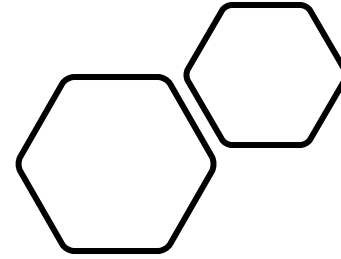


Data-Driven Portfolio Management



Investment strategies
analysis

Programming for Data
Processing Final Project

Group 4:

Kristofer Eyleifsson

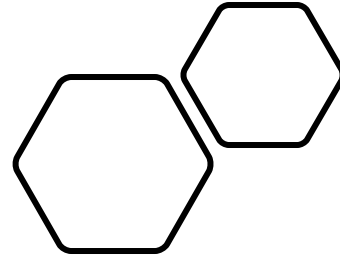
Adam Kazmierczak

Monica Maldonado Olivares

Marcel Schweiker

Max van der Werf

Content



1. Return

“Considering all generated returns, is it more probable to obtain a positive or negative return?”

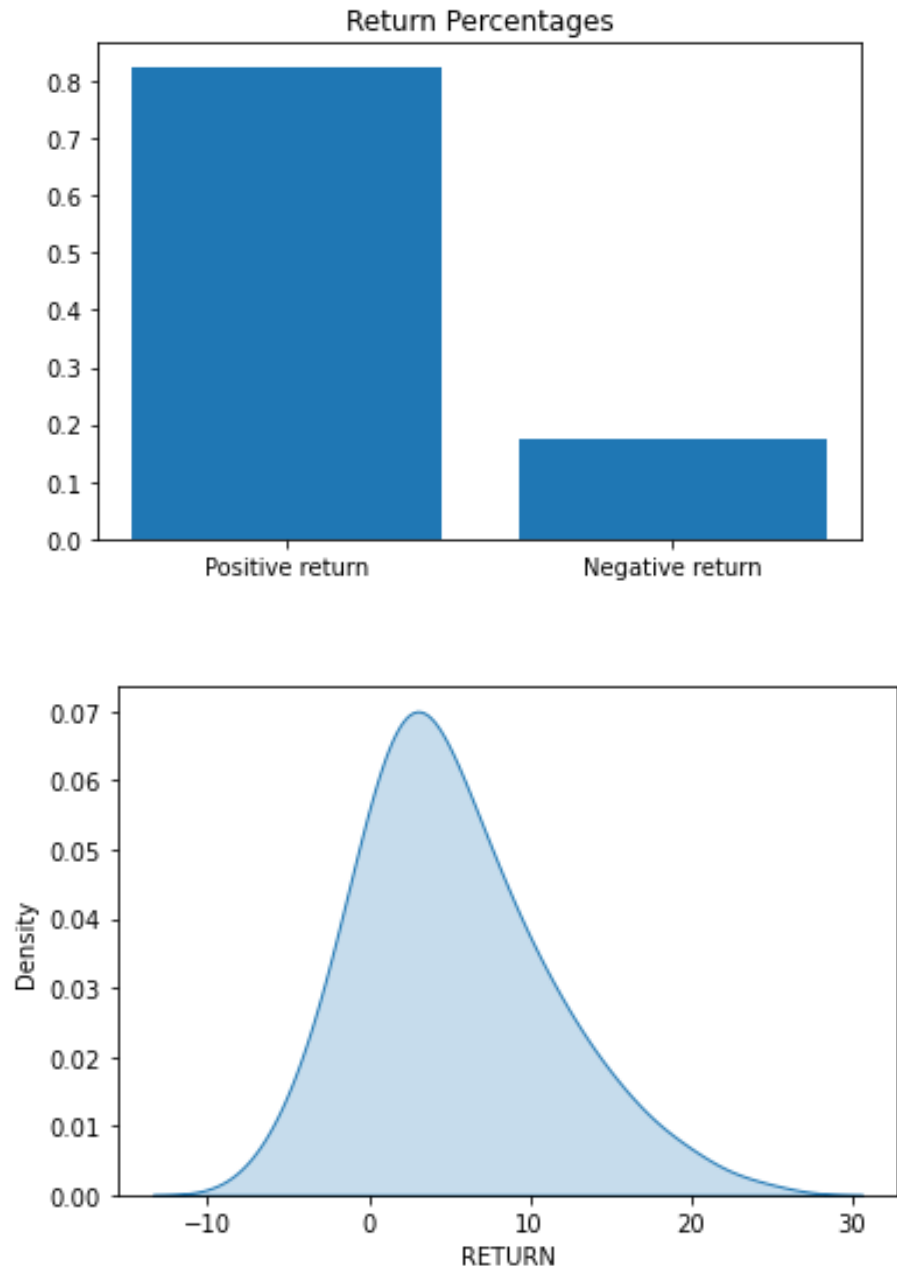
