Amazon.com, Inc. is an aggressive stock, whose systematic risk is higher than that of the market portfolio. The increase in the price of the stock in a bull market is larger than the average market price, and the decrease in the price of the stock in a bear market is smaller than the average market price. On the contrary, the estimated β coefficient of Costco Wholesale Corporation, 0.52, is smaller than 1, indicating Costco Wholesale Corporation is a robust stock, whose systematic risk is lower than that of the market portfolio. The increase in the price of the stock in a bull market is smaller than the average market price, and the decrease of the stock in a bear market is smaller than the average market price.

5 Conclusion

Based on the preceding analysis of β value, it can be seen that investors, especially risk-averse investors, should invest cautiously and not blindly follow the trend when they know that a company has a substantial degree of non-systemic risk. In addition, they should always pay attention to the listed company's relevant dynamics, and should understand the company's risk situation as much as possible.

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