d-fine

defining d-fine

XXXV Heidelberg Physics Graduate Days

Heidelberg, October 5th, 2015

Agenda

Why we exist

Trends in the Financial World

Various developments lead to a high demand for advice

- Increasing regulatory requirements
  - Measurement of market, credit, liquidity and operational risks (Basel III / Solvency II) and the corresponding capital charge
  - Regulatory reporting (AnaCredit, BCBS 239)
  - Market value-driven accounting (IFRS)
- High competitive pressure
  - Declining profit margins
  - Controlled acquisition of risks
- Increasing functional and mathematical complexity
  - Products (complex derivatives) and models
  - Risk measurements
  - Control procedures
- IT development

- (Further) development of risk / return strategies
- Building business functionalities
- Development and implementation of mathematical models and methods
- Implementation through use of information technology and design of organizational processes

Who we are

d-fine in a Nutshell (1 / 2)

» d-fine has more than 500 professionals with offices in Frankfurt, Munich, London, Vienna, and Zurich

» d-fine belongs to the Top 10 German Management Consultancies.[1]

Top 10 der deutschen Managementberatungen

	Unternehmen, die ihren Hauptsitz sowie die Mehrheit des Grund- und Stammkapitals in Deutschland haben.	Gesamtumsatz in Mio. Euro		Mitarbeiterzahl insgesamt	
		2014	2013	2014	2013
1	Roland Berger Strategy Consultants Holding GmbH, München *)	560,0	750,0	2.400	2.700
2	zeb.rolfes.schierenbeck.associates GmbH, Münster	179,0	169,0	897	844
3	Simon Kucher & Partners Strategy Consultants GmbH, Bonn	172,0	152,0	720	680
4	Horváth AG (Horváth & Partners-Gruppe), Stuttgart	122,0	105,5	536	483
5	Kienbaum (Unternehmensgruppe), Gummersbach	115,0	112,0	670	710
7	d-fine GmbH, Frankfurt am Main	95,5	82,0	530	471
9	Porsche Consulting Gruppe, Bietigheim-Bissingen *)	90,0	85,0	372	360
10	goetzpartners Group, München	82,0	77,0	250	220

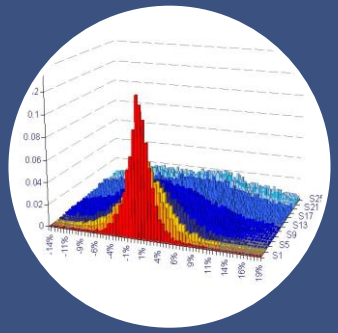
[1] see Lünendonk list 2015

d-fine in a Nutshell (2 / 2)

- We help banks, asset managers, insurance companies, industrial corporations, hedge funds and supervisory organisations with all trading, risk management, asset/liability, loan management and back office projects
  - From A to Z, from first strategic ideas to industry-strength solutions
  - From mathematical modelling to business process implementations
  - From retail and corporate loans to exotic credit and equity derivatives
  - From internal market risk models to IFRS
  - From capital allocation to risk-adjusted portfolio management
  - From internal rating systems to fully fledged Basel III and Solvency II implementations
  - From business analysis to project management

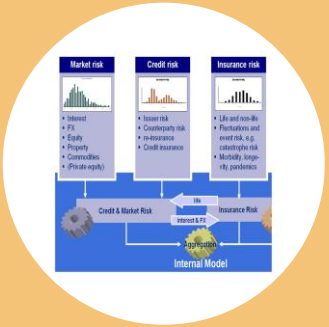
d-fine is actually the leader within some of these specialised areas

Our Services



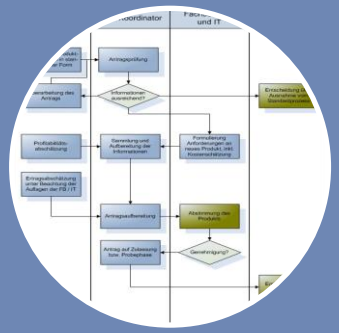
Valuation / Models

- Development and validation of models for valuation and hedging of derivatives
- Rating methodologies
- Calculation and profit testing of insurance rates



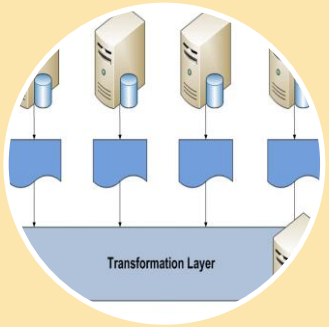
Risk Management

- Development of risk models and control procedures
- Realisation of regulatory requirements, e.g. Solvency II, Basel III or EMIR and REMIT
- Audits with focus on mathematical and regulatory aspects



Professional Design

- Advice on processes and organisational issues
- IFRS realisation
- Procedures for the value-based management of enterprises
- Valuation in the context of corporate finance
- Post merger integration

