

A Guide to Factor-based Investing

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Disclaimer1. The views expressed in this presentation are those of the author, not necessarily those of December & Company

Disclaimer2. Received great helps from the Fint Portfolio Team and Taejin Kim from the Portfolio Solution Team

Part1. Factor Models

What Are Factor Models?

- The core aim of factor models is to understand **the drivers of asset prices**
- Which characteristics really provide independent information about average returns?

What Are Factor Models?

- Theoretically, linear factor models can be viewed as special cases of the arbitrage pricing theory (APT)

$$r_{t,n} = \alpha_n + \sum_{k=1}^K \beta_{n,k} f_{t,k} + \epsilon_{t,n},$$

- According to the CAPM, the only driver of returns is the market portfolio
 - However, if other factors do exist, then they are in contradiction with the capital asset pricing model (CAPM)
 - This explains why factors are also called ‘anomalies’

Examples of Common Factor Groups

- A factor is simply a systematic way of ranking (and selecting) stocks. It could be as simple as value (e.g., P/E) or momentum (e.g., past 12-month returns).

MSCI FaCS

	VALUE Relatively Inexpensive Stocks
	LOW SIZE Smaller Companies
	MOMENTUM Rising Stocks
	QUALITY Sound Balance Sheet Stocks
	YIELD Cash Flow Paid Out
	LOW VOLATILITY Lower Risk Stocks

Factor Groups	What it is
Value	HML = high minus low; undervalued minus ‘growth’ firms (ex. PBR, PER)
Size	SMB = small firms minus large firms
Momentum	WML = winners minus losers (ex. 12-1M returns)
Quality	Characterized by low debt, stable earnings growth, and other “quality” metrics (ex. ROE)
Yield	Captures excess returns to stocks that have higher-than-average dividend yields
Low ‘risk’	sometimes, BAB = betting against beta Depends on articles (ex. volatility, market beta, idiosyncratic volatility, etc.).

Not All Factors Are Compensated

- Pitfall
 - Not all factor exposures are expected to earn a return premium over the long term
- Question1. How do we know it's a good factor?
- Question2. Does factors guarantee future risk premiums?
- Question3. How to expose your portfolio to certain factors

The Most Common Procedure to Evaluate Factors

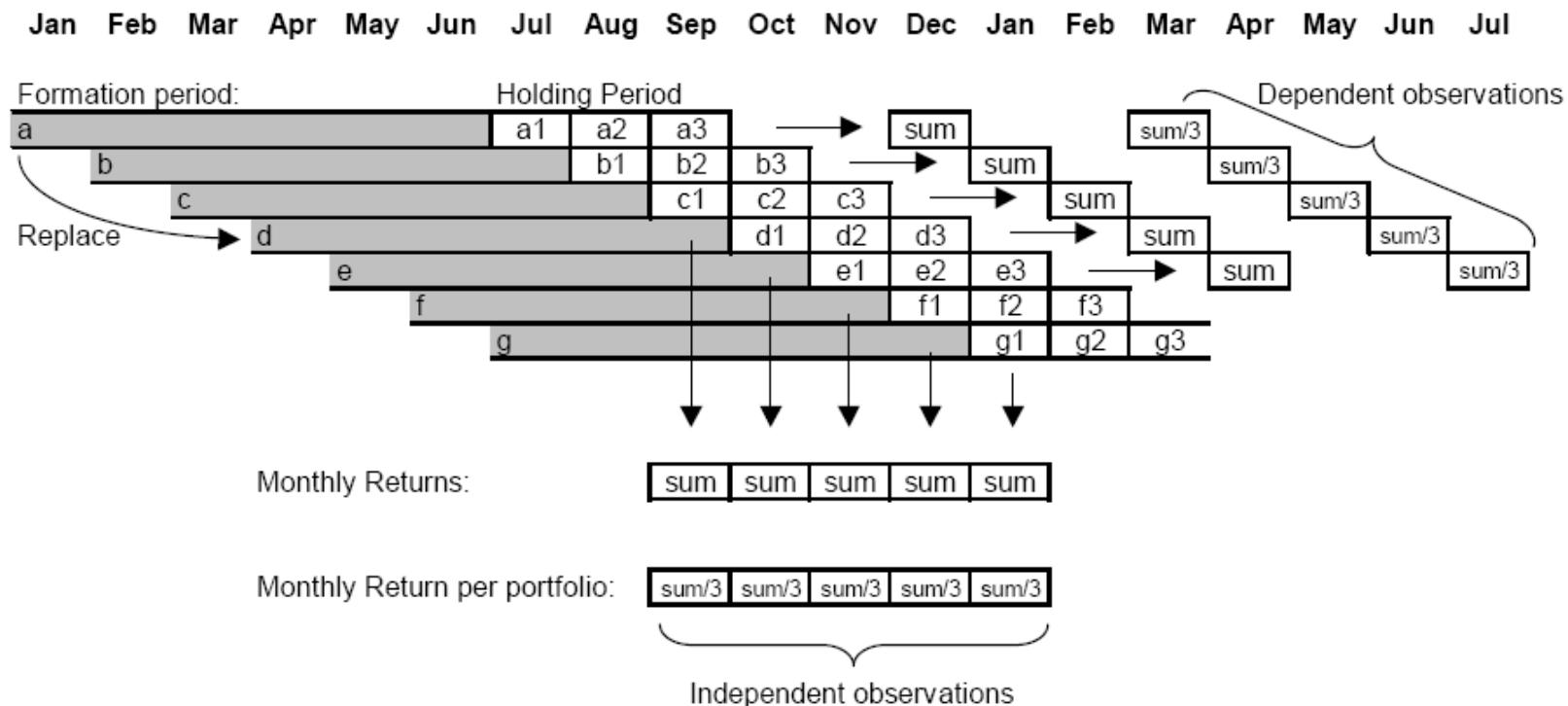
- Step1. Universe filtering
- Step2. Sorting based on a particular score
- Step3. Quantile Portfolio Construction
- Step4. Report the returns of the portfolios
- Step5. Performance validation & robustness checks
- Step6. Examine Rationale of Risk Premiums

