

Project 6: Manual Strategy

Donald Ward – 7/3/2019

dward45@gatech.edu

Part 1: Technical Indicators

Bollinger Bands and Percentage: Bollinger Bands (BB) are upper and lower bands that indicate how volatile a price is over time. They are typically calculated by plotting lines 2 standard deviations above and below a given an n-day simple moving average (SMA). The Bollinger Percentage is a ratio of the price against these boundaries that shows how close the price is moving towards a boundary.

$$\text{BB \% Formula} = (\text{price} - \text{lower_bound}) / (\text{upper_bound} - \text{lower_bound})$$

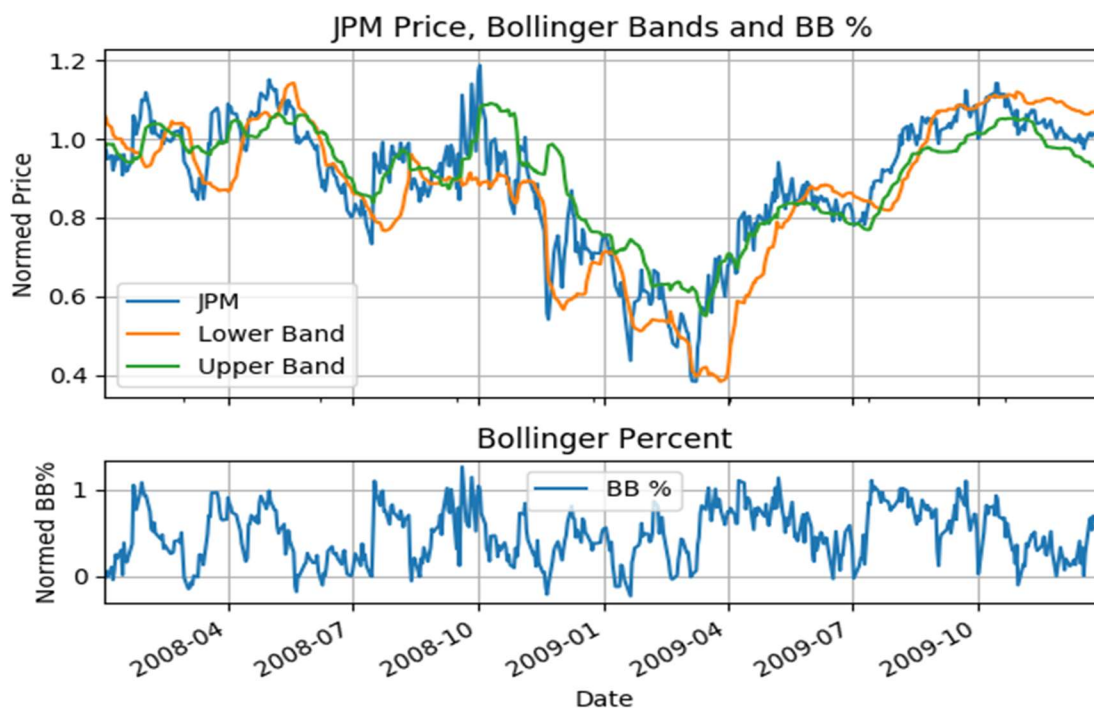


Figure 1. Graph of JPM showing Bollinger Bands

By examining Figure 1. We can see that when prices cross over an upper or lower band, the BB% moves closer to either 1 or 0 respectively. Crossing the upper band is said to indicate overbought conditions and crossing the lower band is said to show oversold conditions.

Momentum: Momentum is a simple measure between the stock's rolling price against a fixed number of days. It's a simple indicator but can be predictive of sustained trends.

$$\text{Momentum Formula} = (\text{price today} / \text{price } n \text{ days ago}) - 1$$

In Figure 2. The momentum starts peak or valley whenever there is large discrepancy between past and present prices. Negative momentum can indicate a down trend and positive momentum an upward trend.