2. Return vs. Risk

“Is it always true that the higher the risk, the higher the obtained return?”

Return

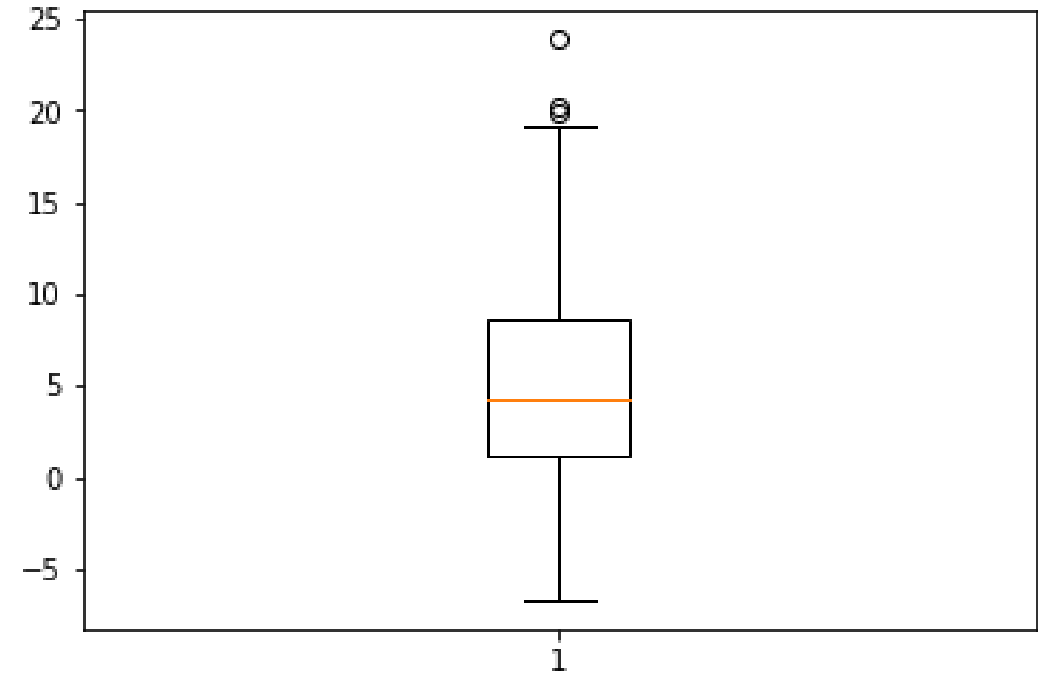
Considering the available data, it is more probable to have a positive return (104 portfolios) than a negative return (22 portfolios). This ratio (82.5% v 17.5%) is depicted on the bar plot on the right.

In addition, the density curve plot shows the distribution of the portfolios with respect to the return, which also supports this thesis.