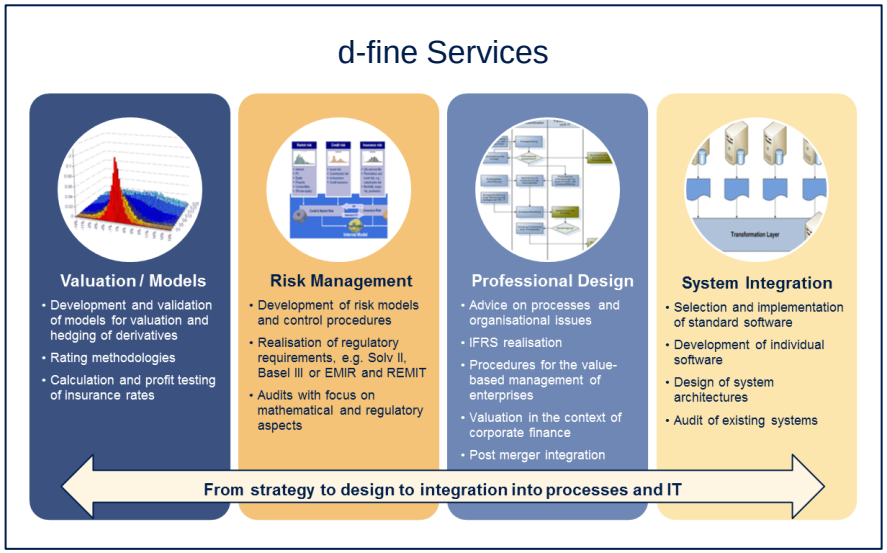


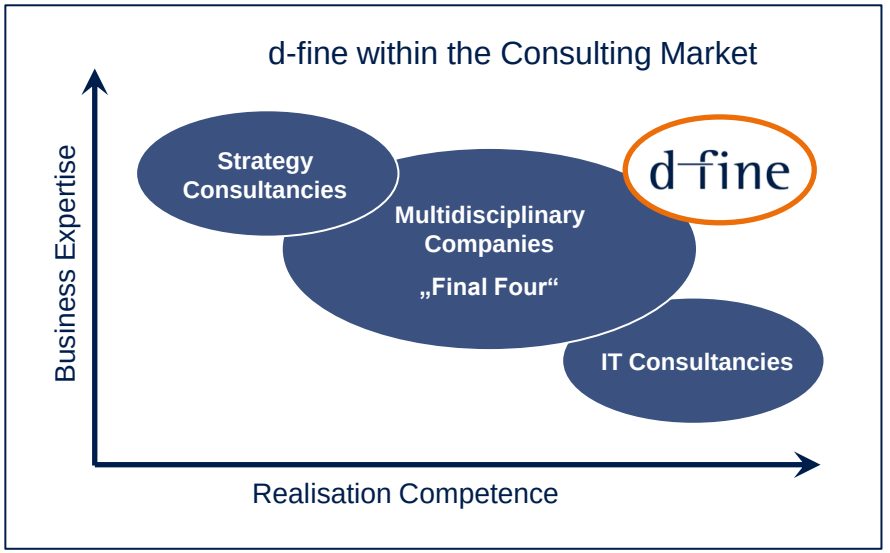
System Integration

- Selection and implementation of standard software
- Development of individual software
- Design of system architectures
- Audit of existing systems

From strategy to design to integration into processes and IT

Our Services within the Market



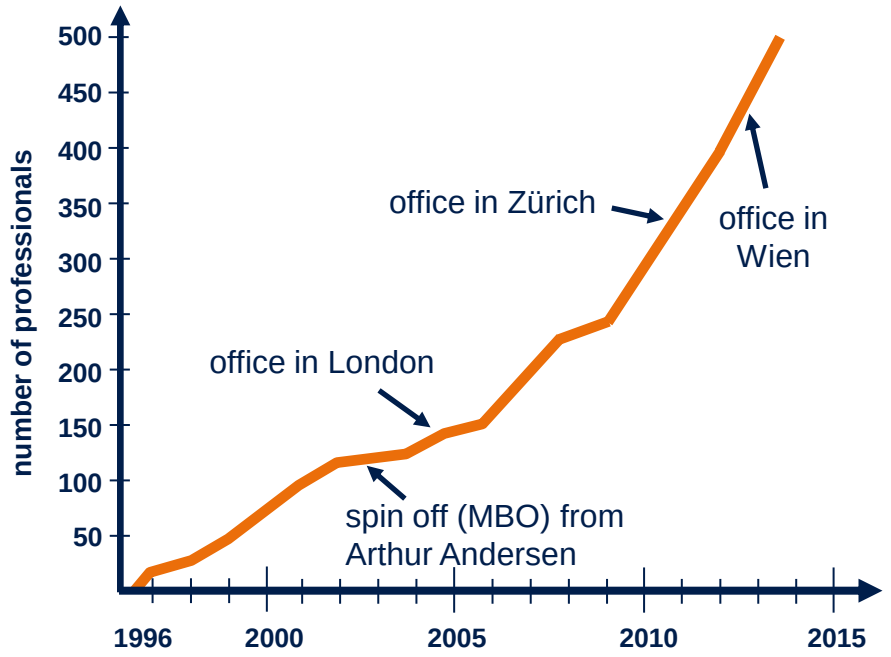


- » d-fine offers services for the financial world around valuation, risk and financial management, accounting, reporting and IT-integration
- » d-fine is independent of the big multidisciplinary companies (audit independence)
- » d-fine combines strategic thinking, professional expertise and methodology with implementation expertise

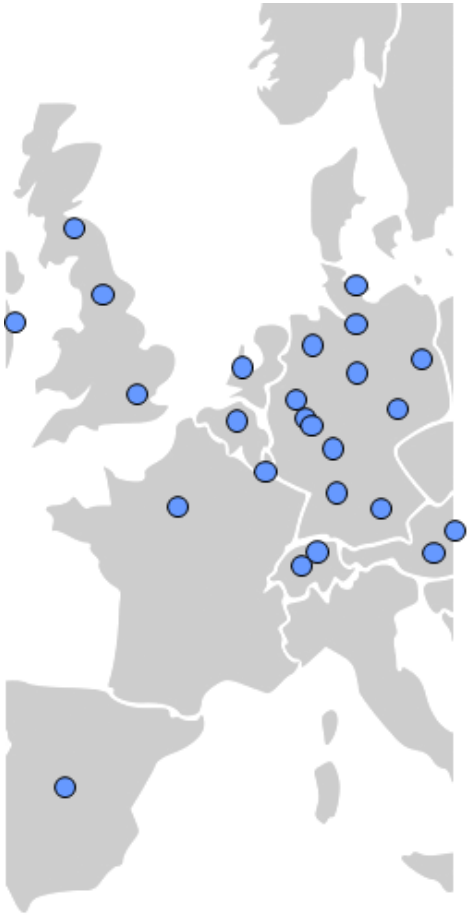
Our History

- Successful in business since 1996
- Founded as a speciality consulting service of Arthur Andersen Germany
- Continuous and constant organic growth
- Hundreds of successful projects on all scales
- Developed a very high level of cooperation with universities and software providers