Step1. Universe filtering

- Building a tradable stock universe
 - Filters (ex. AUM, Trading dollar volume, Days from IPO)
- Backtesting vs. Real Investments
 - Reduce potential “Luck” components
 - Transaction Costs
 - High Turnovers
 - Timing Loss

Note. Terminology for Portfolio Construction

- Formation periods: 1Y
- Holding periods: 1Y
- Rebalancing periods: 1M



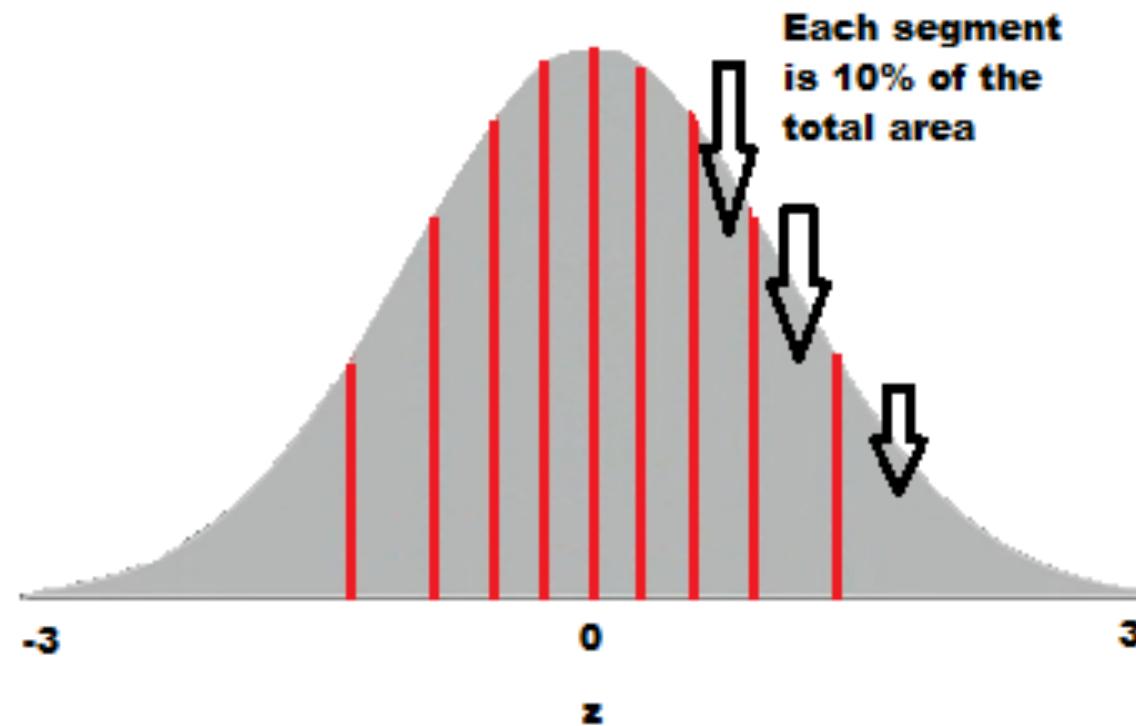
Step2. Sorting based on a particular score

