Foundations of Accounting & Finance

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Lecture – 53

Risk and Return: Individual Securities

The context

I have selected three companies for discussion. Firstly, Aditya Birla Departmental Store representing the fashion and retail sector, followed by Indigo in the airline sector, and lastly, a company in the computer software industry. I am not focusing on specific companies but rather on the sectors themselves.

Expected returns from the fashion and retail industry, is estimated approximately at around 14.47% based on the performance of the industry in the last year. Similarly, the airline sector yielded returns of around 10.99%, while the computer software industry witnessed about 11.61% during the same period.

The questions

- Why do the expected returns across these industry differ so much, and how are these specific numbers calculated?
- Does the higher return offered by department store stocks mean that investors should prefer it compared to others?

Now, as we explore these concepts, one might wonder why we are even discussing these specific return. What is the significance? Does a higher return from department store stocks automatically make them the preferred choice over sectors like airline?

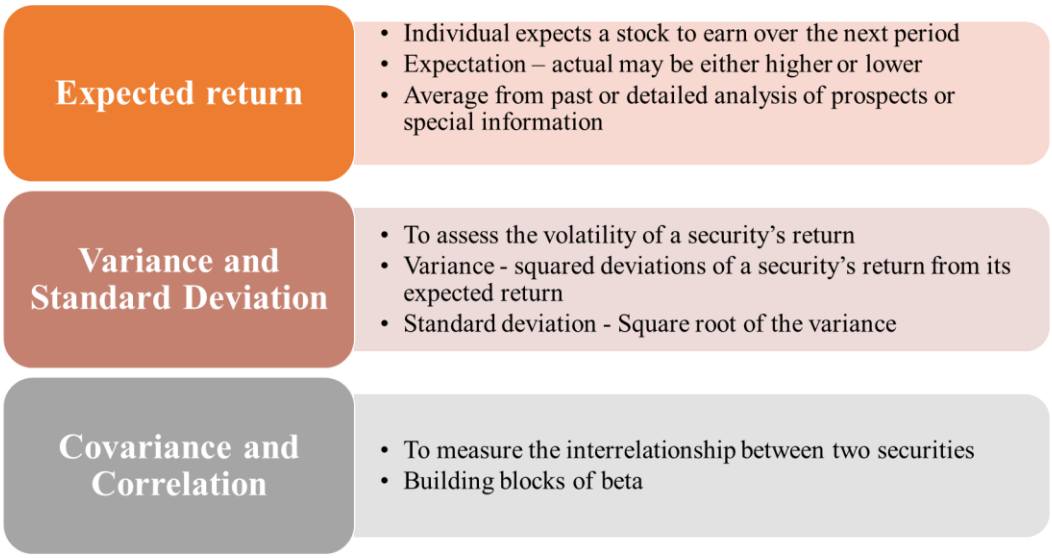
Are we implying that investors should solely focus on the sector with the highest return, such as fashion and retail with its 14.4% return? Not necessarily.

The key lies in understanding the variability inherent in each sector's returns. For instance, while department store stocks may boast high returns, the volatility in this sector could overshadow its appeal. On the other hand, sectors like computer software may offer a more stable investment environment, even though with slightly lower returns around 11.61%.

So, while the numbers provide a partial picture, it is crucial to consider the level of certainty associated with each sector's returns. It is not just about the numbers; it is about the variance and standard deviation, attributes that guide us towards informed investment decisions.

Individual Securities – Characteristics

It is important to recognize that individual securities possess specific characteristics. These attributes can be classified into three fundamental categories: expected return, variance, and standard deviation, alongside covariance and correlation. These three basic attributes play a pivotal role in assessing risk and determining investment strategies. The summary of each characteristics are provided below:



1) **Expected return**

When discussing expected return, we are essentially referring to the anticipated earnings of an individual stock over the next period. It is worth noting that the actual returns may vary, potentially exceeding or falling short of expectations. The anticipated return is typically based on past analyses and the future prospects I have evaluated.

2) Variance and Standard Deviation

Variance and standard deviation helps to assess the volatility of a security. They measure how much the security's returns deviate from the average return. Higher variance or standard deviation implies higher risk, while lower variance suggests lower risk.

For instance, if the expected return is 10 percent, with a narrow variance range of 9.5 to 10.5, the risk is relatively low because returns are likely to stay close to the expected average. However, if the variance is wider, say between 7.5 to 13.5, the risk increases substantially because returns can vary significantly from the expected average.