- d-fine as a separate legal entity
  - Since 07 / 2002: d-fine GmbH
  - Since 11 / 2004: d-fine Ltd, London
  - Since 07 / 2010: d-fine AG, Zurich
  - Since 03 / 2012: d-fine Austria GmbH, Vienna



Our Clients



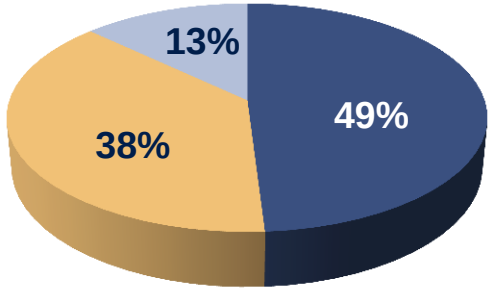
- Large, medium sized, and specialised banks
- Insurances, asset managers, hedge funds
- International industry corporations and energy traders

Our client list (abridged):

- Aareal Bank
- adidas
- apoBank
- ampegaGerling
- ARAG
- AXA
- Barclays Capital
- BayernLB
- BMW
- Bundesrepublik Deutschland Finanzagentur
- Commerzbank
- CQS Management
- CLS
- Daimler
- DBS Singapore
- DekaBank
- Deutsche Bank
- Deutsche Bundesbank
- Deutsche Hyp
- DG Hyp
- DVB
- DWS
- DZ BANK
- EIB
- European Commodity Clearing
- E.ON
- EnBW
- Erste Bank
- Hannover Rück
- Helaba
- HSH Nordbank
- HSBC Trinkaus
- Hypothekenbank Frankfurt
- KfW
- Landesbank Berlin
- LBBW
- MEAG
- Münchener Hypothekenbank
- NRW.BANK
- Nord/LB
- Portigon
- R+V
- RZB, RBI
- RLB Steiermark
- RWE
- Sparkasse KölnBonn
- Talanx
- Toyota Kreditbank
- UBS
- Union Investment
- VW Financial Services
- Zürcher Kantonalbank

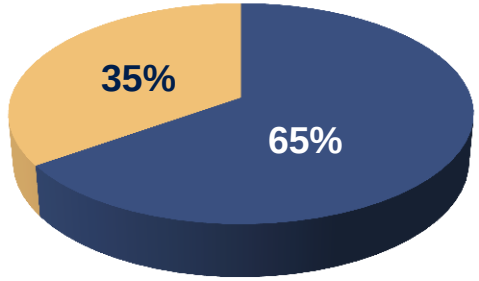
Our People – Your Future Colleagues?

» Deep technical and mathematical skills



- physicists
- mathematicians
- other (IT, MBA, economics)

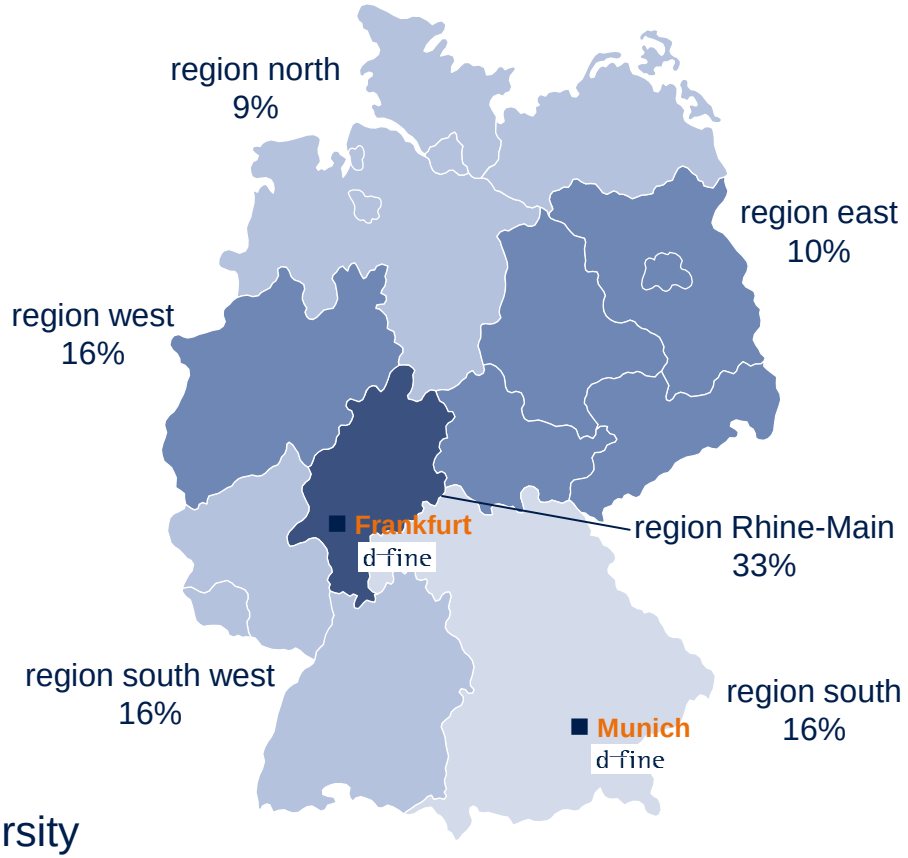
» Highly qualified



- PhD level degrees
- master level degrees

» Typically in top percentile of their class at university

Residences of employees in German regions



What we offer

Interesting Tasks

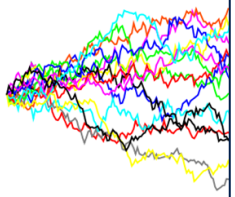
Stock process

The Geometric Brownian motion of some stock price $S(t)$

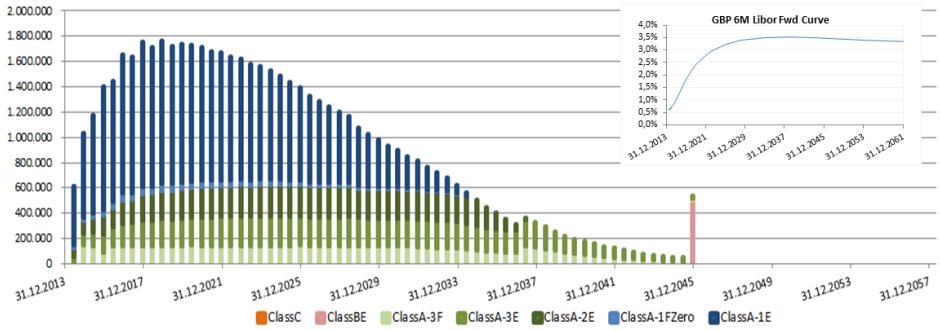
Drift — Volatility — Standard normal distributed random number