- Rank firms according to a particular criterion at formation period
 - e.g., **momentum**, size, book-to-market ratio
 - **momentum**: sort portfolio based on 12-1M return

<https://quant.stackexchange.com/questions/26382/how-to-calculate-monthly-return-from-a-momentum-strategy-with-overlapping-holding>

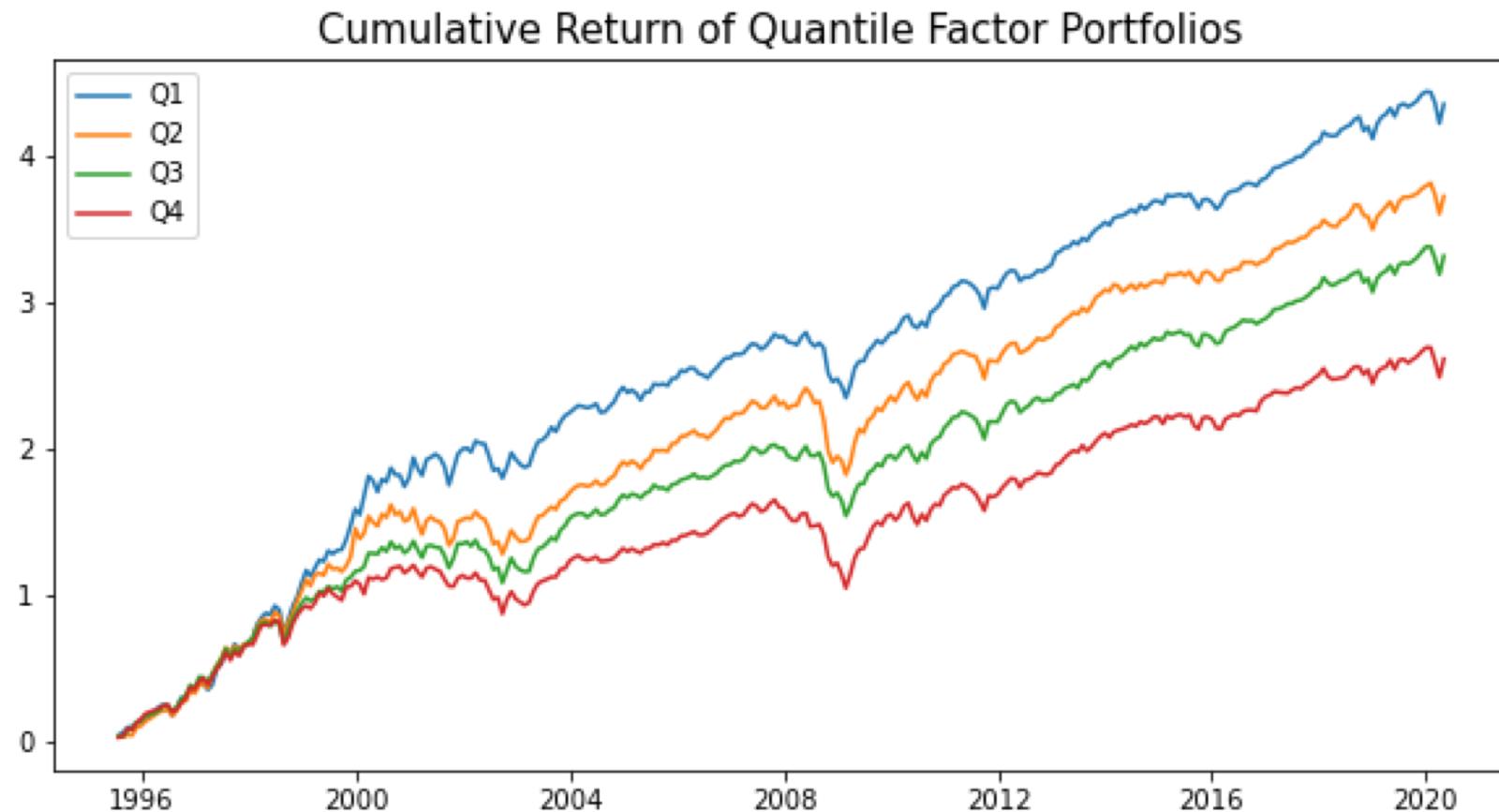
Step3. Quantile Portfolio Construction

- Form $J \geq 2$ portfolios (i.e., homogeneous groups) consisting of the same number of stocks according to the ranking
 - Ex. Decile