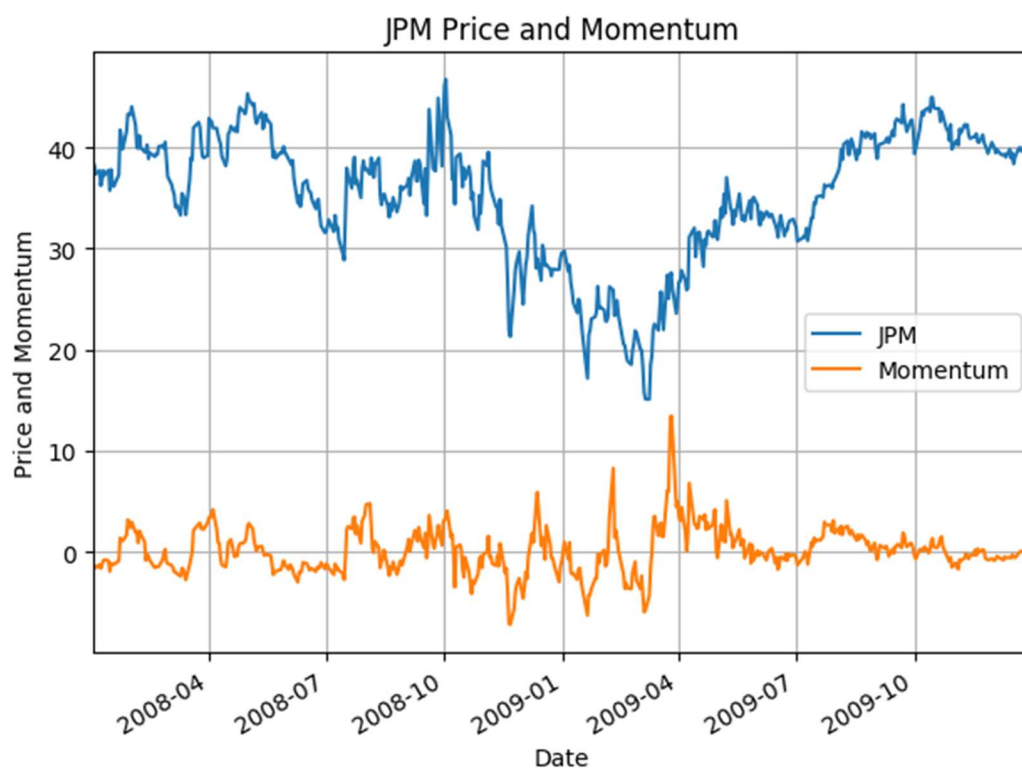


Figure 2. Graph of JPM showing 14-day rolling price momentum

Moving Average Convergence Divergence (MACD): MACD is a price trend indicator that shows the relationship between two rolling price averages. Two period lengths are specific (a fast and a slow) number of days back and the Exponential Moving Average (EMA) is calculated for each of these. The EMA is a moving average that gives greater weight to more recent data points, and in our case the more recent price. Pandas provides a function for this EMA calculation and the MACD can be calculated by subtracting the EMA for the faster (newer) calculation from the slower calculation. A MACD signal is then calculated by using a n day EMA of the MACD line ($n=9$ days in our example).

Signal line crossover of the MACD Signal over the MACD line is used to spot buy and sell opportunities. When the MACD moves below the signal line it indicates downward price movement and when it crosses upward it indicates upward price movement. We can see this upward price movement clearly in Figure 3.