$$dS_t = \mu S_t dt + \sigma S_t dW_t \qquad dW_t \approx \varepsilon\sqrt{dt}$$

$$d \ln S_t = \left(\mu - \frac{\sigma^2}{2}\right) dt + \sigma dW_t$$



FAB UK 2004-1 Ltd. – Interest Cash Flows to Notes (Base Case)



- Exp. interest payments are driven by shape of the forward curve and outstanding nominal
- Class BE receives large interest cash flow from expected asset sale at maturity

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A Personal Comparison – Physics vs. Mathematical Finance (1 / 4)

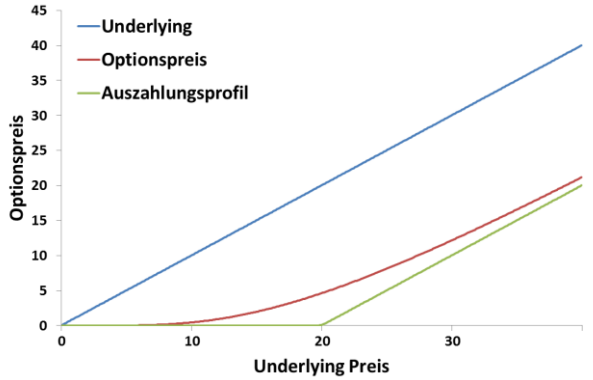
» Heat equation

$$\frac{\partial T}{\partial t} - \frac{\lambda}{\rho c}\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right) T = 0$$

T : temperature
t : time
$\lambda/\rho c$: thermal diffusivity
x,y,z : spatial variables

» Black-Scholes equation

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} - rV = 0$$



V : price of an option on an underlying (e.g. a stock)
S : price of the underlying
t : time
σ : measure for the variance of the underlying
r : risk free rate

Solve different problems with the same mathematical methods

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A Personal Comparison – Physics vs. Mathematical Finance (2 / 4)

» Path integral of pure (lattice) gauge theory

$$\langle \mathcal{O}(U_\mu) \rangle_T = \frac{1}{Z} \int_{per} \mathcal{D}U \, \mathcal{O}(U_\mu) \exp\{-S_G[U_\mu]\}$$

with $$Z = \int_{per} \mathcal{D}U \exp\{-S_G[U_\mu]\} \ .$$

› Monte Carlo simulation of the gauge fields (e.g. gluons) to achieve a thermalisation of the configuration

» Value at Risk (VaR) computation in the context of market risk

$$\mathrm{VaR}_F\left(\vec{S}, P_a, t, \Delta t\right) \cong -a \sqrt{\Delta t} \sqrt{\sum_{i,j=1}^{n} \Delta_i \, S_i(t) \sigma_i \, \rho_{i,j} \, \Delta_j \, S_j(t) \sigma_j}$$

with $S_i(T) = S_i(t) \, e^{\left(\mu_i - \sigma_i^2/2\right)\Delta t + Y_i}$ for $i = 1, \ldots, n$

› Monte Carlo simulation of the risk factors (e.g. stock prices)

Solve different problems with the same numerical methods

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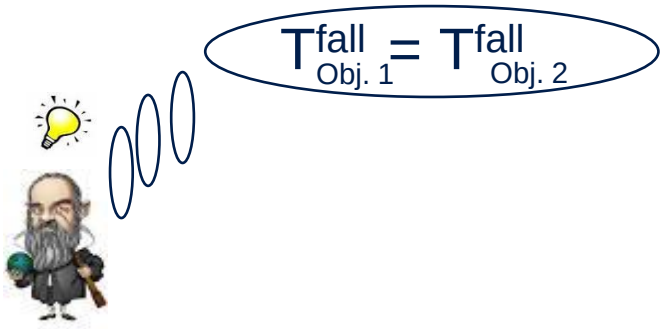
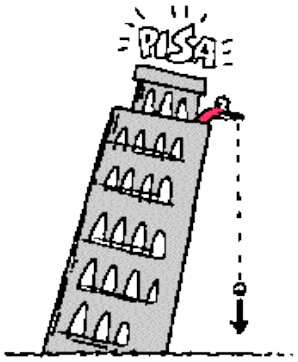
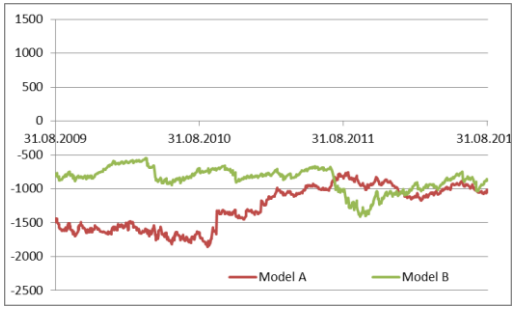
A Personal Comparison – Physics vs. Mathematical Finance (3 / 4)

