Systematic Investing
Professor Dhar
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Assignment COUNTERTREND
(Data available on class website)

In this assignment you will complete the counter-trend example discussed in class. Specifically, test the LONG side of the counter-trend strategy based on the setup discussed in class. But feel free to explore the short side.

PriHWroll is previous day high with roll

The problem is set up as follows (for the Long side, short could be attempted for extra credit):

High: hit-level, **This high is with Roll**

1. **Compute** the average 20 day range (high minus low). Call this A.
2. **Choose** a retracement parameter P. Assume P=2.2 as in the example on the lecture web link.
3. **Compute** a LEVEL, L, at or below which you will go long where L is a retracement from the HIGH of the previous day. L is computed as follows:
$$L = \text{Previous day's HIGH (roll adjusted) minus } P*A; \qquad (1)$$
4. On a day, go long if the signal is triggered, that is, the instrument trades *below* the level L during that day; note the price at which you go long
   Entry(t) = High(t-1) - P*A(t-1)
5. Exit at the close of the day.

Calculate the Sharpe ratio of this strategy. What is the Sharpe ratio of the buy and hold (i.e. always long) strategy for this same period. Please draw the equity graphs for the buy and hold and the counter-trend system where P=2.2. On days when there is no position, assume a return of zero or "blank" (or try both). [But see "extra credit" section below]

Would you expect your **signal quality** to degrade as you lower the threshold P? Try lowering P from 2.2 in increments of 0.2 until a lower bound of 0.8. Graph your results showing the Sharpe Ratio and **number of signals** for the various levels of P. What do you observe? Summarize your findings in a few sentences.

For P=2.2, using days where there is a signal, create a two by two matrix showing the number of days the strategy and the market are both positive, both negative, market is positive and strategy is negative, and market is negative and strategy is positive.

For a little **extra credit**:
1. calculate in which of the four situations the strategy makes or loses money. You can do this by calculating the "total returns" in each of the 4 scenarios above for which you calculated the number of cases (just add up the daily returns for all days where there is a position in each scenario). In which of the four scenarios does the strategy work and when doesn't it work?

2. Since the strategy only assumes a position occasionally, calculate the Sharpe Ratios for the different levels of retracement assuming both zero and "blank" returns on days there is no position. (i.e. different from what you assumed in your analysis if you chose one of them)

For some extra **fun**, implement the "symmetric" strategy on the short side by "flipping" steps 3, 4, and 5 above. Does it work at any retracement level?