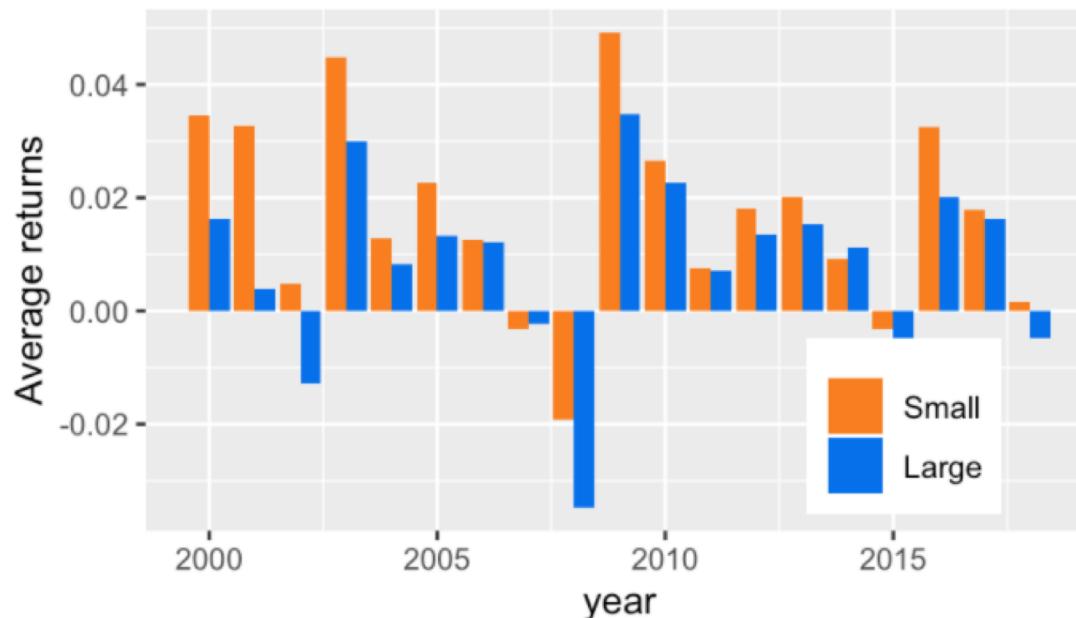
Step4. Report the returns of the portfolios

- Usually one month future returns are reported until the chronological end of the sample



Step5. Performance validation & robustness checks

- An anomaly is identified if the t-test between the first ($j = 1$) and the last group ($j = J$) unveils a significant difference in average returns
- Ex. Size Factor ($J=2$)



Step5. Performance validation & robustness checks

- Why T-Stats?
 - Time varying properties of factor returns
 - Optical illusions
 - Significant & Consistent Alpha
- Evaluate Long-Short T-Stat
 - J^{th} quantile / 1^{st} quantile

