
An introduction to “Statistics for financial practitioners”

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The aim of this course

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

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

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

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

Statistics and econometrics

Building models!

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

- 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

- 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

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