

Trading Strategy Project

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This is code part: [Git Repo Link \(https://github.com/yjiang14/Demo_Projects/tree/master/Trading_Strategy_Project/code\)](https://github.com/yjiang14/Demo_Projects/tree/master/Trading_Strategy_Project/code)

Goal

This project focuses on building trading strategies for JPM to maximize the portfolio value in two-year window.

Introduction

The project contains two parts:

- Trained JPM data starting with \$100,000 cash using manual strategy and strategy learner (Q-Learning) to generate best tradings strategy in in-sample (2008/1/1 - 2009/12/31) and tested it in out-of-sample (2010/1/1 - 2011/12/31). There only were three allowable positions: 1000 shares long, 1000 shares short and 0 shares
- Evaluated those two strategies by calculating daily portfolio value based on strategy-generated tradings. Benchmark was also created to compare with our strategies. Benchmark also started with \$100,000, investigated 1000 shares on the first trading day and held that position.

This report will interpret strategy building processes and display a chart to evaluate those two strategies. The code and related files can be found through this link: [Git Repo Link \(https://github.com/yjiang14/Demo_Projects/tree/master/Trading_Strategy_Project\)](https://github.com/yjiang14/Demo_Projects/tree/master/Trading_Strategy_Project)

Strategy Building

In this project, Strength Index (RSI), Bollinger Bands B% (BBP) and Commodity Channel Index (CCI) were selected to build manual strategy and strategy learner (Q-Learning). In manual strategy, BBP, RSI, and CCI were calculated and different values were assigned to each of them at their different conditions as below:

$$\text{value}_{\text{BBP}} = \begin{cases} -1, & \text{BBP} > 1, \\ 1, & \text{BBP} < 0, \\ 0, & 0 \leq \text{BBP} \leq 1. \end{cases} \quad \text{value}_{\text{RSI}} = \begin{cases} -0.8, & \text{RSI} > 70, \\ 0.8, & \text{RSI} < 30, \\ 0, & 30 \leq \text{RSI} \leq 70. \end{cases} \quad \text{value}_{\text{CCI}} = \begin{cases} -0.6, & \text{CCI} > 100, \\ 0.6, & \text{CCI} < -100, \\ 0, & -100 \leq \text{CCI} \leq 100. \end{cases}$$

Those criterions I selected in this study are usually applied in stocking analytics as described in section. Those values were summed up as each day indication and made long/short/hold decision based on this indication value:

$$\text{value}_{\text{indication}} = \text{value}_{\text{BBP}} + \text{value}_{\text{RSI}} + \text{value}_{\text{CCI}}$$
$$\text{value}_{\text{indication}} = \begin{cases} \text{Long}, & \text{value}_{\text{indication}} \geq 0.8, \\ \text{Short}, & \text{value}_{\text{indication}} \leq -0.8, \\ \text{Hold}, & -0.8 < \text{value}_{\text{indication}} < 0.8. \end{cases}$$

In strategy learner, Q-learning was used to frame this trading strategy. Combined stock trading processes with project requirements, three components were defined: (1) actions: (i) long 1000 shares, (ii) short 1000 shares, (iii) holding; (2) states: discretized RSI in to 8 intervals, BBP into 10 intervals, CCI into 8 intervals, and permutated all intervals. Therefore, there are $8 \times 8 \times 10 = 640$ states. Those states were assigned to each day according to daily RSI, BBP, and CCI intervals combination; (3) rewards: daily return. In the Q-learning, for each day (day loop): (1) calculates indicators and then get a state; (2) request action based on this state by querying current Q table (find a action with maximum rewards) (3) calculate reward based requested action at this state and update reward based on step (3) reward and step (2) state in Q table; repeat above day loop multiple times until cumulative return stops improving.

Strategy Evaluation

In order to evaluate manual strategy and strategy learner, impact of 0.005, commission of \$9.95, and start value of \$100,000 were utilized, and the daily portfolio values were normalized for benchmark, manual strategy and strategy learner. The Figure 1 presents normalized portfolio values for benchmark, manual strategy and strategy learner.

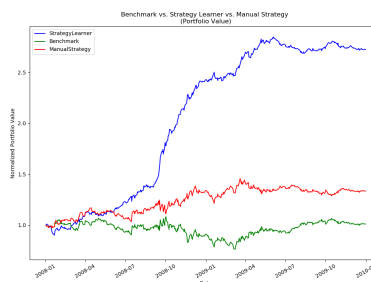


Figure 1: Benchmark vs. Manual Strategy vs. Strategy Learner in Portfolio Values