

Statistics 434: Final Projects

Project Overview

- The nominal task is **either** to design and test a “trading system,” or to develop and test an empirical thesis about return processes.
- Your **real goal** is to show that you have achieved a high level of skill and knowledge in the practical investigation of financial time series. You should demonstrate both the mastery of statistical technique and the soundness of your personal judgement.
- Your report can be written individually or by a two-person team. Individual reports are not to exceed 20 pages, and team reports are not to exceed 30 pages, inclusive of well-designed tables, well-chosen plots, and well-selected code fragments.
- It is expected that your report will be a *synthesis* — not a *blog*. You will want to **begin with an executive summary of one page**. You can then develop your individual themes in several (almost) self-standing sections. The heart of each of these theme sections is likely to be a discussion of one or more individually designed tables of results. At each level, **begin your story with the punch line and then pile up the evidence**. Be ruthlessly clear and never overstep the bounds of your evidence.
- There is no need for a “conclusion” at the back. For an in-house report, the conclusion should be up-front. Put all of the main conclusions on page-one. More minor conclusions should be displayed on the first part of the corresponding section.
- Learn to write like this, and your ideas will get noticed. This is not poetry; it’s business.
- **Be very attentive to the principles of intellectual integrity.** If you use an idea from another source, even a non-public source, be very careful to acknowledge the source. If you hear a snappy phrase and you want to use it, put it in quotes even if you can only attribute it to “anonymous” (or worse yet, Cramer). Please do not put me or you in the position of worrying about integrity issues. It costs nothing to give proper attribution, and the failure to provide such attribution can cost a career.

Project Process

- Discussion of your project ideas will be an important part of our class during much of the last several weeks of class. Talking about your ideas in class is one of the surest ways to make them better. The goal is for everyone to provide a first-rate report.
- We will creep up on the Final Project in three steps. The time-line will be posted on our class blog, but here are the basic steps:

1. A written project proposal (one to three pages, no longer, — pretty informal, not graded — but **on time**)
 2. A ten-minute project proposal presentation. Power Point and polished — but clear and honest. It counts toward your grade but you will be judged on organization and thoughtfulness, not your speech making ability.
 3. Your final project — the bottom line (specifications to follow)
- The brief written “Project Proposal” is mainly to give you space to think through what you intend to do. I will read the written reports before your oral report. This will help me to get up-to-speed with your plans. It will also help you to make your ideas more concrete.

This proposal is not expected to have a punch line, but it should state as completely as possible the themes that you plan to explore and the progress that you have made. Useful progress at this level would be the collection and organization of the relevant data, and perhaps some EDA to confirm that your data really is in working order. If you have a serious data problem, it this is the time to discover it — not after 80% of your project has been written up.

- You should worry about being “stuck” with what you propose. What you propose and what you finally do, can be different. In science, one almost always proposes one thing and then does another. The miracle is that **proposals are still useful**.
- You will give a 10 minute presentation of your proposal **in class**. We’ll handle the logistics of this as the end of the term draws near.
 - The scheduling is always tighter than one would like, so we cannot afford to be sloppy about the 10-minute time allocation. A 10-minutes presentation really is brutally brief, so you want to jump right into the issues. We don’t need any of this “since the advent of modern computers” baloney.
 - Attendance of *everyone* is critical on the presentation days. You really do need to be there to see what your colleagues are doing. Everyone’s effort pull up the effort of everyone else.
 - One can say a lot in 10 minutes if one is well prepared and well focused. The goal of this proposals is to stimulate thoughts that will add depth and polish to everyone’s final project.
 - At the time of the proposal you don’t need to press too hard for a deeply original theme. Originality will emerge naturally after you have begun to dig honestly into your data. What is needed at proposal time is a plan that is complete enough and clear enough so that both further opportunities and potential problems will be evident.

- There may be a proposal or two that I feel has “gone off the rails.” If this happens to you, it is not a happy event, but neither is it an absolute disaster. There is time to get back on track. Our collective promise is not to be “mean” to a team whose proposal bombs. We can all learn from such a disaster, but I’d still prefer that we not have any.

