

An Analysis of SPY

The S&P 500 index has been considered a good representation of the US stock market. SPY is a popular ETF for tracking the index ([SPY: SPDR® S&P 500® ETF](#)). Although it does not cover the entire history of S&P 500 (which, in its current form, was started in 1957), it has experienced a number of slumps and rises. As the stock market has been in a slump for some time, it may be interesting to find out how long the slump is going to last and whether there are investment opportunities.

Basics

	SPY
Inception date	01/22/1993
Category	Large cap US
Benchmark Index	S&P 500 Index
Capitalization	\$335.79 B
Number of holdings	503
Expense ratio	0.0945%
Return since inception	9.35%

The data used here include daily adjusted prices of SPY from 1993-1-29 to 2022-09-26.

IRR statistics

SPY (annualized returns)	6 Month	1 Year	5 Years	Explanation
Minimum	-71.23%	-47.65%	-9.76%	The minimum of all returns
First Quartile	-2.41%	1.72%	-0.71%	One-fourth are below this value
Median	11.05%	11.62%	8.69%	The middle value
Third quartile	23.15%	19.69%	13.29%	One-fourth are above this value
Maximum	119.95%	76.09%	26.19%	The maximum
Mean	10.28%	9.51%	7.57%	The average rate of return
St Dev	22.11%	16.67%	8.23%	The standard deviation

The statistics were derived from annualized returns for specified holding periods. For example, from 1993-01-27 (first trading day) to 2022-3-27 there would be 7344 6-month returns. These are then used to produce the data reported here.

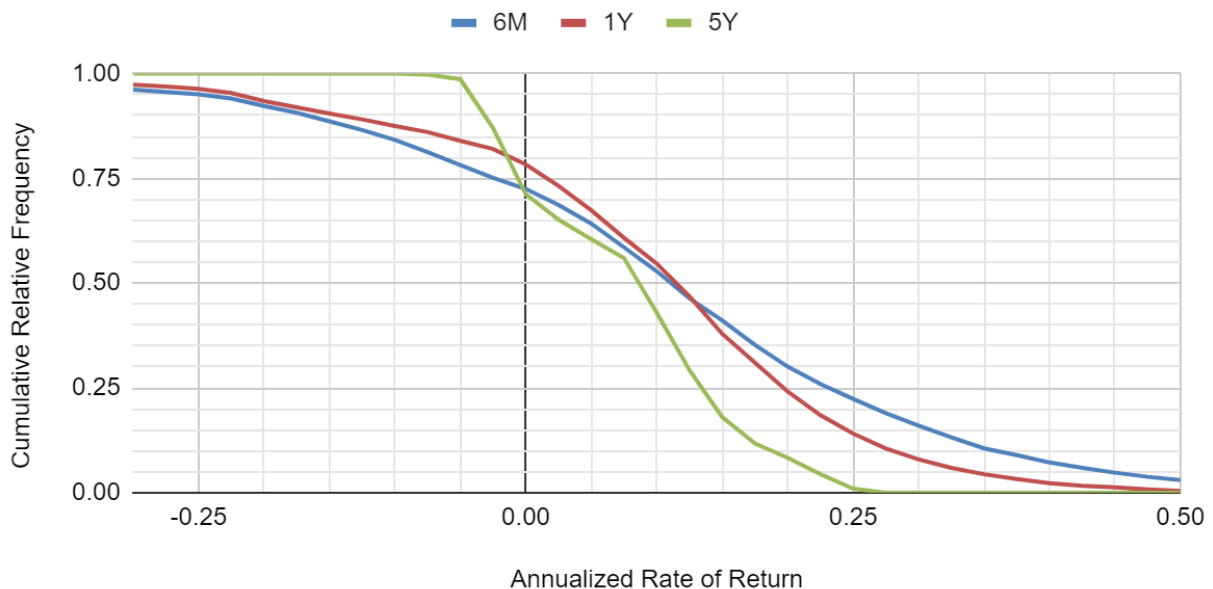
Some observations:

- For 6 month holding periods, one-fourth of them lost at least 2.41% while another one-fourth earned more than 23.15%. Half of them earned at least 11.05%. The average of 10.28%, being less than the median, means that more than half earned more than the average.
- As holding period lengthens, the averages decrease along with volatility, as measured by the standard deviation. Volatility decreases faster than the decrease of means.
- Volatility can also be measured by the range (maximum - minimum) and the interquartile range (third quartile - first quartile). These measures show a similar pattern of decrease.