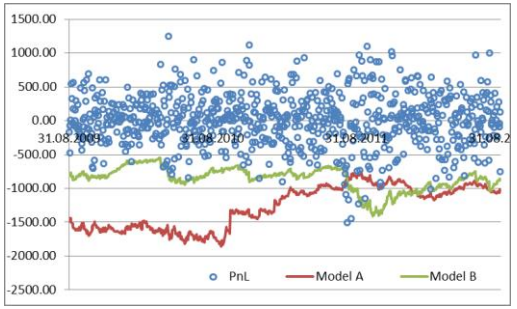
» Model validation – physics:
Testing a theory by experiments





» Model validation – mathematical finance:
Testing a (marked) risk model by „backtesting“

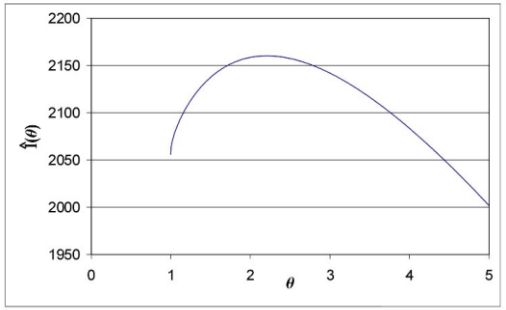




Verify the quality of a model with the same validation criteria

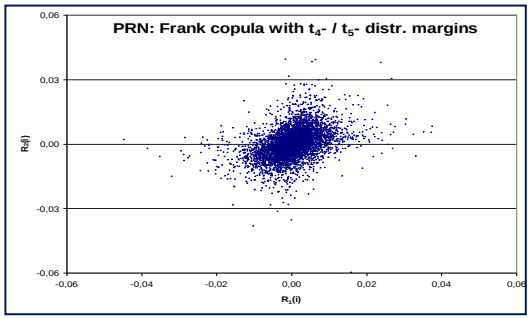
A Personal Comparison – Physics vs. Mathematical Finance (4 / 4)

» Maximum likelihood parameter estimation

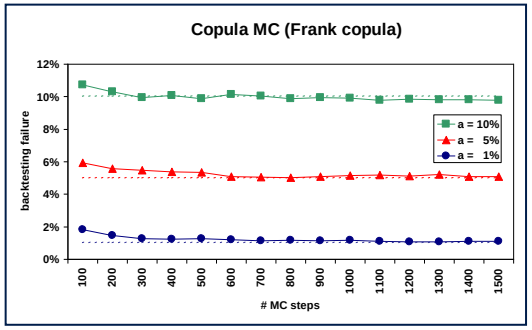


modified likelihood function $\hat{l}(\theta)$ vs. θ

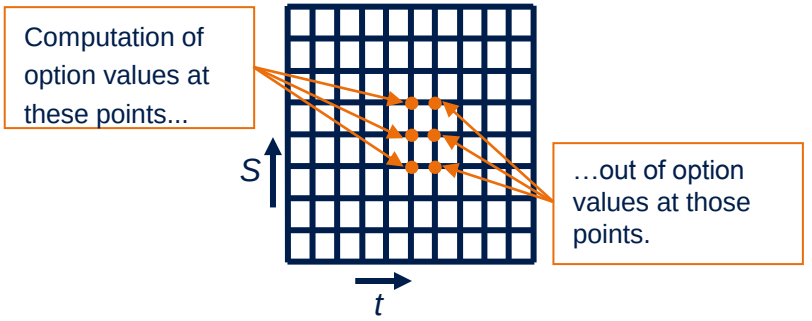
» Generation of pseudo random numbers (MC simulation)



» Evaluation of experimental data



» Solving of PDEs



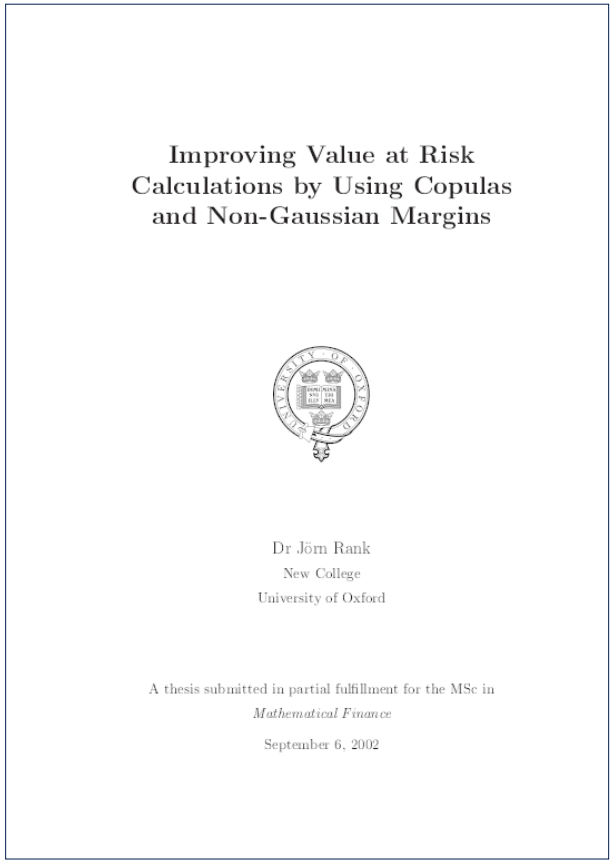
d-fine offers “High End Training”

- University of Oxford
  - M.Sc. or Diploma in Mathematical Finance
  - Duration approx. 2,5 years, modules take place in Oxford
- Frankfurt School of Finance & Management
  - M.Sc. in Finance, Risk Management & Regulation
  - Duration approx. 3 years, modules take place in Frankfurt
- Mannheim Business School
  - Executive MBA (Weekend-Track)
  - Duration approx. 1,5 years, modules take place in Mannheim and abroad (e.g. Singapore)
- European Business School
  - Executive MBA
  - Duration approx. 2 years, modules take place near Wiesbaden and in Durham (UK)
- HHL Leipzig Graduate School of Management
  - Part-Time MBA
  - Duration approx. 2 years, modules take place in Leipzig or Cologne

