CS7646 Project 8: Strategy Evaluation

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Abstract—The project includes two strategies for trading: manual strategy, learner strategy. As required, I choose three indicators to compare the performance of two strategies with bench mark. The three indicators are momentum, price /simple moving averages(SMA) ratio, Bollinger Bands®. In general, learner strategy has the best outcome.

1 INDICATOR OVERVIEW

In this project, we implement five indicators to allocate the portfolio. They are momentum, price /simple moving averages(SMA) ratio, Bollinger Bands®, exponential moving averages(EMA), and MACD.

Momentum:

· Momentum measures the rate rising or falling of stock price.
  The formula to calculate is as below:
  Momentum = (Price today / Price n periods ago) -1

  Momentum can be a intuition that future price may follow. In other words, if momentum crosses above the moving average from below, then trader might can consider to buy, and vice versa.

SMA ratio:

· SMA measures the average closing price.
  The formula to calculate is as below:

· SMA uses the mean of closing price for certain period of days, it can be used as proxy of true value. When SMA price (n) optimized the true value (An), it can be considered as buy/sell signal . For example, if the market is in a downtrend and the SMA is also in a downtrend, the trader might want to sell the stock on next rally up to SMA. However, in order to implement the project in a easier way. I decide to use price divide SMA as a ratio to see if it is a buy/sell signal.

$$\text{SMA} = \frac{A_1 + A_2 + ... + A_n}{n}$$

where:

A_n = the price of an asset at period n

n = the number of total periods

Bollinger Bands®:

· Bollinger Bands® uses two standard deviations (positively and negatively) away from a simple moving average (SMA) to measure.
The formula to calculate is as below:

$$\text{BOLU} = \text{MA}(\text{TP}, n) + m * \sigma[\text{TP}, n]$$
$$\text{BOLD} = \text{MA}(\text{TP}, n) - m * \sigma[\text{TP}, n]$$

where:

BOLU = Upper Bollinger Band

BOLD = Lower Bollinger Band

MA = Moving average

When using Bollinger Bands® as indicator, we know that we can take the band as buy/ sell signals. To be more specific, if the lower band is in an uptrend, trader might can think it as a buy signal. However, I utilize percentage to consider if it is a buy/sell signal. That is, the true price minus lower band divide upper band minus lower band. If percentage above 0.8 means price is near upper band; if it below 0.2 means price is near lower band.
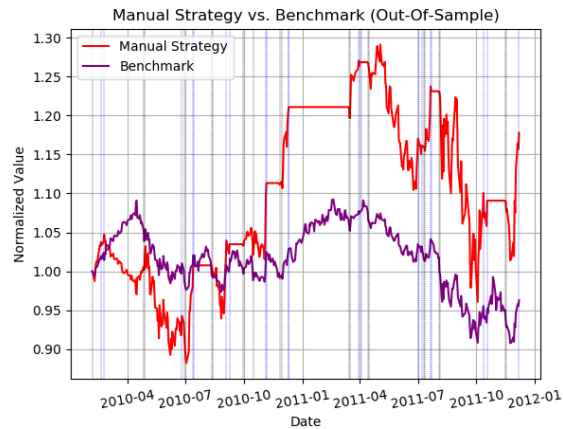
2 MANUAL STRATEGY

The strategy I use is to combine the three indicators to see which combination can bring the best performance. I come up with two combinations in the end. First, when SMA ration is grater than 1.1; Bollinger Bands® is greater 0.8; and momentum is greater than 0.2, that is a sell signal. Second, when SMA ration is grater than 0; Bollinger Bands® is greater 0.8; and momentum is greater than 1, that is a sell signal as well. The concepts behind the two combination are similar based on the discussion I have mentioned in previous section.

The parameters are: JPM stock, in sample time period is from 01/01/2008 to 12/31/2009, out of sample time period is from 01/01/2010 to 12/31/2011, start cash is 100,000, commission is 9.95, impact is 0.005.

Then, the outputs are as follows. The manual strategy outperform the bench mark both in sample and out sample situations. In addition, the cumulative return from manual strategy is larger than bench mark at in sample period. Last, it is obvious that in sample period performs better than out of sample period, the reason is that manual strategy is trained with in sample period.

Manual Strategy vs. Benchmark (Out-Of-Sample)
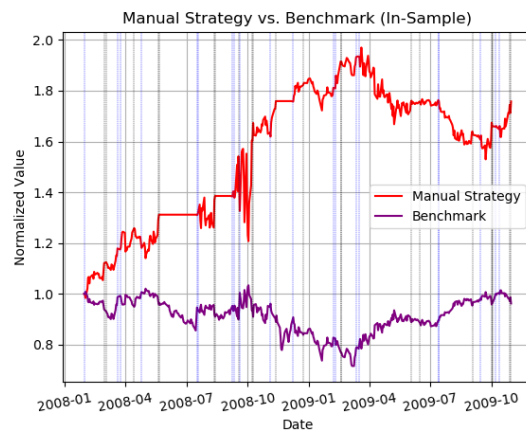
table

	Manual Strategy (In Sample)	Benchmark (In Sample)	Manual Strategy (Out of Sample)	Benchmark (Out Of Sample)
cummulative_returns	0.757696	-0.037966	0.177838	-0.037152
average_daily_return	0.001595	8.9E-05	0.000483	-4.9E-05
std_daily_return	0.025672	0.018811	0.016233	0.008069

3 STRATEGY LEARNER

The strategy learner I implement with a classification learner, which is an ensemble learner using BagLearner and RTLearner. In this project, I use stock true price as x variable, and convert the BUY, SELL, HOLD to 1, -1, 0 categories as y variable. The time period as in sample is from 01/01/2008 to 12/31/2009 and out of sample period is from 01/01/2010 to 12/31/2011.