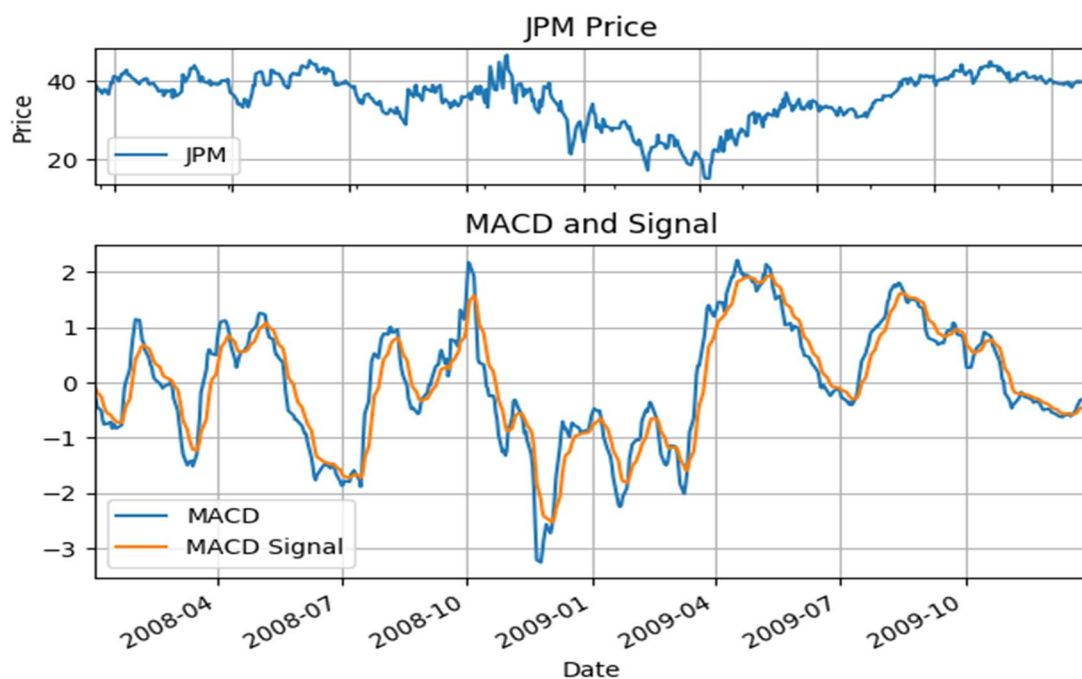


Figure 3. Graph of JPM showing MACD for 12 and 26 day exponential moving average (EMA) and MACD Signal for 9 days

Part 2: Theoretically Optimal Strategy

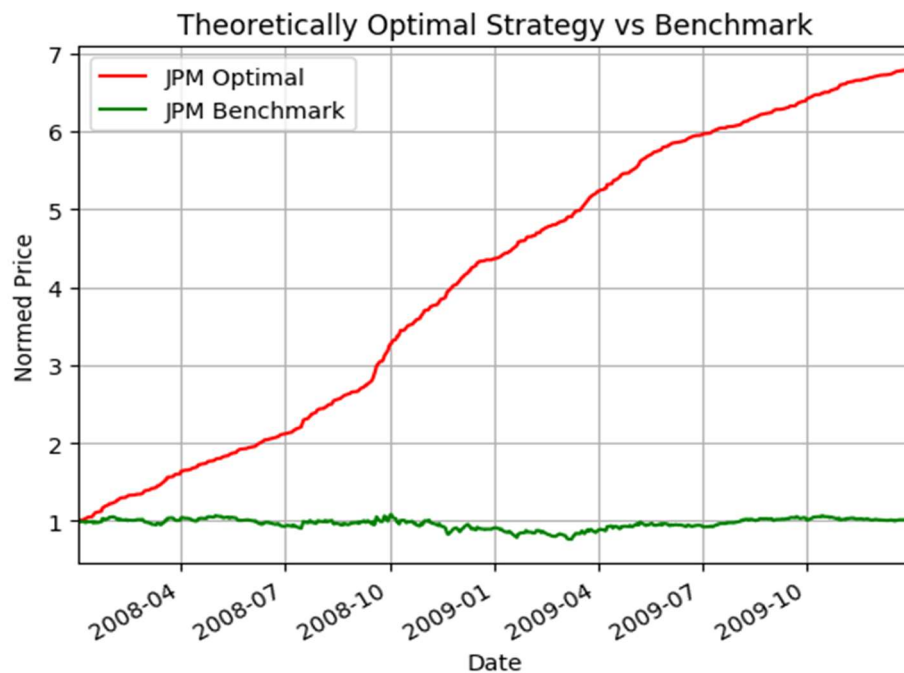


Figure 4. Optimal trading strategy for JPM vs Benchmark

Method to optimize:

I created this optimal strategy by first by examining all days in the date range and for each day comparing the current's day price against the next day's price. If tomorrow had a better price and I was not already in a LONG position I would buy enough shares until 1000 were held. If tomorrow's price was lower, I entered a short position by reducing shares until -1000 shares were held. The last day of the range I simply did nothing because the next day's price would not make any change to the value of the shares held on that day and not affect overall portfolio value.

Theoretically Optimal Stats:

Cumulative Return of Fund: 5.7861

Standard Deviation of Fund: 0.00454782319791

Average Daily Return of Fund: 0.00381678615086

JPM Benchmark Stats:

Cumulative Return of Fund: 0.0123

Standard Deviation of Fund: 0.0170043662712

Average Daily Return of Fund: 0.000168086978191

Part 3: Manual Rule-Based Trader

I used the following rules to indicate a LONG position (all required to be true):

- Momentum less than or equal to 0.0
 - o Reason: Momentum downward indicates a bottoming price
- Bollinger Percentage < 0.2
 - o Reason: This signal a price moving below its normal range
- MACD greater than MACD Signal
 - o Reason: This indicates the beginning of upward trend in price

I used the following rules to indicate a SHORT position (all required to be true):

- Momentum > 0.0
 - o Reason: Momentum downward indicates a peaking price
- BB Percentage > 0.8
 - o Reason: This signal a price moving above its normal range
- MACD less than MACD signal
 - o Reason: This indicates a beginning of downward trend in price