Return

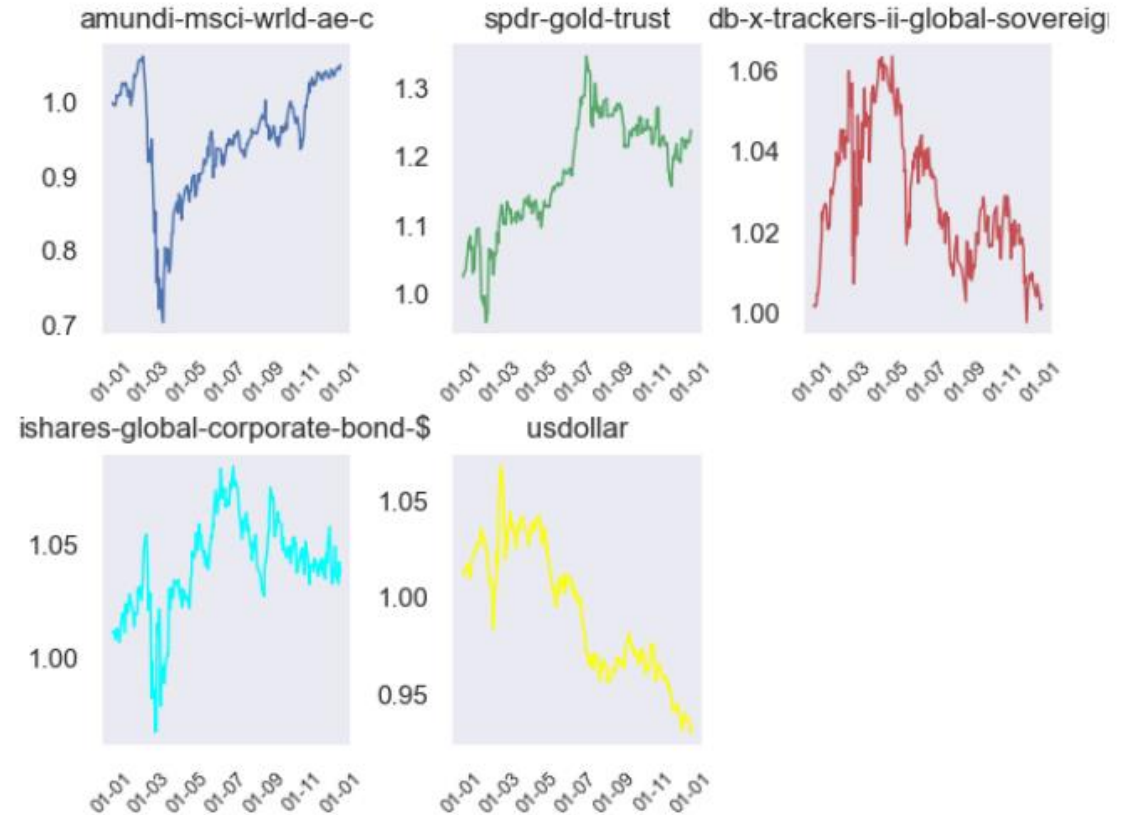
The average return over all the portfolios was 5.30%, and the five-number summary (min, q1, mean, q3 & max) of the distribution of returns can be seen in the depicted boxplot.

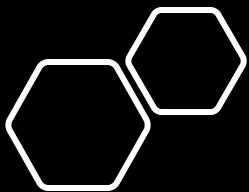


Return

It needs to be considered that 2020 was a good year for financial assets in general as can be seen in the plots on the right.