3) Covariance and Correlation

Covariance and correlation are essential concepts that measure the relationship between two securities. They indicate how these securities move together or diverge from each other.

We use covariance and correlation primarily when assessing diversification in our investment portfolio. While variance and standard deviation are crucial when analysing individual stocks, covariance and correlation come into play when we are considering a range of investments.

Example

Let us consider two stocks with a high positive correlation. If we invest 50% in each and they are positively correlated, both stocks are likely to move in the same direction. In this scenario, we are not effectively hedging our risk. Conversely, if the stocks are negatively correlated, investing 50% in each means that when one stock goes up, the other tends to go down. This diversification strategy helps mitigate risk by offsetting losses in one stock with gains in the othe

How to calculate expected return

I have taken two simple stocks, each representing different states of the economy: depression, recession, normal, and boom periods. The detailed informations about these two stocks are provided below:

State of the economy	Stock A		Stock B	
Depression	.20	-10%	.15	-22%
Recession	.25	-4.5%	0.30	-12.5%
Normal	.40	6%	0.45	5.5%
Boom	.15	12%	0.10	32%

What is the expected return for these two stocks?

Solution

In the first column, we focus solely on the probability of depression occurring. If depression does occur, there's a 20 percent likelihood of it happening.

Now, considering depression: with a probability of 0.2, Stock A yields a negative return of 10 percent, while Stock B has a 15 percent chance of depression and yields a negative return of 22 percent.

Moving on to recession: there is a 25 percent chance of this economic state occurring. For Stock A, this results in a 30 percent probability, whereas for Stock B, it's slightly higher. Let us analyse the returns during this period.

Lastly, let us discuss the boom period: there is a 15 percent chance of this happening for Stock A, with a resulting return of 12 percent. Conversely, Stock B has a 10 percent probability of a boom period, offering a substantial 32 percent return.

Calculation of expected return

For example, the expected return can be calculated by multiplying the probability of each event occurring by the return associated with that event, and summing up these values. Expressing this as a percentage, the expected return for Stock A is approximately 1.075 percent.

Moving on to Stock B, we will follow a similar process. With the respective probabilities and returns for each economic state, we find that the expected return for Stock B is approximately negative 1.375 percent. The detailed calculation is depicted below:

State of the economy	Stock A		Stock B	
	Probability	Return	Probability	Return
Depression	0.2	-10%	0.15	-22%
Recession	0.25	-4.50%	0.3	-12.50%
Normal	0.4	6%	0.45	5.50%
Boom	0.15	12%	0.1	32%
Expected return		1.075%		-1.375%

Expected Return, Variance and Covariance

Example: Suppose financial analysts believe that there are four equally likely states of the economy: Depression, recession, normal, and boom. The returns on the Supertech Company are expected to follow the economy closely, while the returns on the Slowpoke Company are not. The return predictions are as follows:

	Supertech Returns R_{At}	Slowpoke Returns R_{Bt}
Depression	−20%	5%
Recession	10	20
Normal	30	−12
Boom	50	9

What is the expected return, variance and standard deviation?

Solution:

Supertech	Probability	Return	Product
Depression	0.25	-0.200	(0.0500)
Recession	0.25	0.100	0.0250
Normal	0.25	0.300	0.0750
Boom	0.25	0.500	0.1250

In the above table, the probabilities are calculated based on the problem's assumption that all four states are equally likely, with a 25 percent chance for each: recession, depression, normal period, and boom period. The corresponding expected returns are provided as -20, 10, 30, and 50, respectively.

Similarly, I have applied this approach to the two companies mentioned. Now, let us determine the expected return, variance, covariance, and standard deviation.

Expected return

Firstly, let us calculate the expected return. This involves multiplying the probability of each state occurring by the return associated with that state and summing up these values. For example, there's a 25 percent chance of a depression occurring with a -20 percent return, resulting in a certain expected return.

Overall, the expected return of Supertech and Slowpoke is 17.5% and 5.5 % respectively. The detailed calculation is provided in the following tables.