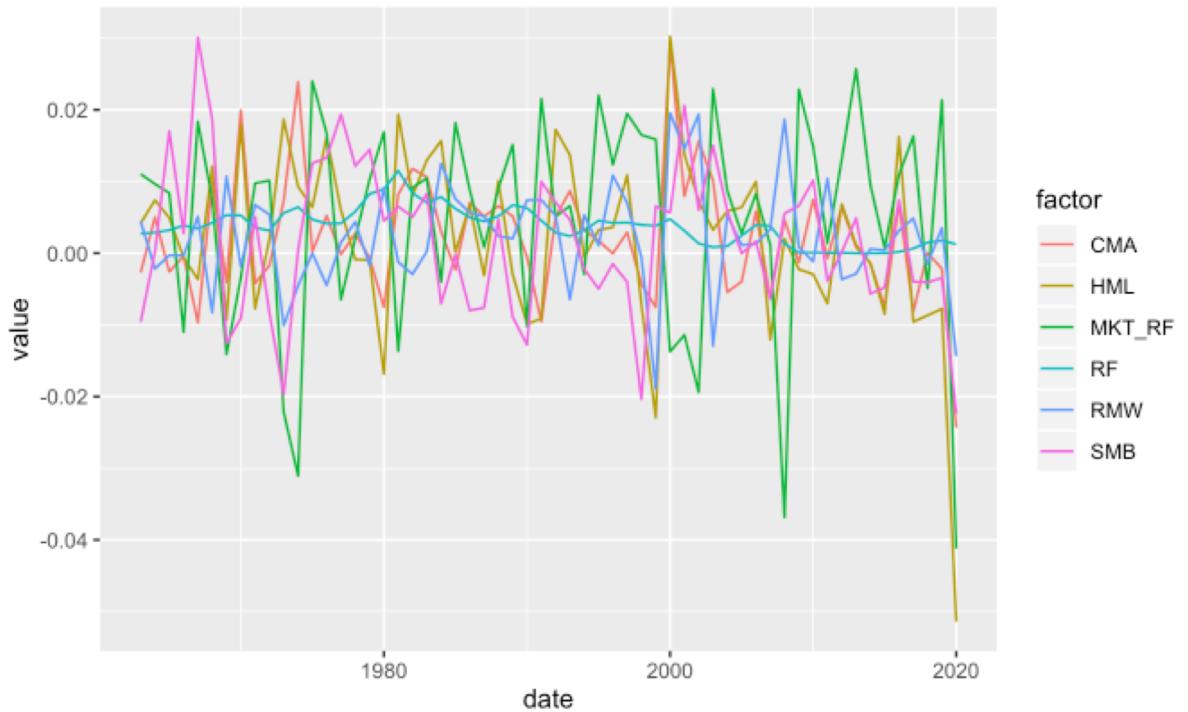
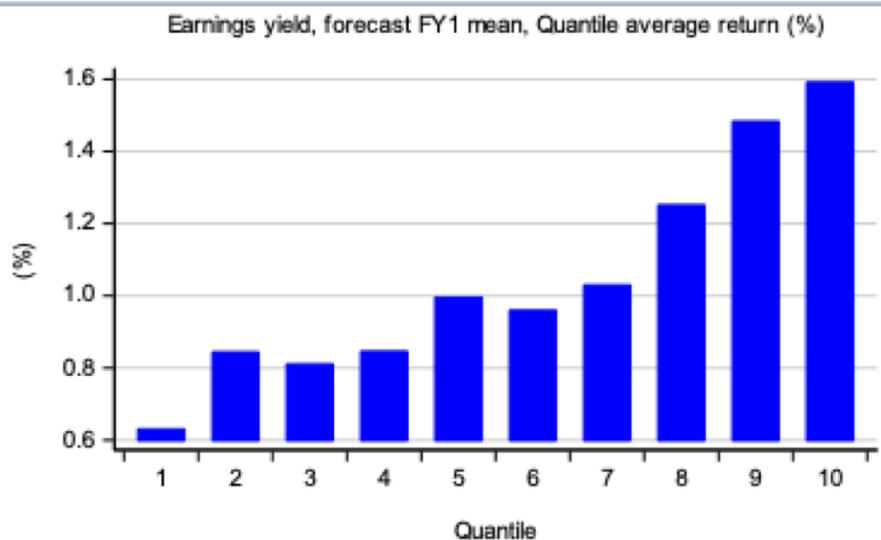


FIGURE 3.2: Average returns of common anomalies (1963-2020). Source: Ken French library.

Step5. Performance validation & robustness checks

- Also, need to evaluate long only position
 - In most cases, portfolios take long only positions, so we cannot exploit factor returns as it is. (Long only position = market factor + factor tilts)

Cheap stocks are (almost) always good



- Evaluate Long Only Performance T-Stat
 - 10th quantile vs. Benchmark
- Benchmarks
 - Market Cap Weighted
 - Equally Weighted
 - Risk Parity

Step6. Examine Rationale of Risk Premiums

- **Source of Abnormal Returns**
 - **Type1. Risk Compensation**
 - Compensation from exposures to systemic risk
 - Ex) Small Size, High Vol
 - **Type2. Mispricing**
 - Efficient Market Hypothesis (EMH)
 - Null Hypothesis: News is rapidly and fully incorporated in prices
 - Ex) Inherently Inefficient Information (Text)