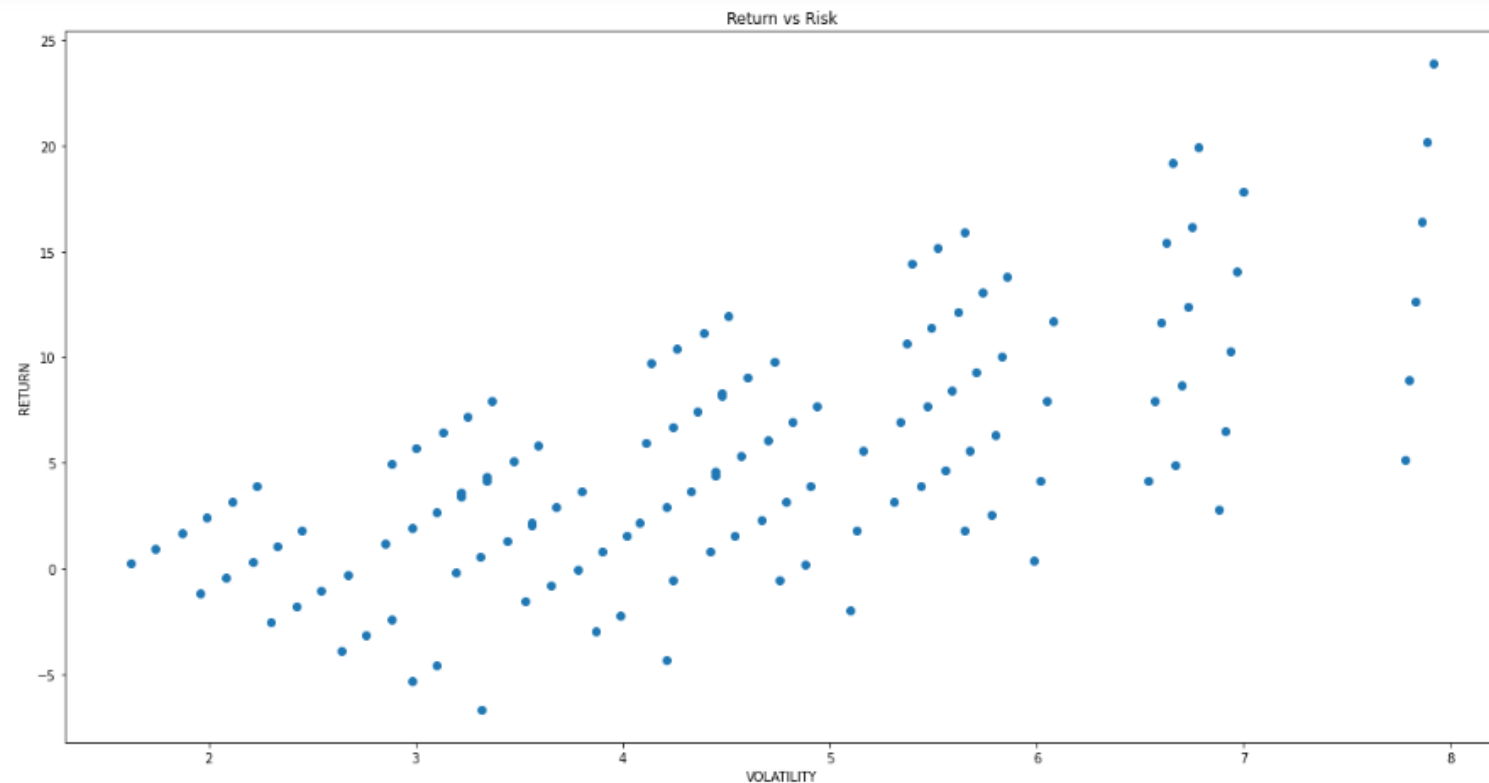
Thus, most portfolio compositions would provide a positive return. Therefore, this data does not provide significant evidence to make general statements with more confidence. To do so, more data over a longer time horizon would be necessary.

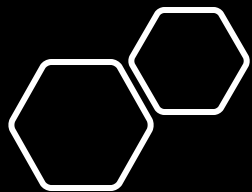




Return vs. Risk

Based on the depicted scatter graph, there is a general positive relationship between higher volatility portfolios and higher returns.





Return vs. Risk

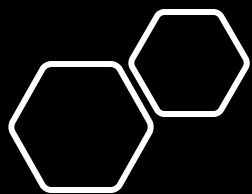
However, the riskiest portfolios do not obtain the highest returns, and similarly the portfolios with the highest returns are not the riskiest (compare tables on the right).

