Introduction

Research Methodology

Xianhua Peng

M1, 2019-2020

Outline

Outline

Leading Academic Journals in Quantitative Finance and Fin Tech

First tier

- Journal of Finance (JF), Journal of Financial Economics (JFE), Review of Financial Studies (RFS), Journal of Financial and Quantitative Analysis (JFQA)
- Management Science, Operations Research, Mathematics of Operations Research
- Mathematical Finance, Finance and Stochastics, SIAM Journal on Financial Mathematics

Second tier

- Review of Finance, Journal of Empirical Finance, Journal of Futures Market, Journal of Economic and Dynamic Control, Journal of Banking and Finance, Quantitative Finance, Advances in Applied Probability

Practioner's Journal in Quantitative Finance and Fin Tech

- Journal of Computational Finance, Risk Magazine
- Financial Analysts Journal

Major Conferences

- AFA Annual Meeting (American Finance Association)
- INFORMS Annual Meeting (Institute for Operations Research and Management Science)
- SIAM Conference on Financial Mathematics
- World Congresses of the Bachelier Finance Society
- Top ranked conferences in computer science and artificial intelligence: CVPR, NeurIPS, ICML

Major Websites for Papers

- SSRN: `https://www.ssrn.com/index.cfm/en/`
- ArXiv: `https://arxiv.org/`
- Main campus library: `https://www.lib.pku.edu.cn/portal/en`
- To donwload officially published papers that require subscription, first download and install PKU VPN: `https://its.pku.edu.cn/service_1_vpn.jsp` then connect the VPN using your ID and password. Then, you will be able to download papers for which the library has already purchased license.

Outline

Why Is It Valuable to Do Research

- Reserch is a process to innovate, to discover something new.
- The ability to discover something new is valuable, even if you work in industry.
- Furthermore, most topics in quantitative finance/FinTech are practical.

The Strategic Mentality of Doing Research

- Be critical. Challenge the existing authority/theory/conception.
- Think out of the box.
- Stay curious. Stay foolish.
- Think deeper (one step further than others).

Research Creates New Knowledge

- What is the new knowledge you intend to create? (articulate a research problem)
- Why this is new knowledge instead of existing knowledge? (literature review)
- Why this has not been done before? (articulate the difference/innovation of your work compared with existing literature, and maybe articulate the difficulty of the problem)
- Why this is new knowledge instead of belief/superstition/guesswork (showing the correctness of your work)

Good research creates good new knowledge

What are good new knowledge

- Strong results: significantly improve performance
- Generality: can be widely applied
- Highly intellectually challenging: solving a long-standing problem/empirical puzzle

Research Involves Intellectual Challenge

Anything that can be easily (in an intellectual sense) inferred is not considered research

- Mechanically applying existing approaches is not research
- Applying existing approaches to a different context without much modification/adaptation is not research
- Simply combining multiple existing orthogonal approaches is not research

Research Involves Intellectual Challenge

You need to show in your paper/thesis:

- Why your new knowledge involves intellectual challenge, i.e., sufficient distance from existing knowledge
- Why you are the one overcoming this intellectual challenge?
  - Show that you are the first one to try
  - Demonstrate your unique insight

Research Problem Selection

- Good research largely depends on the selected problem
- Choose a problem that you are really interested in.
- How to choose a problem?
  - Is it an old or new problem?
    - ★ Usually research papers on new problems may be better recognized by the academic community
    - ★ Research on new problems are both easy and difficult: it is easy as there are a lot can be done for new problems, and you do not need to compare your results with existing literature; it is difficult because it requires more problem formulation skills, and it is difficult to convince others that the new problem is important
    - ★ In general, doing research on new problems generate more payoff
  - Is it a significant problem?