Step6. Examine Rationale of Risk Premiums

Risk explanation		Behavioral explanation
Premiums are consistent with rational pricing		Premiums are a result of suboptimal investor behavior
Market	Economic uncertainty; borrowing constraints; uncertainty about long-run risks.	Loss aversion and concern over short-term volatility of wealth.
Value	Cyclical risk of positive correlation between economic activity and security's returns.	Recency bias leads to investors shunning distressed firms and overpaying for recent growth.
Size	Cyclical risk of smaller firms being more exposed to changing, negative economic activity and default risk.	NA
Momentum	NA	Underreaction to new information being incorporated in asset prices.
Low volatility	Leverage and institutional (benchmarking) constraints.	"Lottery" effects leading to preference for high-volatility stocks with small chance of large payouts.
Term	Inflation uncertainty; supply/demand factors.	Loss aversion at longer maturities; role of bonds as a safe-haven asset.
Credit	Default and downgrade risk; positive correlation to economic activity.	NA

Source: Vanguard.

Does Factors Guarantee Future Risk Premiums?

- Challenge 1. The publication bias towards positive results
 - The need for replication is therefore high and many findings have no tomorrow, especially if transaction costs are taken into account (Patton and Weller (2020), A. Y. Chen and Velikov (2020)).

Does Factors Guarantee Future Risk Premiums?

- Challenge2. The anomaly becomes public after publication
 - Then, agents invest in it, which pushes prices up and the anomaly disappears
 - McLean and Pontiff (2016) and Shanaev and Ghimire (2020) document this effect in the US but H. Jacobs and Müller (2020) find that all other countries experience sustained post-publication factor returns

Does Factors Guarantee Future Risk Premiums?

- Challenge3. Smart-beta products (ETFs)
 - The democratization of so-called smart-beta products that allow investors to directly invest in particular styles (value, low volatility, etc.)

How to Expose Your Portfolio to Certain Factors

- Quantile Portfolio
 - Long / Short
 - Long Only: Market + Factor
- Factor Tilts
 - Weighting Scheme
 - Considering Active Risks
- Smart Beta (ETFs)

Summary of Factor Models

- Question1. How do we know it's a good factor?
 - Find **statistically significant** risk premiums over long enough periods
 - Examine **underlying mechanisms** of risk premiums
- Question2. Does Already Known Factors Guarantee Future Risk Premiums?
- Question3. How to implement factor exposures to our portfolio
 - Long only, Long/Short position based on a quantile portfolio
 - Factor-tilts
 - Smart beta (ETFs)

Not covered topics.. But highly recommend to study!

- Double sorting methods
- Multi factor models
- Characteristic Models
- Regression-based & ML-based Approach
- Factor Returns \neq Risk premium
 - Control contributions of other factors
 - Fama-Macbeth Regression

Part2. Career Advice to Become a Quantitative Portfolio Manager

(Sample Size 1)

Summon my previous years...

- I have followed unstructured learning paths
 - Major in {CS, Finance and MIS}
 - Served as CTO for 2 years at startups
- Basically, two dimensions
 - Skill1. Computer Science (ex. Algorithms) and Coding Skills (ex. Python)
 - Skill2. Finance (ex. Asset Pricing)

Thought Has Been Changed as My Experience Grows Up

- At the beginning of my career, I had thought that ...
 - Computer Science > Finance
 - Even interviewers prefer candidates who have strong CS backgrounds
- However, as my industry experience grows up ...
 - Finance > Computer Science
 - CS techniques are just tools to efficiently examine our ideas and questions
 - More important things are related to **the investment philosophy** grounded on scientific evidences

Some Paradoxes at Interviews

- Paradox at the interview
 - Knowing the context of finance is more important than computer science techniques but you should position yourself as a CS master at interviews
 - Similarly, everyone knows the limitations of machine learning in Finance.
 - However, you should show huge interests on ML in Finance to elicit curiosities of interviewers.

How to Hone Your Scientific Investment Philosophy

- Your scientific investment skills are directly proportional to the reading volume of finance literature
- But, not all papers are meaningful
 - **Academic Journals:** the Journal of Finance, the Review of Financial Studies, the Journal of Financial Economics
 - **Practitioner Journals:** the Journal of Portfolio Management, the Financial Analysts Journal
 - **Working Papers (SSRN):** Why? Market efficiency, Decaying alphas

Random Tips

- Maintain sharp learning curves
- Be energetic and open-minded
- Don't forget social skills and communication skills

Closing Remarks

- Feel free to ask questions
 - Jongho Kim
 - Contact: quantic.jh@gmail.com
- Good luck!



Thank You

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