	ST	CB	PB	GO	CA	RETURN	VOLAT
5	0	0	0	100	0	23.90	7.92
60	20	0	0	80	0	20.15	7.89
94	40	0	0	60	0	16.39	7.86
113	60	0	0	40	0	12.65	7.83
122	80	0	0	20	0	8.89	7.80

Top 5 – Most Volatile Portfolios

	ST	CB	PB	GO	CA	RETURN	VOLAT
5	0	0	0	100	0	23.90	7.92
60	20	0	0	80	0	20.15	7.89
25	0	20	0	80	0	19.91	6.78
10	0	0	20	80	0	19.17	6.66
4	0	0	0	80	20	17.80	7.00

Top 5 – Highest Return Portfolios

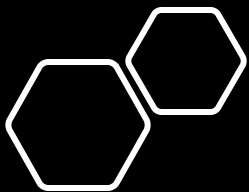


Return vs. Risk

In addition, a portfolio's return is highly dependent on the composition of the portfolio into asset classes.

This correlation matrix also shows the positive correlation between volatility and returns: 0.684.

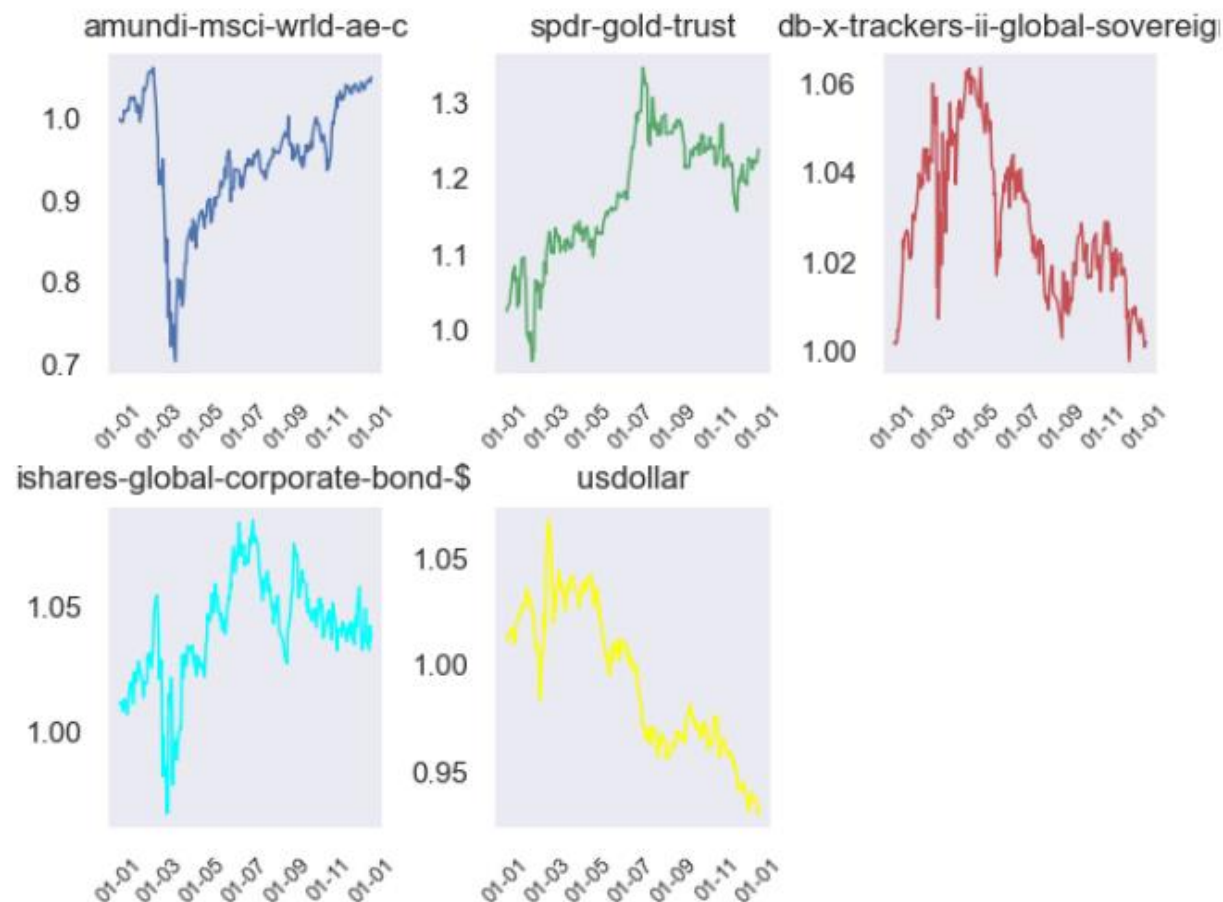
	ST	CB	PB	GO	CA	RETURN	VOLAT
ST	1.000000	-0.250000	-0.250000	-0.250000	-0.250000	-0.008086	0.586752
CB	-0.250000	1.000000	-0.250000	-0.250000	-0.250000	-0.067811	-0.428466
PB	-0.250000	-0.250000	1.000000	-0.250000	-0.250000	-0.249607	-0.541278
GO	-0.250000	-0.250000	-0.250000	1.000000	-0.250000	0.914435	0.613285
CA	-0.250000	-0.250000	-0.250000	-0.250000	1.000000	-0.588931	-0.230293
RETURN	-0.008086	-0.067811	-0.249607	0.914435	-0.588931	1.000000	0.684683
VOLAT	0.586752	-0.428466	-0.541278	0.613285	-0.230293	0.684683	1.000000



