Chapter 2.1 - Investment strategies analysis

1) Taking into account ALL generated returns, does your team think it is more probable to obtain a positive or negative return?

Based on the generated return values for the portfolios, it is more likely that positive returns will occur, as the median *(4,17%)* and average *(5,54%)* return values are positive. Also, the maximum return *(23,90%)* is much higher than the minimum (-6,69%). As the median return is lower than the mean, this indicates that there are negative returns pulling down the overall average. This can also be seen in Figure 1, which plots all return values in a bar chart. Nevertheless, the proportion of negative return values is very low, at 12.7%.

Besides the histogram and kernel density plot show a high density of shares between 0 and 5% (see Figure 2 and 3). The distribution is slightly skewed to the right with a skewness of 0.78. This indicates a few very high returns and suggests that there may be more positive returns than negative returns.

Taking all those informations into account, it is more probable to obtain a positive return from the portfolios of Smallville Asset Management. However, with an average of about 5 % the return of invest (ROI) is not considered as very high. According to the Forbes magazine, “an annual ROI of approximately 7% or greater is considered a good ROI for an investment in stocks”[1].

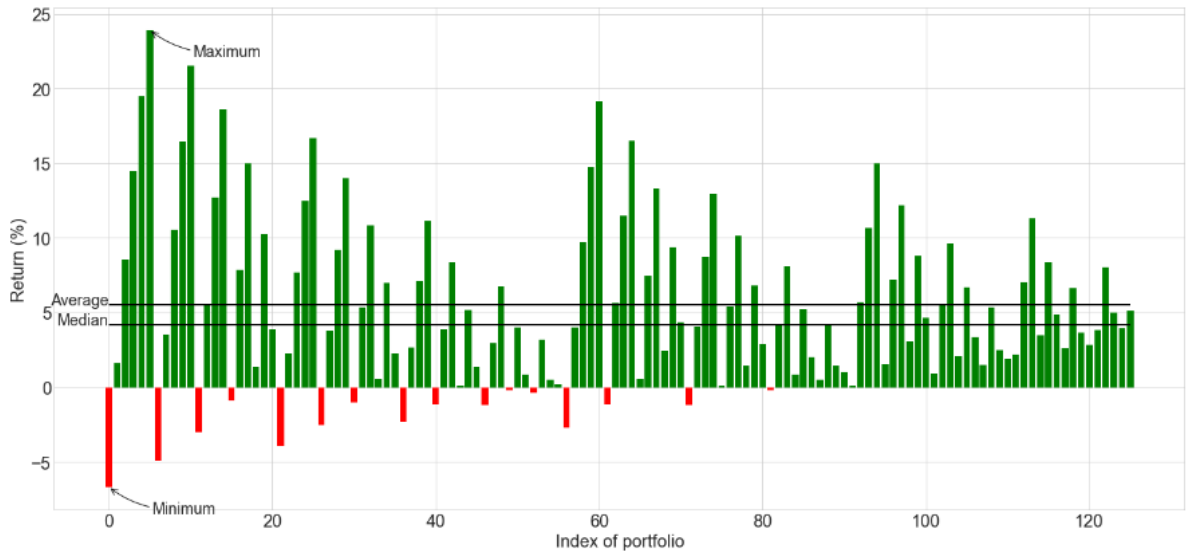

Figure 1: Bar chart of all return values

[1] https://www.forbes.com/advisor/investing/roi-return-on-investment/#:~:text=According%20to%20conventional%20wisdom%2C%20an,S%26P%20500%2C%20accounting%20for%20inflation

