Answer on Question #51675, Economics, Finance

Stock X and Y have the following probability distributions of expected future returns:

Probability	X	Y
0.15	-10%	-20%
0.20	2	0
0.30	10	20
0.20	20	25
0.15	30	40

1) Calculate the expected rate of return for both stocks.

2) Calculate the standard deviation for both stocks.

3) Which stock is risky and why?

Solution:

1) Calculate the expected rate of return for both stocks.

Stocks X and Y have the following probability distributions of expected future returns:

Probability	**X**	**Y**
0.15	(10%)	(20%)
0.20	2	0
0.30	10	20
0.20	20	25
0.15	30	40

Firstly we calculate the expected rate of return for the Stock X. We apply the following formula.

$$\hat{r}_X = \sum_{i=1}^{N} p_i r_{X,i}$$

We substitute the given data into the formula noted above.

$$\hat{r}_X = 0.15(-10\%) + 0.2(2\%) + 0.3(10\%) + 0.2(20\%) + 0.15(30\%) = 10.40\%$$

Then we determine the expected rate of return for the Stock Y. We apply the same formula.

$$\hat{r}_Y = 0.15(-20\%) + 0.2(0\%) + 0.3(20\%) + 0.2(25\%) + 0.15(40\%) = 14\%$$

$$\hat{r}_X = 10.4\%, \hat{r}_Y = 14\%$$

2) Calculate the standard deviation for both stocks.

Standard deviation is equal to the square root of variance. Variance is defined as:

$$\sigma^2 = \sum_{i=1}^{N} p_i(r_i - \hat{r})^2$$

Thus, the standard deviation can be expressed as

$$\sigma = \sqrt{\sigma^2} = \sqrt{\sum_{i=1}^{N} p_i(r_i - \hat{r})^2}$$

Our objective is to compute the standard deviation of the rate of return of Stock X. First, we need to compute the variance. We have to know the expected rate of return before we proceed. We already found that the expected rate of return for Stock X is equal to 10.4%.

So, we can apply the formula noted above for calculation.

$$\begin{aligned}\sigma_x^2 = {} & (-10\% - 10.4\%)^2 \cdot 0.15 + (2\% - 10.4\%)^2 \cdot 0.20 + (10\% - 10.4\%)^2 \cdot 0.30 \\ & + (20\% - 10.4\%)^2 \cdot 0.20 + (30\% - 10.4\%)^2 \cdot 0.15 \\ & = (-20.4\%)^2 0.15 + (-8.4\%)^2 \cdot 0.20 + (-0.4\%)^2 \cdot 0.30 + (9.6\%)^2 \cdot 0.20 \\ & + (19.6\%)^2 \cdot 0.15 = 152.64\%\end{aligned}$$

$$\sigma = \sqrt{\sigma^2} = \sqrt{152.64\%} = 12.355$$

The standard deviation of Stock X's rate of return is equal to 12.36%.

Now we have to calculate the standard deviation of Stock Y. We apply the same method of calculation.

$$\begin{aligned}\sigma_y^2 = {} & (-20\% - 14\%)^2 \cdot 0.15 + (0\% - 14\%)^2 \cdot 0.20 + (20\% - 14\%)^2 \cdot 0.30 \\ & + (25\% - 14\%)^2 \cdot 0.20 + (40\% - 14\%)^2 \cdot 0.15 = 349\%\end{aligned}$$

$$\sigma = \sqrt{\sigma^2} = \sqrt{349\%} = 18.682$$

The standard deviation of Stock Y's rate of return is equal to 18.68%.

3) Which stock is risky and why?

Thus, we can conclude based on the obtained results in previous part, the standard deviation of Stock X's rate of return is lower (12.36%) than the standard deviation of Stock Y (18.68%), which can be interpreted as Stock X being less risky than Stock Y.