Additional Continuous and Intensive Training

- CFA (Chartered Financial Analyst)
- Actuary
- Corporate Finance: University of Warwick
- Considerably more additional internal and external training: e.g. finance, soft skills, software, …
- State of the art know-how through internal research, cooperation with leading universities, e.g.
- University of St. Andrews (Scotland)
- Goethe University (Frankfurt)
- You are able to regularly attend international conferences and seminars
- European Credit Risk Conference (Vienna)
- Annual Capital Allocation and Management Conference (London)
- RiskMinds Conference (Geneva)
- Testing & Finance Conference (Frankfurt)

d-fine Publications – Theses, Papers, Books, …

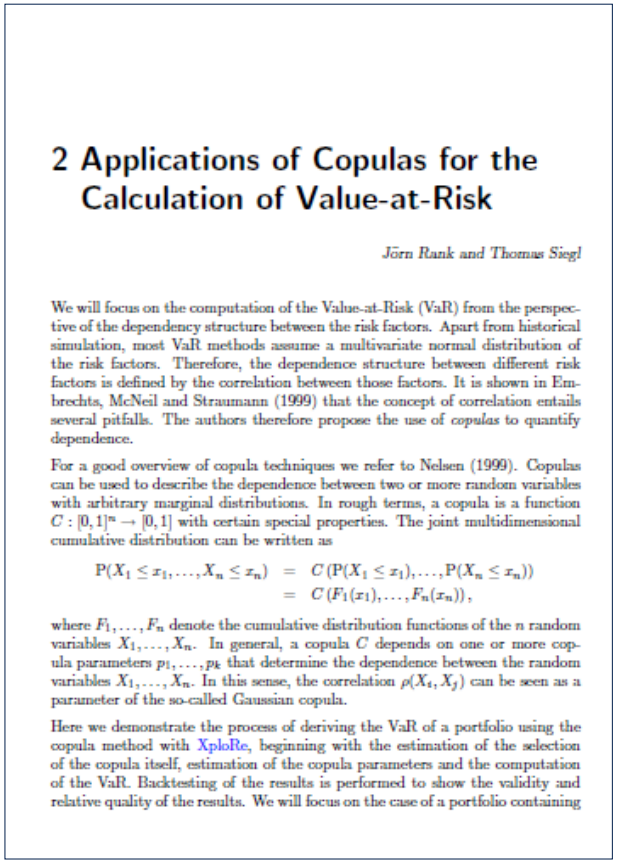


Improving Value at Risk Calculations by Using Copulas and Non-Gaussian Margins

Dr Jörn Rank
New College
University of Oxford

A thesis submitted in partial fulfillment for the MSc in *Mathematical Finance*

September 6, 2002



2 Applications of Copulas for the Calculation of Value-at-Risk

Jörn Rank and Thomas Siegl

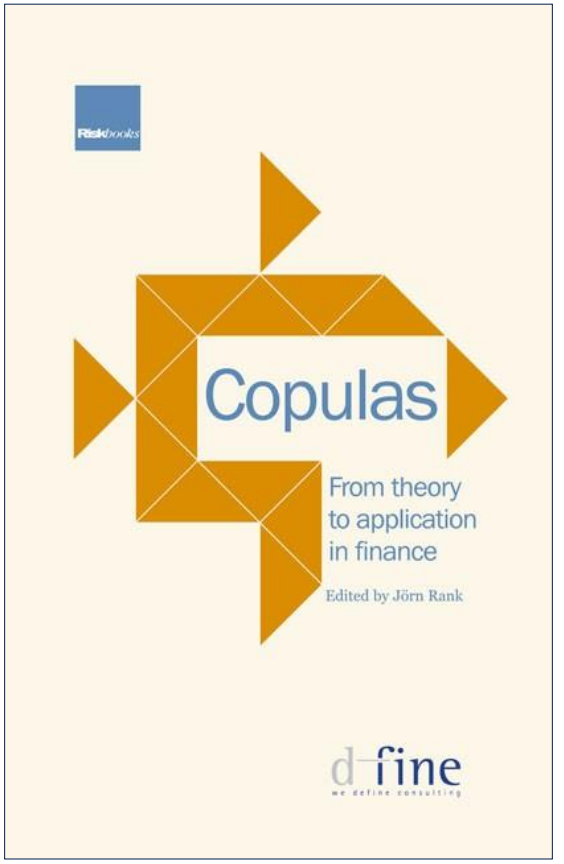
We will focus on the computation of the Value-at-Risk (VaR) from the perspective of the dependency structure between the risk factors. Apart from historical simulation, most VaR methods assume a multivariate normal distribution of the risk factors. Therefore, the dependence structure between different risk factors is defined by the correlation between those factors. It is shown in Embrechts, McNeil and Straumann (1999) that the concept of correlation entails several pitfalls. The authors therefore propose the use of *copulas* to quantify dependence.

For a good overview of copula techniques we refer to Nelsen (1999). Copulas can be used to describe the dependence between two or more random variables with arbitrary marginal distributions. In rough terms, a copula is a function $C : [0,1]^n \to [0,1]$ with certain special properties. The joint multidimensional cumulative distribution can be written as

$$\begin{aligned} \mathrm{P}(X_1 \le x_1, \ldots, X_n \le x_n) &= C\left(\mathrm{P}(X_1 \le x_1), \ldots, \mathrm{P}(X_n \le x_n)\right) \\ &= C\left(F_1(x_1), \ldots, F_n(x_n)\right), \end{aligned}$$

where $F_1, \ldots, F_n$ denote the cumulative distribution functions of the n random variables $X_1, \ldots, X_n$. In general, a copula C depends on one or more copula parameters $p_1, \ldots, p_k$ that determine the dependence between the random variables $X_1, \ldots, X_n$. In this sense, the correlation $\rho(X_i, X_j)$ can be seen as a parameter of the so-called Gaussian copula.