Data Collection and Organization

You should let your project proposal shape your data collection, but, as a gauge of scope, most people will need data on 8 (or so) stock returns (or other financial series). Most of our class discussions have focused on daily returns, but you may find that weekly returns are more informative. Weekly returns are guaranteed to have a better signal to noise ratio, though this comes at the price of increased likelihood of non-stationarity. Also, trading strategies that use weekly returns are less sensitive to your assumptions about transaction costs.

We will discuss some designs in class for testing trading strategies. There really is quite a bit of flexibility, but you want to make sure that you have anticipated the natural criticisms of your design.

Finally, the choice of your assets and the choices of your time periods will depend on the themes that you intend to explore. Certainly fixed income explorations are possible, but they are tricky and we should discuss your ideas. The same is true with options or futures. You can use these, but you’ll need to exert some care to be sure that you are using them correctly. Also, accounting data (such as P/E ratios) or macro-economic data (such as CPI) can be used, but you will need to be attentive to the issues of contemporaneity. You will also need to be explicit in your report about the way you have handled these issues. Frankly, most projects stick pretty close to the time series properties and trading analyses of equities, ETFs, CEFs, or MLPs.

Theme Creation and Development

As often as not, the hard part about the **creation of a theme** is an ironic *lowering of the bar* to a level where you can almost “step over it.” In contrast, the hard part about the **development of a theme** is that of *raising of the bar* to a level which — once cleared — assures that your results deserve to stand as part of human knowledge.

There is no automatic path to theme invention any more than there is an automatic path to genuine invention of any other kind. This is a personal matter which is at its best when driven by personal curiosity. Still, examples help to “prime the pump,” and we will discuss several concrete project designs in class. Whether you decide to test an empirical thesis or to try your hand at designing a trading system, there are some issues that always deserve our attention.

- “Trend following” and “mean reversion” are two of the most recurrent ideas of quantitatively oriented investors. Almost all of the projects will address these in some way or another. What twists and turns can you put on the investigation of these basics?

- “Risk” and “reward” are a constant part of the financial conversation, and we have found from the examination of rolling means and standard deviations that these two are not always related in the way that avuncular financial advisors would have us believe. What concrete investigations can you invent that would deepen this conversation?
- Trading strategies have been classified as (1) univariate, (2) ordered univariate, and (3) multivariate. For example, in a typical ordered univariate strategy one takes a collection of stocks, orders them by rolling estimated AR(1) coefficient and then places bets (perhaps guided by some modified α -Kelly bet sizing) of varying sizes — perhaps just favoring the most propitious bets. There are endless variations on this theme, all of which deserve exploration.
- Don’t underestimate the importance of structural insights, whether you can trade on them or not. For example, we now have a nice collection of stylized facts that guide us anytime we think about prices or returns. Can you add to this list of insights, or can you refine some that we have already found? Finally, don’t forget that it is also important to discover what does not work. This is important since many things — even many widely used things — do not work!
- The Efficient Market Hypothesis is a worthy strawman. There are lots of reasonable ideas that one can try, and a most of these do not produce excess returns — especially after risks are taken carefully into account. While every year there are teams that do turn up ideas “with promise” of excess returns, you should not feel bad if your ideas do not show “promise.” Your report will have recorded honest facts that will continue to guide us all. Valid empirical knowledge is of genuine value — forever.

Flexibility

If you are curious about a theme that has data requirements that differ from those suggested here, let’s discuss your idea. Once the scope is clearly understood, there is room for flexibility.

Time Integrity

In many business environments, nothing will get you into more hot water than being late with a report. There are lots of bosses who may not understand what you write, or even find time to read what you write. Still, if you are late with a report, it is up-close and personal for them.

Late projects will be penalized at one letter grade per day. This is a huge penalty, so I am confident that all reports will be safely submitted when due. Naturally, if you want to hand in your project early, I am happy to make arrangements.

Report Submission is Required in “Duplicate”

I need a hard copy of your report AND an electronic copy. I will mark comments on the hard copy, and you can pick it up at the end of the term. I will keep the electronic copy as a permanent record of your work.