Indicator Evaluation

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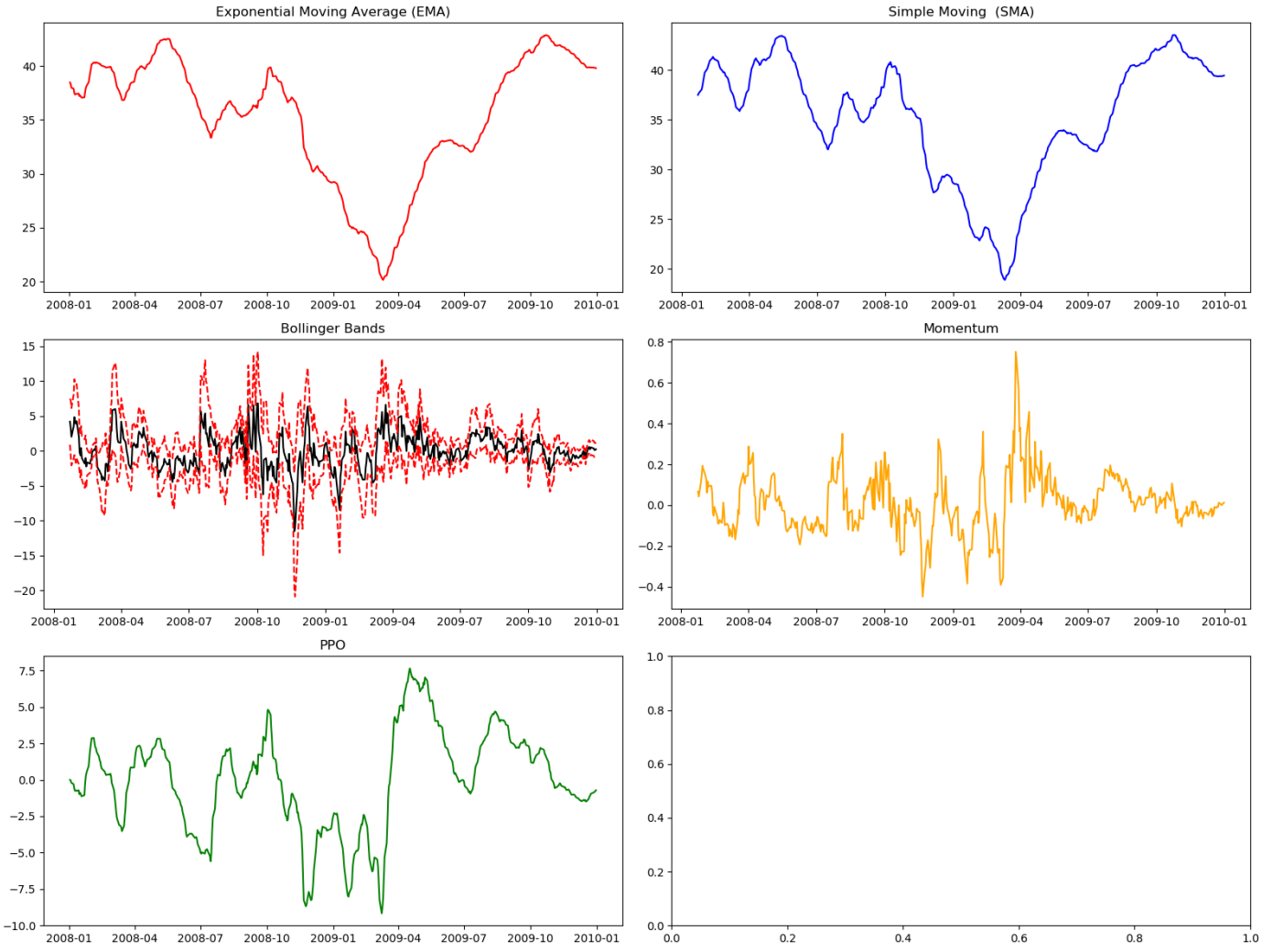
Indicators

To better understand the effectiveness of the Theoretical Optimal Strategy and the patterns of JPM within the portfolio, I applied five technical market indicators onto the daily stock data. The five indicators I computed were: exponential moving average (EMA), simple moving average (SMA), Bollinger Bands, momentum, and Percentage Price Oscillator (PPO). The figure below shows a plot for each indicator over the specified time period for JPM.



Exponential moving average was calculated using a window size of 25 days. EMA is used to show the trend of a given stock over a period of time while accounting for time weighting of performance. To calculate this value over time, an exponential weighting scheme was applied to the adjusted closing price of JPM. This both smooths

the data and gives a reasonable estimation of the stock's value at a given day in time relative to recent performance. If using EMA to make trading decisions, one could be reactive to the highs and lows of the EMA, selling as a stock's EMA is on the rise and buying as it falls.

