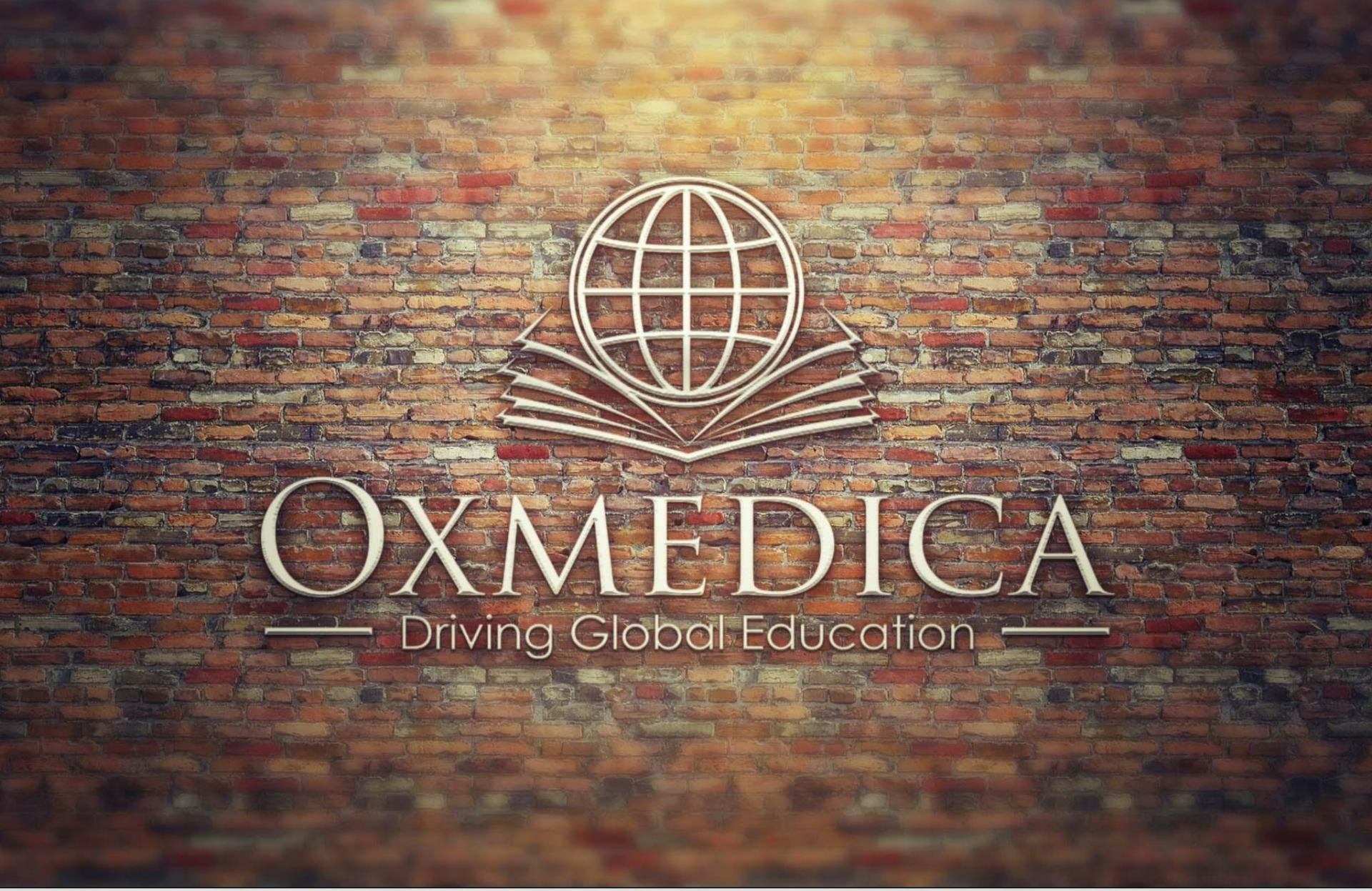
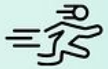


Quantitative Finance

What is Quantitative (Quant) Finance

- Specific wing of finance concerned with using mathematics (often called **mathematical finance** or **financial mathematics**)
- Alternative is traditional trading

Difference Between Traditional & Quant Trading

Traditional Trading		Quant Trading
Intuition based Decision Making		Data Driven Decision Making
Emotional Biases		Objective decisions
Based on Experience		Mathematical Proficiency
Slow and Time Taking		Fast Paced
Limited		Scalable

Wright.

[Source]

Financial objects

Stocks: A share of the ownership of a company. Also called shares or equity.

Bonds: Debt issued by a company or the government with the promise to pay the buyer interest payments (coupons) and repayment at maturity

Derivatives: Contracts whose value is derived from underlying financial assets. You can think of these as calculated bets on the price of other financial objects. Useful for hedging risk.

Risk and return

- Buying assets has the promise of **return**
- … but comes at some **risk** of the return not materialising

Quantitative Finance

- Goal is to use statistics and machine learning to model the price of assets and therefore predict the best time to buy/sell
- Is this supervised or unsupervised?

Discussion: What is a basic model we could use?

Simple Moving Average (SMA)

- Average the prices over a period to predict the future price
- Simple as that!
- Common windows are 10-day, 50-day, or 200-day MAs.
- **Question:** What would a price above the moving average indicate and how might you act?

