# **Statistics is cross-disciplinary!**

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C.A.S.E. – Center for Applied Statistics and Economics

http://lvb.wiwi.hu-berlin.de http://www.quantnet.de



- What will be the Social Security contribution in 2030?
- How likely is it that a portfolio changes by a certain amount?
- How to classify the probability of default for a company?
- At what temperature can a space shuttle get a clearance for take off?



- Insurance against weather volatility
- Reference to a weather index
- Determinants of weather indices
  - Temperature (95% of all WDs)
  - Precipitation (Rain, Snow)
  - Humidity, wind speed
- Transaction form
  - Options
  - Futures







• How many own goals did Hertha BSC score in 2010/2011?

• How likely is an own goal in the last three minutes?







Adding the football team to the sample broadens the histogram: dispersion of weight increases









Estimation of PDs: The boundaries of six risk classes are shown, which correspond to the rating classes: BBB and above (investment grade), BB, B+, B, B- and lower.





2007

2030

#### Demographic development in Germany

Interactive example at http://www.destatis.de/bevoelkerungspyramide/



#### **Descriptive Statistics**

Description of observed values

• Frequency distribution and graphs

• Mean Values and dispersions

#### **Inferential Statistics**

• Conclude from a sample to the population

• Degree of uncertainty is measured with

probability theory

• Inference over several models



#### **Descriptive Statistics**



What is the average income? Mean (blue) = 40493 EUR, Median (red) = 33690 EUR

#### **Inferential Statistics**





## Ladislaus von Bortkiewicz

- 1901 1931: Chair of Statistics at the Institute of Political Economy and Statistics, Friedrich-Wilhelms-Universität zu Berlin
- Prussian army horse kick data
- LvB (Poisson) distribution

W. Härdle: "data challenges good theory, theory is created from real data"





### Lecture Statistics I

- 1. Basics of probability theory
- 2. Univariate statistical analysis
- 3. Bivariate statistical analysis
- 4. Distribution models
  - 90-min Exam



## Lecture Statistics II

- 1. Sample theory
- 2. Estimation techniques
- 3. Hypothesis testing
- 4. Regression analysis
- 5. Time series analysis

90-min Exam



### How to teach STAT

#### Bachelor

#### Master





#### Ph.D.

- 😹 Economic Risk Seminar
- Statistical Tools in Finance and

Insurance

- 😹 Mathematical Statistics Seminar
- 😹 Selected Topics of Mathematical Statistics





#### **Statistics of Financial Markets**





#### **Statistical Tools in Finance**



Cat Bonds: Structure of Cash Flows. Event (red), no event (blue)



### Multivariate Analysis



Single Linkage Dendrogram: displays the observations, the sequence of clusters and the distances between the clusters



# Statistics – Scientific Data analysis made clear



• german, english, spanish,

french, . . .

- HTML-based
- Access via www.mhsg.de



#### Databases – Quantnet, MM\*Stat

Direct Link to Quantlets of:	Keywords option PCA		
SM	IS SPM MVA SFM SFS STF XFG SCatterplot regression density vo		
Published in:	Statistics of Financial Markets		
See also:	SFEWienerProcess, SFElognormal, SFEsimCIR		
Keywords:	Euler, brownian, discrete, stochastic		
Submitted:	Thu, August 25 2011 by Awdesch Melzer		
Usage:	SERCEMProcess		
Tanut			
Input.	method - type of method used: 1 - direct integration 2 - Euler scherne		
Output:	- Plot of typical path of a geometric brownian motion.		
Example:			
Description: Use n=1, x0=0.084,	er inputs the SFEGBMProcess parameter "Method". A plot is provided for the case mu=0.02, sigma=sqrt(0.1) delta=1/1000 m		
Direct integratio	Operative Description Matters		
Direct integratio	Geometric Brownian Motion		
Direct integratio	25		
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- Quantnet: Matlab, R
- MM\*Stat: Wiki,

Multi-Media-Statistics



### Bloomberg, Datastream and Ecowin

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• Bloomberg

- News and Information Services
- Extensive financial data (i.e. on

weather, energy and climate risk)

- Datastream/Ecowin:
  - Historical economic Data
  - Bonds and stocks
  - Interest and exchange rates



#### Compustat and CreditReform



• Time Series for Company Data

(20 years)

 Balance sheet data for solvency of companies in the US, Germany and Austria



Conclusion \_\_\_\_\_

#### Enjoy statistics – the data science!

Statistics is cross-disciplinary!



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