Supertech	Probability	Return	Product
Depression	0.25	-0.200	(0.0500)
Recession	0.25	0.100	0.0250
Normal	0.25	0.300	0.0750
Boom	0.25	0.500	0.1250
		E(R) =	**0.1750**

Slowpoke	Probability	Return	Product
Depression	0.25	0.050	0.0125
Recession	0.25	0.200	0.0500
Normal	0.25	-0.120	(0.0300)
Boom	0.25	0.090	0.0225
		E(R) =	**0.0550**

Variance and standard deviation

Variance represents the degree of variation or dispersion in returns. It measures how much each state's return differs from the mean or average return. This deviation from the mean is referred to as return deviation. We subtract the expected return from the actual return to obtain the return deviation for each state.

Next, we square these return deviations to account for both positive and negative differences. This squared deviation is essential for calculating variance. By squaring the deviations, we ensure that negative deviations don't cancel out positive ones.

Then, we consider the probability of each squared deviation occurring. Multiplying the squared deviation by its probability gives us the weighted contribution of each state's deviation to the overall variance. Summing up these weighted squared deviations yields the variance.

Similarly, standard deviation, which is the square root of variance, provides a measure of the dispersion of returns around the mean. It quantifies the extent of variability in returns. For instance, in this scenario, the standard deviation for the given data is calculated to be 25.86 percent for Supertech and 11.5% for slow poke.

Comparing these metrics between the two companies allows investors to assess the level of risk associated with each investment option. In this case, "Slowpoke" exhibits a lower expected return but also lower variability, making it a more attractive option for risk-averse investors compared to "Supertech." The detailed calculation of the variance and standard deviation is depicted below:

Supertech	Probability	Return	Product	Return Deviation	Squared Deviation	Product
Depression	0.25	-0.200	(0.0500)	(0.3750)	0.14063	0.0352
Recession	0.25	0.100	0.0250	(0.0750)	0.00563	0.0014
Normal	0.25	0.300	0.0750	0.1250	0.01563	0.0039
Boom	0.25	0.500	0.1250	0.3250	0.10563	0.0264
		E(R) =	**0.1750**		Variance =	0.06688
	Standard Deviation	**25.86%**				

Slowpoke	Probability	Return	Product	Return Deviation	Squared Deviation	Product
Depression	0.25	0.050	0.0125	(0.0050)	0.00003	6.250E-06
Recession	0.25	0.200	0.0500	0.1450	0.02103	5.256E-03
Normal	0.25	-0.120	(0.0300)	(0.1750)	0.03063	7.656E-03
Boom	0.25	0.090	0.0225	0.0350	0.00123	3.063E-04
		E(R) =	**0.0550**		Variance =	0.01323
	Standard Deviation	**11.50%**				

Covariance and correlation

In the next step, we get into covariance and correlation analysis. The following information are taken form the calculation that we did in the previous sections:

Relevant Data from Example of Supertech and Slowpoke

Item	Symbol	Value
Expected return on Supertech	$\bar{R}_{Super}$	.175 = 17.5%
Expected return on Slowpoke	$\bar{R}_{Slow}$	.055 = 5.5%
Variance of Supertech	σ^2_{Super}	.066875
Variance of Slowpoke	σ^2_{Slow}	.013225
Standard deviation of Supertech	σ_{Super}	.2586 = 25.86%
Standard deviation of Slowpoke	σ_{Slow}	.1150 = 11.50%

Covariance measures the relationship between the deviations of both stocks from their respective means. By multiplying these deviations and summing them up, we obtain the covariance. Dividing this sum by the number of observations (in this case, four) yields the covariance value.

$$\sigma_{AB} = \text{Cov}(R_A, R_B) = \text{Expected value of } [(R_A - \bar{R}_A) \times (R_B - \bar{R}_B)]$$

In this instance, the covariance is calculated to be -0.488, or -4.88% if expressed as a percentage.

A negative covariance implies an inverse relationship between the two stocks. To measure the strength of this relationship, we calculate correlation. Correlation is obtained by dividing covariance by the product of the standard deviations of the two stocks.

$$\rho_{AB} = \text{Corr}(R_A, R_B) = \frac{\text{Cov}(R_A, R_B)}{\sigma_A \times \sigma_B}$$

The resulting correlation value is negative .1639, indicating a negative correlation between the two stocks. The detailed calculation is provided below:

	Devaiation of return (Super Tech)	Devaiation of return (Slow spoke)	Product
Depression	-0.3750	(0.0050)	0.0019
Recession	-0.0750	0.1450	(0.0109)
Normal	0.1250	(0.1750)	(0.0219)
Boom	0.3250	0.0350	0.0114
		Total	(0.0195)
		Covariance	**-0.488%**
		Correlation	**-16.39%**