Here we demonstrate the process of deriving the VaR of a portfolio using the copula method with XploRe, beginning with the estimation of the selection of the copula itself, estimation of the copula parameters and the computation of the VaR. Backtesting of the results is performed to show the validity and relative quality of the results. We will focus on the case of a portfolio containing



d-fine offers Clear Career Perspectives – without Up-or-Out-Mechanism

d-fine is a “Fair Company”

Fair Companies…

- … they do offer internships mainly for professional orientation during the time of education,
- … they do give well defined tasks and goals and name a dedicated contact person within the company,
- … they do hire interns for a meaningful duration only,
- … they do not put off a university graduate who applied for permanent position with an internship,
- … they do pay adequate expense refunds to interns,
- … they do inform interns about the tasks, contact persons, and objective of the internship and do inform on the Fair Company regulations(1).

d-fine obeys the above mentioned rules. That’s why we are allowed to use the Fair Company seal of quality, issued by karriere.de.

(1) http://www.faircompany.de/fileadmin/pdf/2015_fair_company_regelwerk.pdf

d-fine supports Science (Examples only)

- October 2015:
  Conference sponsoring „19. Deutsche Physikerinnentagung“ at Georg-August-University Göttingen

- August 2015:
  Conference sponsoring „11. Doktorandentreffen Stochastik“ at Humboldt-University Berlin and Technical University Berlin

- Since April 2012 (ongoing)
  Support of PhD students in mathematical finance by the d-fine PhD scholarship „Optimization in Financial Markets“ at Humboldt-University Berlin

- Since October 2010 (ongoing)
  Support of a MSc student in physics by a so called Deutschland-stipendium at the University Cologne

- Since October 2002 (ongoing)
  Sponsoring of the Physics Graduate Days at the University of Heidelberg (2 x per year), including lecture series during fall events

d-fine offers Attractive Compensation and Work-Life-Balance

Attractive compensation

- Competitive fixed salary plus bonus
- Accident insurance and pension fund
- Company car program

Work-Life-Balance

- Free choice of place of residence all over Germany
  - You may live wherever you like, we take care of your business travel and accommodation
- Extra programs, e.g. “Childcare”
  - Support when looking for suited child care or in cases of emergency care in almost all big German cities

The first 100 Days at d-fine

- Initially, a good amount of training (around 4 weeks)
  - Training on basics of banking and risk modelling
  - IT training, best practices, basics of project management
  - Hands on training on a typical trading system or risk management system
  - Getting to know the colleagues who joined in the same month
- At some point you will receive a phone call concerning your first project
  - Currently a very low probability that you will stay in the office after training
- There will be a lot to read
  - Documents related to the project, background information, etc.
  - Internal documents, relevant magazines, books from our library
- And there will be a test
  - Usually at least an informal interview with the client
- After starting, a senior consultant / manager will be responsible for you
  - If you have any questions, ask them
  - Complexity of tasks increases with your knowledge / experience

Networking @ d-fine

Working together with excellent people,

- » having the same academic background (physics, mathematics, etc.),
- » having the same level of qualification (at least an MSc degree, plenty of PhD's) and
- » having reached the same high level in their university degrees

is a great experience!

More than 500 d-fine colleagues – distributed over more than 100 projects...

⇒ Q: How to get in contact with colleagues you typically don't see?

⇒ A: Regular d-fine conventions, 3 times a year!

d-fine Conventions (1 / 2)

- Three 2 day d-fine internal events each years (spring, summer, before Christmas)
- Everybody resides in a hotel
- Content:
  - Plenary talks for all consultants, e.g. Management Information
  - Parallel talks on each level – beginners, more experienced colleagues, experts
  - Time for networking, e.g. meetings between mentor & mentee

- Every 2nd year, Summer Convention together with spouses
  - Destination: Somewhere in Europa
  - Duration: Full weekend (Friday – Sunday)
  - Content: No business, fun and recreation only
  - Previous events: ...

d-fine Conventions (2 / 2)

Vienna 2008: Gala-Dinner at Kunsthistorisches Museum

Rome 2012: Gala-Dinner at Villa Miani

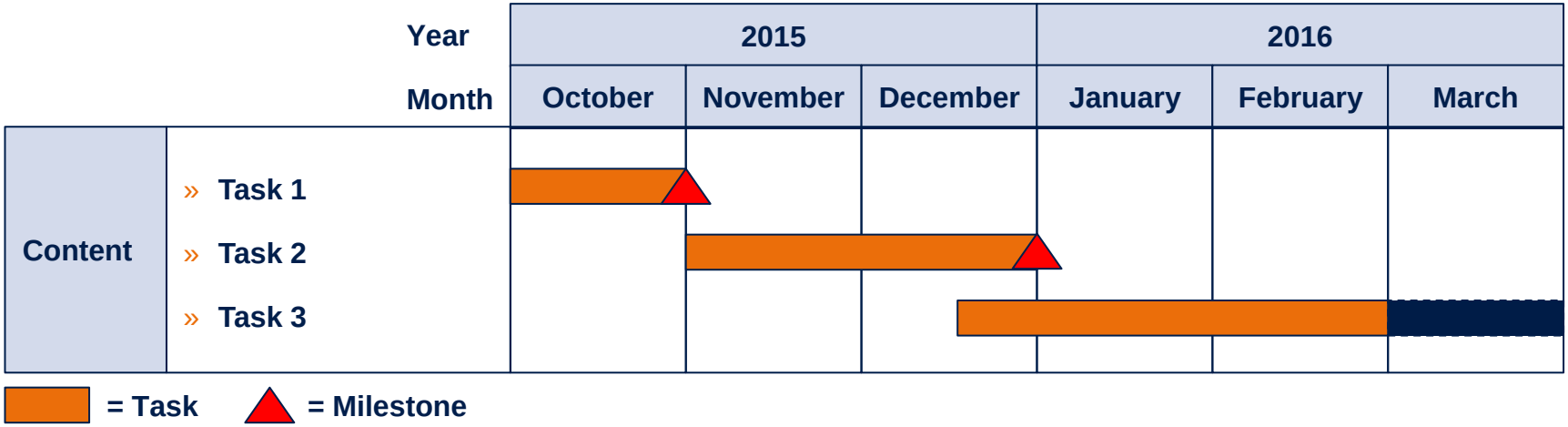
Barcelona 2010: Convention Hotel

Strasbourg / Rust 2014: One of the Convention Hotels

d-fine

What does “Project Work” really mean?

