

## MFE 230G: Homework 3

### Due: September 7, 2021

1. Assume you are testing a new idea, and you believe ex ante it has a 25% chance of adding value. You run it through a backtest with a 5% rate of false positives and a 5% rate of false negatives.
  - a. If the backtest result tests positive, with what probability do you expect the idea to add value?
  - b. What if you actually test several variants of the idea until you find one—the 5<sup>th</sup> variant—that tests positive. With what probability do you now expect the idea to add value?
2. Browse the SSRN website for an interesting investment idea. While you can look broadly through SSRN, here are a few specific sites that might be of interest:

**(Behavioral & Experimental Finance (Editor's Choice):**

[https://papers.ssrn.com/sol3/JELJOUR\\_Results.cfm?form\\_name=journalBrowse&journal\\_id=1175282&Network=no&lim=false](https://papers.ssrn.com/sol3/JELJOUR_Results.cfm?form_name=journalBrowse&journal_id=1175282&Network=no&lim=false)

**(Big Data & Innovative Financial Technologies):**

[http://papers.ssrn.com/sol3/JELJOUR\\_Results.cfm?form\\_name=journalBrowse&journal\\_id=2616882](http://papers.ssrn.com/sol3/JELJOUR_Results.cfm?form_name=journalBrowse&journal_id=2616882)

**(Chicago Booth: Accounting Research Center Research Paper Series):**

[http://papers.ssrn.com/sol3/JELJOUR\\_Results.cfm?form\\_name=journalBrowse&journal\\_id=925812](http://papers.ssrn.com/sol3/JELJOUR_Results.cfm?form_name=journalBrowse&journal_id=925812)

(You can sort these sites by most recent posts or most downloads over time, among other choices.) Pick an idea and write up a 1 page proposal for using it in an equity strategy. Your proposal should include:

- a. Why should the idea work? Why don't market prices already reflect it?
- b. How would you translate the idea into a forecast alpha for every stock? In other words, what is the right hand side of:

$$\alpha_n(t) =$$

- c. Discuss possible flaws in the idea—what are the most questionable assumptions, and/or the dependencies that may change in the future. Would you expect the idea to perform particularly well, or particularly poorly, in particular investment periods (e.g. rising or falling markets, recessions or economic booms, trending or turning markets...)

3. Based on forecast alphas, risk, and transactions costs, you are planning to buy \$1,000,000 of stocks A and B. You know that stock B is twice as volatile as A, and that its daily trading volume is twice that of stock A. Which trade do you expect to exhibit the higher price impact? How should the price impact for stock B compare to the price impact for stock A?
4. You have been hired as a trader for the Haas MFE Endowment Fund. At the market close of 4:00 pm on Tuesday, you receive instructions to sell 10,000 shares of ABC and use the proceeds to buy 10,000 shares of XYZ. Both stocks close at \$100 on the NYSE that day. You proceed to work on the trade over the course of the trading day on Wednesday, with the following executions:

New York time	Trade	Price per Share
10:00 AM	Sell 10,000 of ABC	\$99.90
11:00 AM	Buy 5,000 of XYZ	\$100.00
2:00 PM	Buy 4,000 of XYZ	\$100.50
4:00 PM	Buy 950 of XYZ	\$101.00

Assuming that commissions are zero, and that execution prices reflect all trading costs, what opportunity costs and execution costs have you incurred? Express these in dollar terms, and relative to the initial order size.

5. In the context of the quadratic dynamic model we discussed:
  - a. Show that

$$E\left\{Cov\left\{\mathbf{h}_Q(t), \mathbf{h}_Q(t-\Delta t)\right\}\right\} = e^{-\gamma\Delta t} \cdot \omega_Q^2$$

Remember that  $\tilde{\mathbf{s}}(t)$ , the new information, is uncorrelated with  $\boldsymbol{\alpha}(t-\Delta t)$ . Because of this, you can assume that:

$$E\left\{\mathbf{h}_Q^T(t-\Delta t) \cdot \tilde{\mathbf{s}}(t)\right\} = 0.$$

- b. The transfer coefficient in this model is:

$$TC = Corr\{\mathbf{h}, \mathbf{h}_Q\} = \sqrt{\frac{1-\delta^2}{1-(\gamma\delta)^2}}$$

How does the transfer coefficient behave in the limits of:

- Low transactions costs?
- High transactions costs (i.e. when transactions costs dominate risk aversion)?
- When the halflife gets very low?

6. Given a moderate risk aversion parameter of  $\lambda=10$  (in decimal units), a transactions cost coefficient of  $\eta=50$ , a halflife of 0.5 years, and alphas updated monthly (i.e.  $\Delta t = (1/12)$  years):
  - b. What are  $\delta$  and  $\psi$ ?
  - c. What is the effective transactions cost amortization parameter?
7. Problem 17.1, p. 508-509.
8. Problem 17.2, p. 509.
9. Problem 17.4, p. 509.