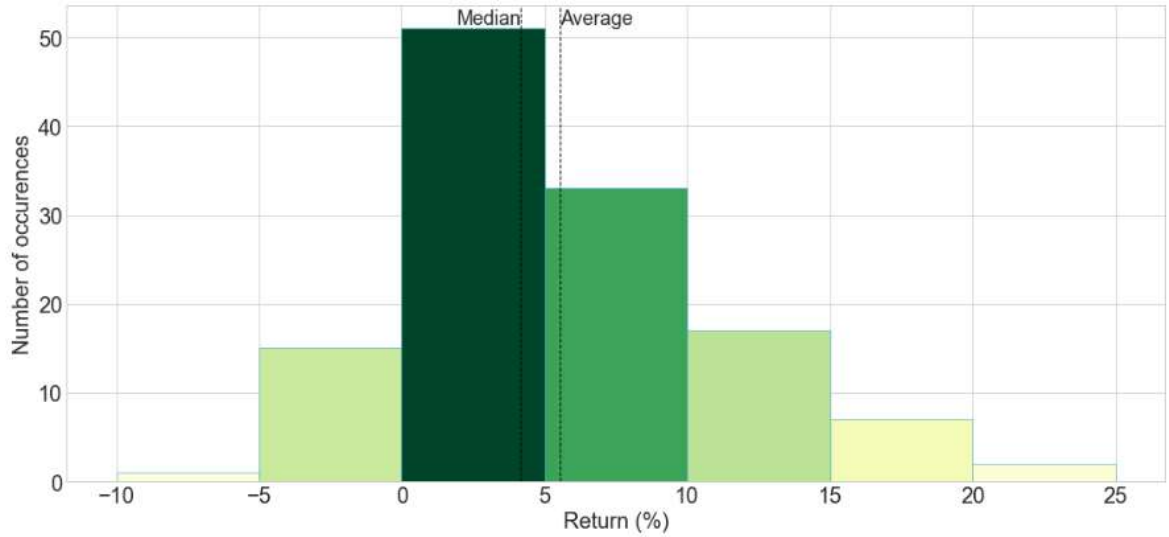

Figure 2: Distribution of return values (Histogram)

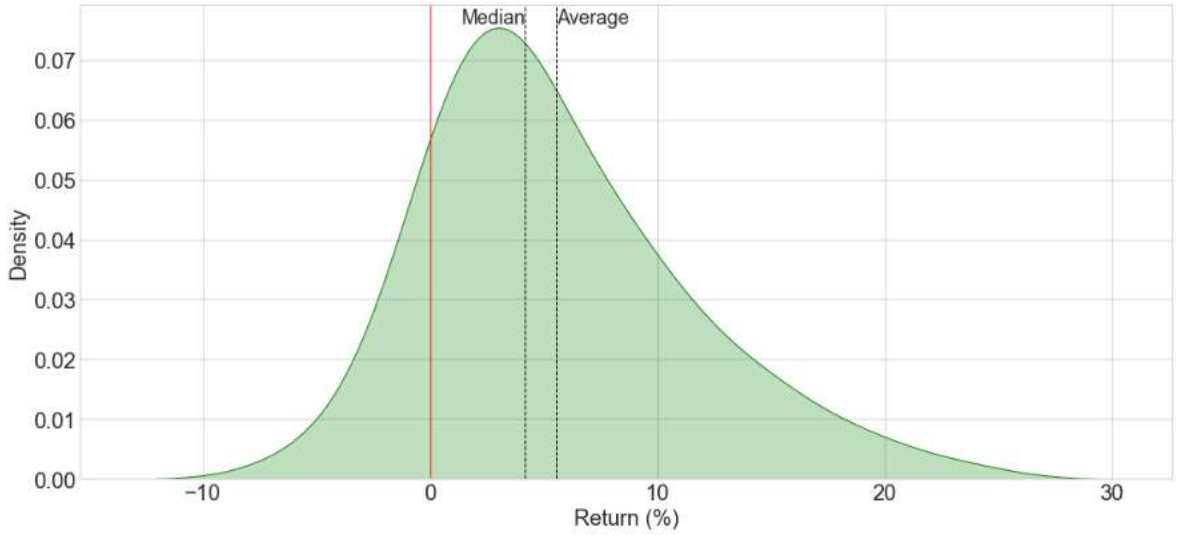

Figure 3: Distribution of return values (Kernel density plot)

2) Does your team think it is ALWAYS true that the higher the risk, the higher the obtained return is?

To analyze the relationship between *risk* and *return*, we first calculate the **correlation coefficient** between the two variables. We obtain a value of **0.7**. Such a value is quite high and therefore indicates a strong positive linear relationship between the two variables. This means that there is a strong tendency that as risk increases, return also increases. However, this does not necessarily mean that all variations in the dependent variable ('RETURN') are explained by the independent variable ('VOLATILITY'). Thus, that does not allow us to say that higher risk always leads to higher return. We can see this on the scatterplot: some portfolios with a higher risk value lead to lower returns than other less risky portfolios.