IRRP graph

SPY IRRP

1993-01-29 to 2022-09-26



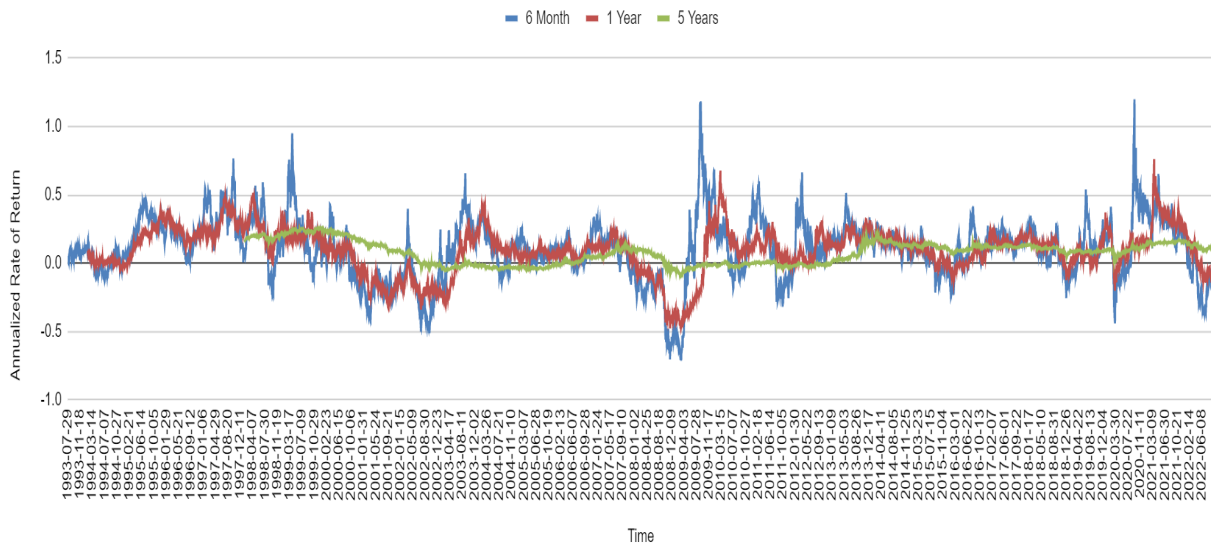
The height of a curve is the proportion of returns that are greater than the corresponding horizontal value. For example, at $x=0.0$, the height of one-year returns is about .78; so 78% of all one-year returns are at least positive. On the other hand, the distance from the curve to the ceiling is the chance of earning less than the corresponding return and is considered to be the

risk of not making that return. So if your target return is 10%, then the risk with one year investments is about 45% and with five year investments it is about 57%.

Volatility is reflected in the steepness of the curve; the steeper it is, the less volatility there is. Five-year curve is steeper than the one-year curve, which in turn is steeper than the six-month curve. So volatility is the least with five year returns.

Return time chart

SPY Returns History



This depicts the entire history of SPY returns.

- As expected, the swings were larger for shorter investment periods. It is thus easier to see the patterns of 6 month or one year returns.
- Using returns as a measure, a slump is a sustained period of negative returns. There are many slumps by this definition. The notable ones (seen in both 6 month and one year curves) occurred around 2001-2003, 2007-2009, and the current one from 2022.
- There were also sustained periods of high returns, for example, around 1995-2001, 2004-2008, 2010-2015, and 2016-2018.
- For five year returns, the curve has been above the positive line since 2013.

Durations of negative returns

Here we concentrate on the negative cycles.