Nurturing Good Taste

- Finding a good research problem is an art and it largely depends on a researcher's taste
- There are many mediocre papers published
  - Do not ruin your taste by poor-quality papers
- Read selectively
  - Highly cited papers and papers from first-tier journals and top top-ranked conferences
- Classification of papers
  - Type A: 80% understanding (main idea, solution method and main results)
  - Type B: 50% understanding (idea & results)
  - Type C: 20% understanding (only introduction)
- Learn to appreciate good papers and criticize poor papers

The Key Ingredients of Research: Innovation

- The most valued contribution of research is innovation
- One major contribution is better than many small ones
- What is the contribution type? Knowledge discovery, invention, integration, application
  - a (partially or completely) new model/theory
  - a (partially or completely) new approach/algorithm for solving a problem under an existing model
  - solving a new problem
- How to create a new model/theory/approach/algorithm?
  - Find new empirical facts and extend an existing model to incorpoate them
  - Extension of existing work
  - Combination of existing work
  - Refinement of existing work
  - Cross discipline: apply models/methods in other fields, e.g., application of machine learning in finance

Active Research Area in Quantitative Finance/Fin Tech

- Derivative pricing and hedging models, computational methods, model calibration methods
- Stochastic control and applications in finance
- Quantitative risk management models, computation, and statistical tests
- Financial econometrics
- Market microstructure, limit order book models
- Algorithmic trading: execution, market making, pairs trading, alpha strategy, etc.
- Credit risk and derivatives
- Portfolio selection
- Machine learning and artificial intelligence in finance: deep learning, reinforcement learning
- Energy and commodity markets and derivatives

Active Research Area in Quantitative Finance/Fin Tech

- Bitcoin and cryptocurrency
- Blockchain
- Consumer credit risk models
- Natural language processing and its application in finance
- Image processing and its application in finance

Outline

Search for Papers on a Particular Topic

- Google using key words (using double quotes to search for exact phrase)
- Search in SSRN and ArXiv using key words
- Find a recent paper in the topic. If the paper is an working paper posted online two or three years ago, try to find its newest version, which usually may have been officially published at some journals.
- Find related further research development after the current paper: search the current paper by Google, and then click on “cited by ...". Then, go through the list of new papers that cited the current paper.

Literature Review

- Start from the most recently published (online posted) paper, as its introduction may identify important existing literature in the topic
- Read the paper in detail, try to understand major parts of the paper. You may need to skip some parts of the introduction section.
- After you read through the paper, go back and read the introduction section of the paper again.
- Continue to read other papers, in the sequence of their importance and relevance, which may be hinted by the current paper

How to Study (Review) a Paper

While you are reading/studying a paper, you may also actively think and keep asking questions to yourself

- What is the problem that the author is trying to solve? Why is this problem interesting or important? Are there any other related problems worth studying?
- What is the motivation of the paper? Is it motivated from trying to improve the performance of existing model/method?
- What is the main idea of the paper? Where does the idea come from?
- What is the main contribution of the paper? What is new in the paper compared with existing literature?
- What is the mathematical tool used in the paper?

How to Study (Review) a Paper

Always be critical while reading a paper

- What are the empirical facts found or mentioned in the paper?
- What are the assumptions made in the paper? What are the basis or motivation of these assumptions? Are these assumptions reasonable? Are the assumptions tested by empirical data? Are these assumptions too strong? Is it better to make other assumptions?
- Is the mathematical model/formulation of the problem reasonable? Can it be improved?
- Are there any other empirical facts that cannot be taken into account by the current model?
- Are there any issues that are neglected by the authors? How to incorporate them into the model?
- What are the potential drawbacks of the current model?

How to Study (Review) a Paper

Associate the paper with other knowledge/problems/papers

- How is this paper related to other papers in this field?
- How is this paper related to problems in other field?
- Can the model/method be applied or modified to solve other problems?
- Can the model/method be combined with other models/methods to generate a better model/method?

How to Study (Review) a Paper

Write down your thoughts in notes while you studying/reviewing a paper, otherwise you forget after a while!

- Summarize the main points of a paper, which will be needed when you write your thesis
  - The main idea, empirical facts taken into account, modeling assumptions, main gradients of the model, problem formulation
  - The main contribution of the paper, compared to previous literature
  - The main shortcomings of the paper
- Your own thoughs/ideas/criticism to the paper, which may lead to a new paper
  - Alternative formulation of the same problem
  - Alternative assumptions that can be made based on the same emprical facts
  - Potential improvement that can be made
  - Further development/extension based on the paper