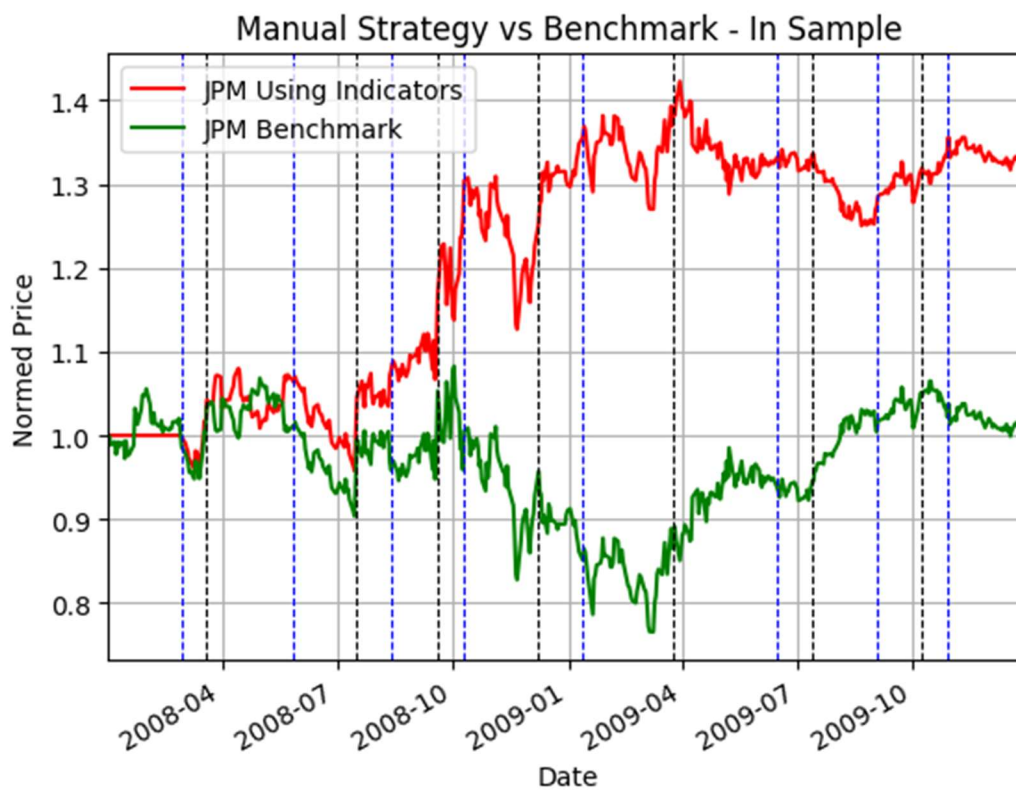


Figure 5. In sample results for manual trading strategy. Blue lines are long entries and black lines are short entries.

Part 4: Comparative Analysis

Out-sample performance was not as good as In-sample and for a time was doing awful before turning profitable.

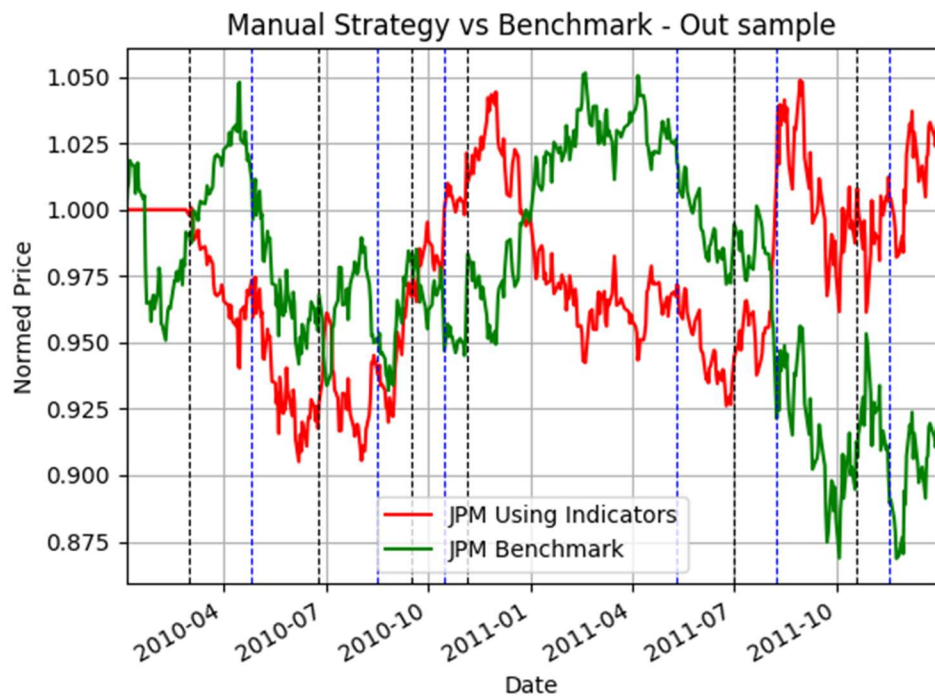


Figure 6. Out sample results for manual trading strategy. Blue lines are long entries and black lines are short entries.

Insample and Outsample Performance and Benchmarks for JPM

	In Sample Performance	In Sample Benchmark	Out Sample Performance	Out Sample Benchmark
Sharpe Ratio	0.794443549889	0.157204964889	0.180033736415	-0.25665656052
Cumulative Return of Fund	0.3301485	0.0123249333401	0.02977	-0.083579110032
Standard Deviation of Fund	0.012989671454	0.0170412470682	0.00784771823	0.0085001583223

Average Daily Return of Fund	0.000650071220	0.000168759162	0.0000890014	-0.00013742923
Final Portfolio Value	133014.85	101027.7	102977.0	91445.7

Observations:

My manual strategy was able to beat the benchmarks in both the Insample and Outsample data. However, the outsample results were not as good against the benchmarks as the insample results. The simple explanation for this is that I was able to keep changing my parameters for my insample rules until I was able to optimize my returns to my liking. I received no such benefit of observing the results with the outsample data and was left to rely only on the performance which was configured against the insample data.