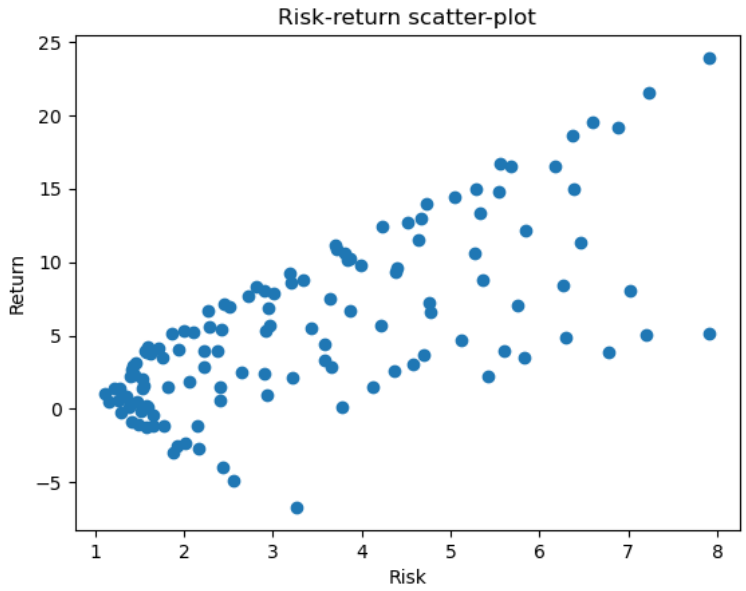

Figure 4: Scatterplot of risk and return levels

To further determine whether a significant linear relationship exists between risk and return, we perform a linear regression. We obtain a determination coefficient **R^2 of 0.5**. So, it means that only 50% of the variation in the return is explained by the risk. This confirms that there are other factors to consider besides risk to determine the level of return. There may be some cases where these other factors lower the return of a riskier portfolio.

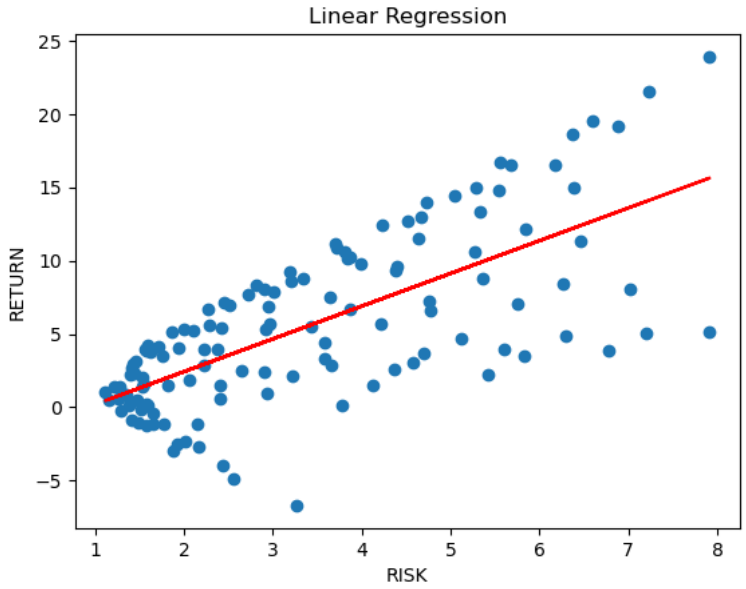

Figure 5: Linear regression - return vs. risk

To better understand the relationship between risk and return, we divide portfolios into three groups: low-risk, medium-risk and high-risk portfolios.

For each risk category, we calculate the average return:

Risk category	Low	Medium	High
Average return	1.4	4.8	10.4

Table 1: Average return according to risk level

We can see that higher risk leads, on average, to higher return.

On the following boxplots, we can see that the higher the risk category, the more dispersed the return values. This could mean that higher risk portfolios have potentially higher returns but are also more unpredictable.

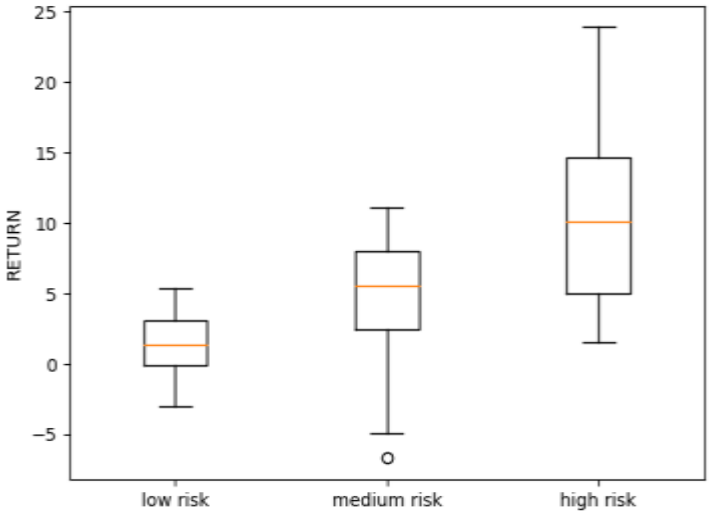

Figure 6: Box plot of return according to the level of risk

To conclude, we can say that higher risk favors higher return. However, risk is not the only factor influencing returns. Many macroeconomic factors such as interest rates, inflation, government policies, etc., also influence investment returns. It is important to take these factors into account when interpreting the results and not to conclude that high-risk portfolios are always more profitable than low- or moderate-risk portfolios.

Note: To reproduce the findings of the report and get a deeper look at the data, see the Jupyter notebook analysis.ipynb. It includes the data handling, calculations and plots of the report.