Simple moving average was calculated using a window size of 15 days. SMA is similar to EMA in that it uses prior adjusting closing price performance to smooth out the daily valuation estimate of a given stock. In contrast to EMA, SMA does not use a time weighting scheme, so any adjusting closing cost in the window is equally weighted when calculating SMA. As seen in the figure above, SMA and EMA have very similar shapes, but are not identical. SMA can be used to make trading decisions as traders can sell as the stock's SMA is rising and buy as a stock's SMA is dropping.

Percentage Price Oscillator shows the relationship between the 9-day and 26-day EMAs. These are referred to as the short-term and long-term oscillator respectively. To calculate PPO we subtract the long term indicator from the short term indicator and divide by the long term indictor. Traders can use this value to indicate whether to buy, if the PPO is positive and rising, and sell if the PPO is negative or dropping. This gives a trader more information about recent performance and can be of particular value when investigating short-term performance.

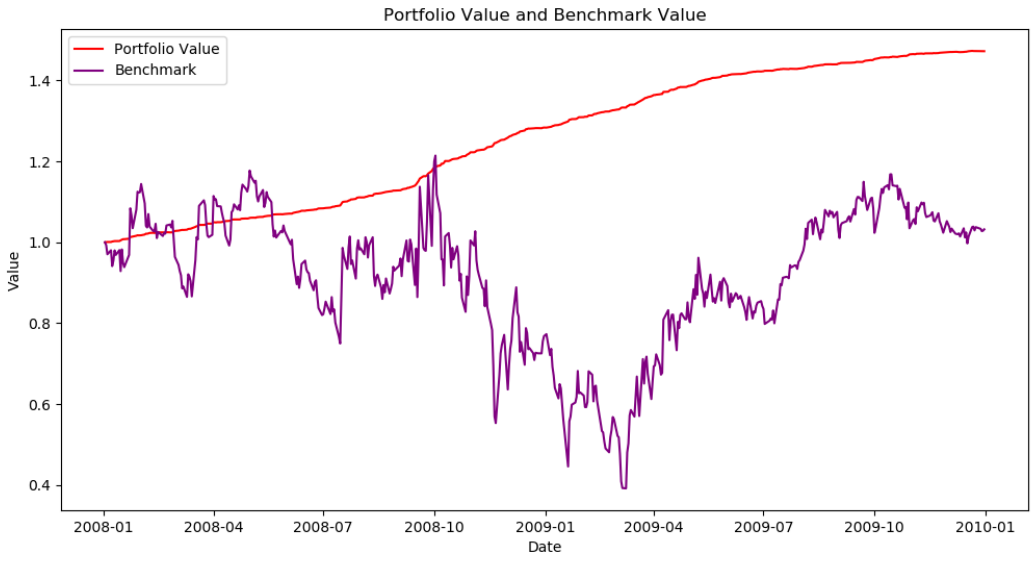
Momentum was calculated as each day's adjusted closing cost divided by the previous day's adjusting closing cost minus one. This gives us an idea of the directionality of a stock's worth relative to recent performance. When using for trading, if a stock's momentum is rising it would indicate a time to sell, whereas if a stock's momentum was dropping it would indicate a time to buy. Similar to the other indicators, momentum gives a sense of the recent performance trend of a stock directionally.

Finally, Bollinger Bands were derived using the adjusted closing prices and simple moving average. The high Bollinger Band represents 2 standard deviations above the difference in adjusted closing price and SMA, while the lower Bollinger Band represents 2 standard deviations below the difference in adjusted closing price and SMA. The difference between the two bands show a given stock's volatility. Traders can use the volatility as a point of reference to their tolerance within a portfolio. If the volatility is starting to trend beyond their tolerance, they can sell the stock, whereas if it is performing in a more stable way they may choose to invest in the stock.

Theoretically Optimal Strategy

The Theoretically Optimal Strategy I employed used the knowledge of JPM's adjusted closing history to indicate whether a trader should have bought or sold the stock on a given day. Since we had knowledge of the stock's performance in the given time period, we were able to definitively say which position would have resulted in a gain during each day.

To implement this strategy, I checked to see if the stock's price would have risen or fallen on the next day and assigned an action to the previous day accordingly. If a stock's value was going to rise the next day, I indicated to buy on the previous day. In contrast, if a stock's value was going to fall on the next day, I indicated to sell on the previous day. I then assigned the corresponding number of stocks to buy/sell on a given day. The maximum positions outlined in the guidelines were accounted for in these calculations (net holdings with an absolute value of 1000 shares or less). The following chart shows the normalized performance of the Theoretical Optimal Strategy compared to the benchmark measure:



As we can see, the Theoretical Optimal Strategy well outperformed the benchmark, and had a constant positive relative value over time. The table below shows the cumulative returns, average daily returns, and standard deviation of daily returns:

Measure	Benchmark	TOS Portfolio
Cumulative Return	0.031973	0.472139
Average Daily Return	0.000063	0.000937
Standard Deviation (Daily)	0.041718	0.001147

The values in the table illustrate that the TOS portfolio far outperformed the benchmark in cumulative return and average daily return while maintaining a much smaller standard deviation. This performance relative to the benchmark is compelling that the strategy was highly effective.