

# An introduction to “Statistics for financial practitioners”

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# The aim of this course

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To learn probability and statistics as tools specifically to

1. understand,
2. manipulate and
3. model

financial variables.

“To convert inchoate intuition into quantitative strength.”

# The formal structure

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There will be three logically contiguous chunks:

1. Probability
2. Statistics and the econometric framework
3. The ultimate financial application: continuous time finance

# Probability

# The random world of returns

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For equity, fx, bond returns:

- Summarise random numbers into a probability distribution.
- How to choose between alternative distributions.
- Applications:
  1. Value at Risk
  2. Multivariate distributions of returns
  3. Risk–return trade-offs
  4. Portfolio characteristics and optimisation
  5. Pricing assets
- The **How, Where, and Why** of using Monte Carlo simulations.

# The limitations

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- Static picture, but the world is dynamic.
- Linear products and analysis
- We assume we know the **true** distribution.

# Statistics and econometrics

# Building models!

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## Some applications

1. The central limit theorem: the single index market model for stocks
2. Overcoming ignorance of the true distribution: the bootstrap in Mibid-Mibor
3. Cross-dependance in returns of different assets: linkages between INR-USD returns and the one-year interest rate
4. Time series dependance in returns and risk: VaR of a portfolio



# Testing model performance

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- Using statistical tests: does the model output fit “our (statistical) perception” of the world?
- Using market price tests: does the model output fit market prices?

# Continuous time finance

# Price behaviour in real-time

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- Move from monthly, weekly, daily returns to intra-day returns
- Forecast returns as a function of volumes, spreads, volatility, returns.
- Ito's lemma
- Pricing options: Black–Scholes
- Models for interest rates

# References

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- **“Introduction to probability models”** by Sheldon Ross.
- **“Investment Science”** by David Leunberger.