Return vs. Risk

It needs to be considered that 2020 was an exceptional year for most asset types. Prices were skyrocketing after the covid pandemic crash, which can be seen in the plots on the right, showing the returns for the different asset classes. Barely any portfolio allocation provided a negative result.

Therefore, it would be valuable to see the risk-return combinations of various asset classes during a bear market. It is highly likely that in a bear market, riskier (more volatile) portfolios would return larger losses, hence the returns would be lower.



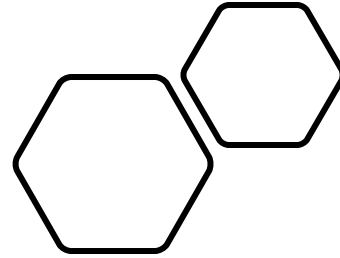
Return vs. Risk

Finally, this table shows that the 5 best performing portfolios have a proportion of at least 80% gold. If we take into account even the weakest version of the Efficient Market Hypothesis (Fama, 1960), it is unlikely that one asset class consistently outperforms others in the long-term, without price corrections happening.

Thus, it would be difficult to select asset classes for the next year, purely based on the returns of the previous year. A more informative way of selecting the optimal portfolio allocations in terms of the risk-return trade-off would be by using the Sharpe ratio (Sharpe, 1998), by considering the market risk, a risk-free return and the dependence of each asset's returns on the market returns.

	ST	CB	PB	GO	CA	RETURN	VOLAT
5	0	0	0	100	0	23.90	7.92
60	20	0	0	80	0	20.15	7.89
25	0	20	0	80	0	19.91	6.78
10	0	0	20	80	0	19.17	6.66
4	0	0	0	80	20	17.80	7.00

Conclusion

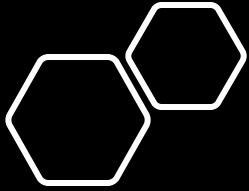


“Considering all generated returns, is it more probable to obtain a positive or negative return?”

Based on the available data, yes.

“Is it always true that the higher the risk, the higher the obtained return?”

There is a positive correlation in the available data to support this thesis. However, this correlation should be interpreted cautiously.



References

Fama, E. F. (1960). Efficient market hypothesis. Diss. PhD Thesis, Ph. D. dissertation.

Klikken om afbeelding te voegen
Sharpe, W. F. (1998). The sharpe ratio. Streetwise—the Best of the Journal of Portfolio Management, 169-185.