Here is the process. First, I set up the leaf size to 5 and bags to 20 to prevent overfitting at in sample period. Then, add evidence from three indicators as Xtrain and Ytrain data from in sample period. Last, I use three indicators from out of sample period as Xtest to query the output as Ytest.

A bit more detail about how to execute Ytest is that when I write this part of code, I have to consider the situation from current position(shares) and the reality of Y to finish the prediction for Ytest.

4 EXPERIMENT 1

· Hypothesis: The strategy leaner and manual strategy will outperform the bench mark.
· Parameters: JPM stock, time period is from 01/01/2008 to 12/31/2009, start

cash is 100,000, commission is 9.95, impact is 0.005, leaf size is 5, bags is 20.

· Result: Strategy learner and manual strategy did perform better than the banch mark. Besides, we can have confidence that strategy learner will always beat banch mark because we use ensemble learner to reduce the overfitting and lead to better performance.

The outputs are as below:

· In sample

Manual Strategy vs. Benchmark vs. Strategy Learner(In-Sample)
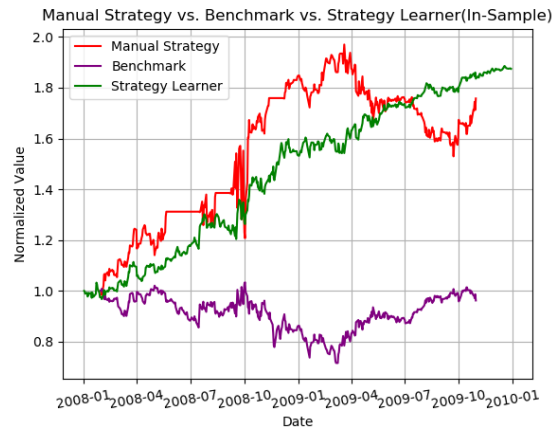
ex_in

|	Manual Strategy (In Sample)	Benchmark (In Sample)	Strategy Learner (In Sample)
cummulative_returns	0.757696	-0.037966	0.954025
average_daily_return	0.001595	8.9E-05	0.001409
std_daily_return	0.025672	0.018811	0.011987

· Out of sample

Manual Strategy vs. Benchmark vs. Strategy Learner(Out-Of-Sample)
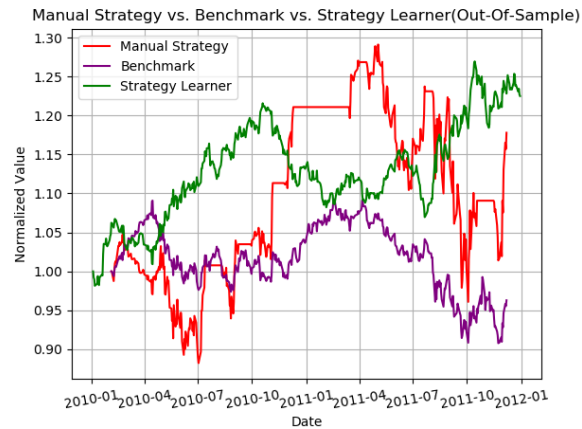
ex_out

	Manual Strategy (Out Of Sample)	Benchmark (Out Of Sample)	Strategy Learner (Out Of Sample)
cummulative_returns	0.177838	-0.037152	0.318101
average_daily_return	0.000483	-4.9E-05	0.000571
std_daily_return	0.016233	0.008069	0.006511

5 EXPERIMENT 2

· Hypothesis: The strategy leaner will perform worse along with the increasing impact value.
· Parameters: Use three different impact values: 0.0, 0.005, and 0.01. JPM stock, time period is from 01/01/2008 to 12/31/2009, start cash is 100,000, commission is 9.95.
· Result: Strategy learner did perform better when the impact value is smaller. We can prove that with cumulative returns, average daily return.
  The outputs are as below:

Strategy Learner(Impact:0.0 vs. Impact:0.005 vs. Impact:0.01
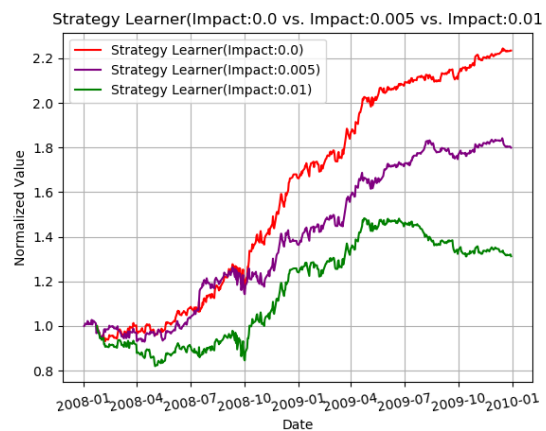
ex2

	Strategy Learner (Impact:0.0)	Strategy Learner (Impact:0.005)	Strategy Learner (Impact:0.01)
cummulative_returns	1.464	0.732819	0.404717
average_daily_return	0.001861	0.001215	0.000786
std_daily_return	0.011258	0.012929	0.013822