SPY	6 Month	1 Year	5 Years
Total entries (trading days)	7344	7218	6212
# Negative returns	2021	1565	1790

Percent of negative returns	27.52%	21.68%	28.82%
Longest consecutive negatives	354 days	340	591
(from, to)	(2007-12-11, 2009-05-07)	(2008-01-08, 2009-10-05)	(2003-10-16, 2006-02-21)
Most recent start	2022-04-14	2022-05-05	

- The US stock markets average about 252 trading days a year. Except for the initial periods of 6 months, one year, and five years, the returns cover the entire history of SPY, up to 2022-09-29.
- There were about a quarter of entries where the returns were negative. So losing money with SPY is not a rare event.
- As seen above, slumps can last over one year, even over two years for five year returns.
- The current slump started in April and May 2022 for 6 month and one year returns respectively. Five year returns haven't turned negative yet.
- So, the slumps can continue for a while. How long? We don't know.

Buy the dip?

Question: If you buy during the slump, can you make a lot of money?

Based on 6 Month Returns

Since we use returns as a measure, we relate the returns of today with the returns in the future. Some randomly selected entries are shown here. The returns are all annualized.

Date	6 Month	6 Month After	1 Year After	5 Years After
2008-11-12	-63.81%	8.03%	30.12%	17.55%
2011-10-26	-16.99%	32.29%	12.63%	10.72%
2013-02-07	15.74%	24.27%	19.71%	11.96%

On 2008-11-12, we saw a -63.81% return in the last 6 months. Suppose that we had then invested in SPY on the next day, then we would have received a positive 8.03% return 6 months afterwards. If we had stayed for another 6 months, then we would have received a positive 30.12% for the whole year. If we had stayed even longer for a total of five years, then the return would have been 17.55%. (If you had invested 6 months before, you would not have recovered your money after 5 years.)

Similarly, if we had invested the day after 2011-10-26, we would have received a 32.29% return 6 months afterwards, a 12.63% return one year afterward, and a 10.72% five years afterward.

These entries show that the relationship between current returns and future returns are not clear-cut. So we summarize the results by looking at average returns within a certain interval of current returns.

1. Column 1 is the percentile interval of current 6 month returns.
2. Column 2 is the minimum for the interval. So for the lowest ten percent, the returns were at least -16.70%. For example, 2018-11-12 falls in this interval. For the first quartile, the returns were at least -2.41%.
3. Column 3 is the average of current 6 month returns in the interval. So for the lowest 10 percent, the average returns were -30.87%.
4. Column 4 is the average of 6 month returns in the future. Recall that 2018-11-12 was in the lowest 10 percent and it had a 6 month future return of 8.03%. So the mean is the average of such returns in the interval.
5. Columns 5 and 6 are averages for one year and five years in the future.

Percentile	Threshold	Mean(6M)	Mean(6M A)	Mean(1Y A)	Mean(5Y A)
0- 10%	-16.70%	-30.87%	6.77%	6.59%	8.71%
10-25%	-2.41%	-8.90%	6.58%	4.19%	7.73%
25-50%	11.05%	5.35%	10.62%	10.38%	7.91%
50-75%	23.16%	16.65%	10.09%	10.24%	6.43%
75-90%	35.83%	28.95%	11.57%	11.43%	6.74%
90-100%	119.95%	48.61%	17.03%	14.17%	6.71%

As a reminder, the means for the entire data set are:

	6 Month	1 Year	5 Year
Mean	10.28%	9.51%	7.57%

Some observations:

- Buying the dip using 6 month returns is only good for the long term; i.e. 5 years. At any time when 6 month returns were below the median, both the 6 months and one year in the future did not offer better than average returns.
- For the short term it is better to follow the crowd during high returns. Both future 6 month and one year returns go up along with the high current returns.
- Conclusion? For long term investment it doesn't matter much when you enter the market. For short term investors, follow the market.

Based on 1 Year Returns

Instead of using 6 month returns as a guide, we now use one year returns and consider one and five year future returns.

	Mean(1Y)	Mean(1Y A)	Mean(5Y A)
0-10%	-25.09%	-16.61%	5.69%
10-25%	-4.30%	-1.10%	5.05%
25-50%	6.87%	8.22%	7.93%
50-75%	15.37%	16.54%	11.67%
75-90%	23.30%	25.50%	11.27%
90-100%	36.07%	39.45%	No entries

The interpretation of each entry is similar to before. So we come directly to observations.

- Both future returns are positively correlated with the current returns, much more so for one year future returns.
- When the current returns are above 50%, it is a good idea to start investing (or doubling down when you are already in the market).