Exponential Moving Average (EMA):

- Slightly more complex model…
- Weights recent prices a little bit higher in predicting the next price

Example strategy

- Calculate the 200 and 50-day moving averages
- When the 50-day MA > 200-day MA we call this the “Golden Cross” -> What should we do here?
- When the 50-day MA < 200-day MA we call this the “Death Cross”. What should we do here?

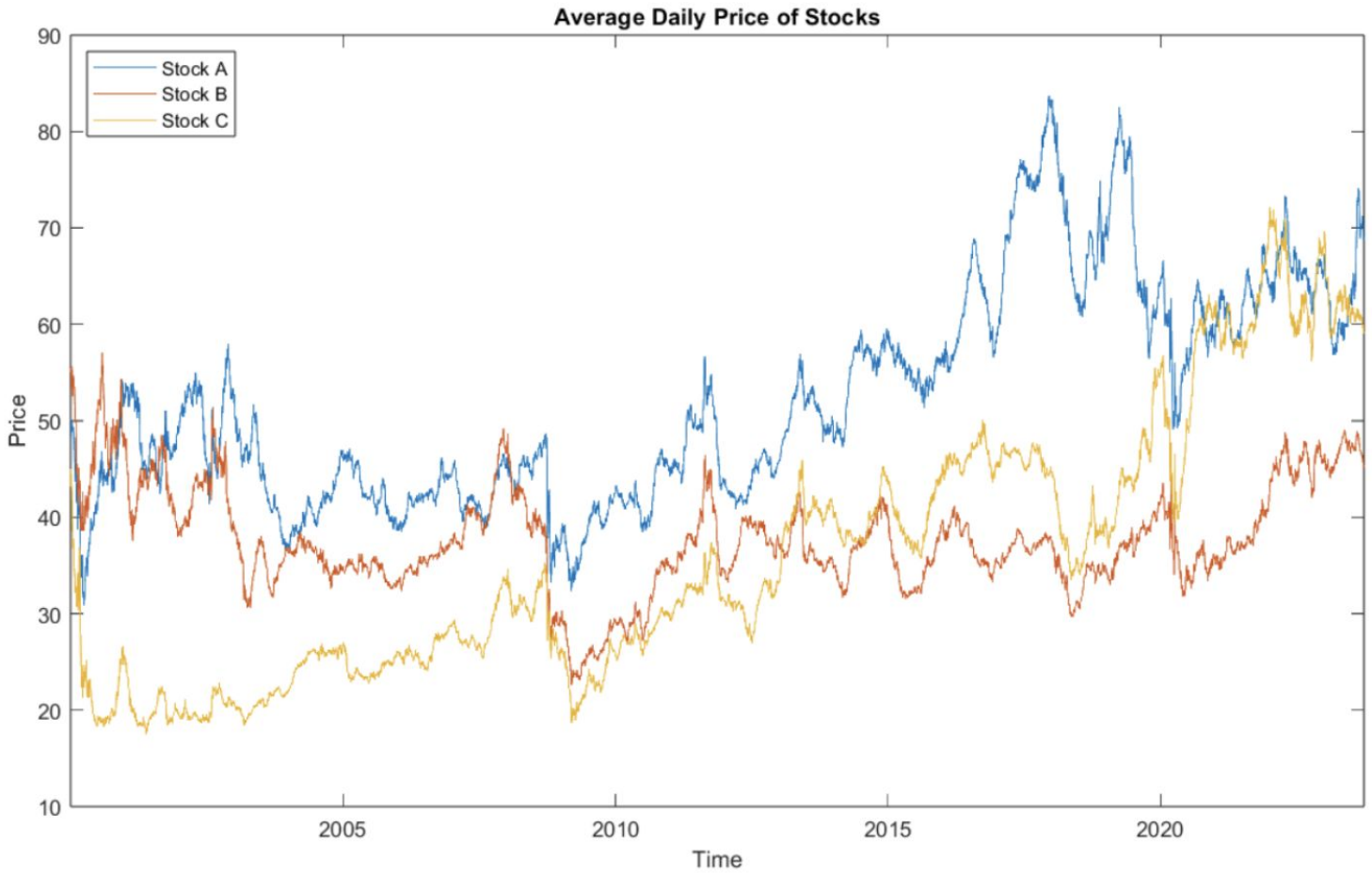
Discussion in pairs: What are the strengths and limitations of this method?

Strengths and weaknesses of this strategy

✅ Simple strategy which may make money long-term

❌ The cross is likely to indicate a past change in the trend so it might have already happened by the time you make your move!

Advanced Machine Learning Models



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Advanced Machine Learning Models: Deep Learning

- Use **deep learning models** to predict future stock price.
- Is this supervised or unsupervised learning? Why?
- What might be useful input features?

Discussion in pairs:

Can you think of any limitations of quantitative approaches to finance?

Limitations

1. **Overfitting** on past data.
2. Complexity
3. Interpretability and explainability.
4. Herding
5. Non-quantitative factors like “mood” and “expectations”
6. Events not captured by the training data e.g. 2008

Salaries?

What are quant finance salaries like?

Data Scientist	$40k
Machine Learning Engineer	$70-120k
AI Researcher	$100k-$300k
Quant Finance	$150k-$400k

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Source, Source, Source, Source, Source

Case Study

Individual Task

Long-Term Capital Management

- Read this overview of the hedge fund Long-Term Capital Management, then we're going to discuss the text.
- https://www.bauer.uh.edu/rsusmel/7386/ltcm-2.htm
- Discussion