- Project
  - (Complex) topic
  - Limited time frame
  - Limited budget
  - Dedicated team
  - Nonrecurring activity, (almost) independent of daily business
  - Done at client side, together with the client
  - Accommodation from Monday until Friday in a hotel at the project location
- Roles
  - Project leader
  - Project staff
  - Internal contact persons (from business departments)
- Project management
  - Project planning, scope, specification
  - Mile stones, quality gates
  - Prioritisation
  - Status reports, regular meetings



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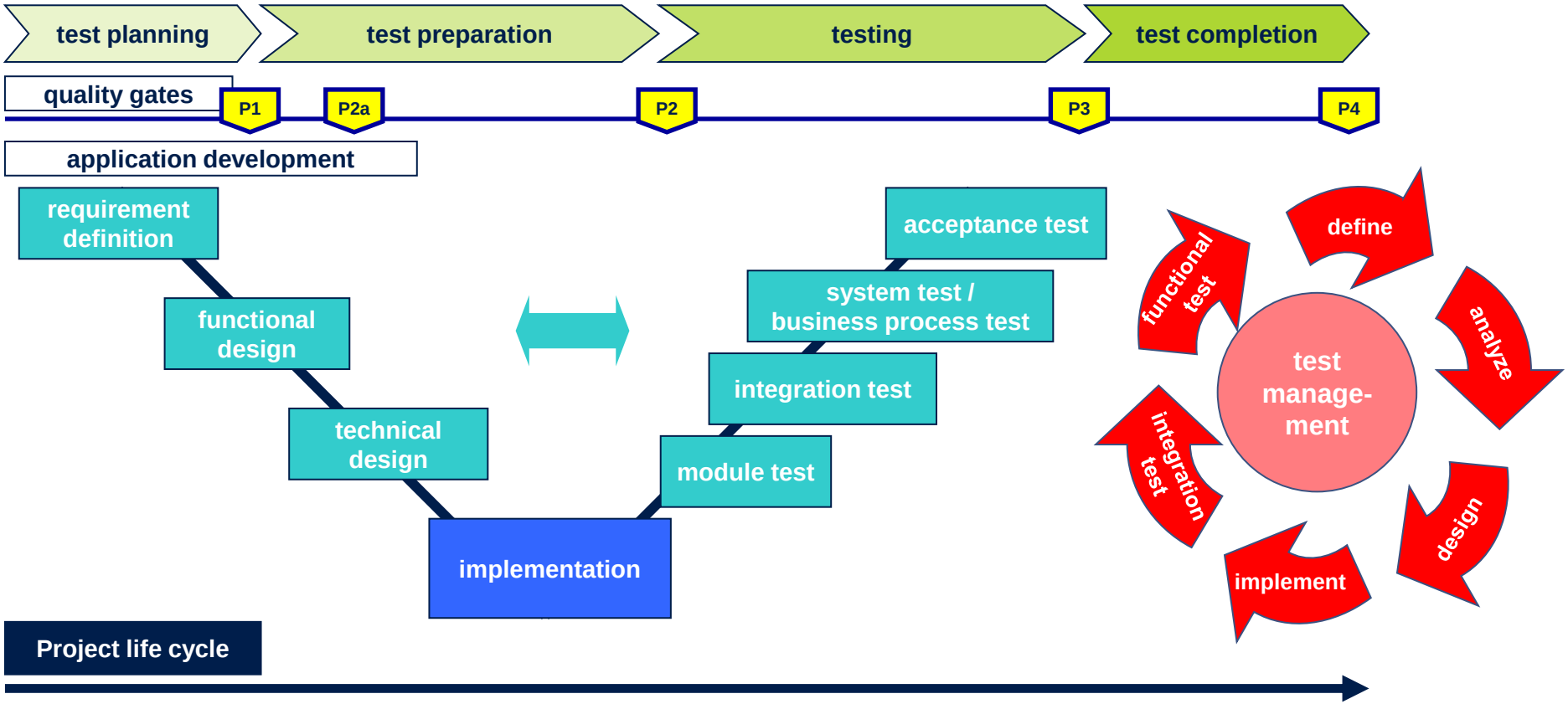
Testing, Testing, Testing…



Variety of Project Types

strategic	specialised/ conceptual	technical	time, budget limited / time & material
big / small	sub project/ own PMO	involvement of 3rd parties	IT dependent/ IT independent
initial project	follow up project	system selection	system implementation
implementation internal model	numerous topics	special topics	…

Example: System Implementation

usage of old system	gap analysis of old system	new system requirements	selection of new system
business specification	parameterisation of software given	business architecture: connected systems, DWH?	realisation concepts
specification of interfaces	realisation (programming) of interfaces	tests	documentation
approval / acceptance	go live	usage of new system (incl. support, if applicable)	…

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Who we are looking for

Qualification Profile: Key Qualifications and Skills…

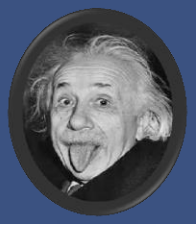
- Excellent quantitative and analytical skills

  ⇒ Very good final degree at university (Diploma, Master) or PhD in Physics, Mathematics, Business Informatics, etc.
- High grade of social competence
- Very good IT skills
- Very good English skills
- Interest in financial markets
- Work experience abroad, internships, scholarships, etc.

...and why Physicists and Mathematicians most of them fulfil

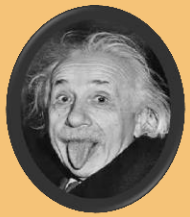
Strong Analytical / Methodical Skills

- Stochastic methods
- Monte Carlo methods
- Differential equations



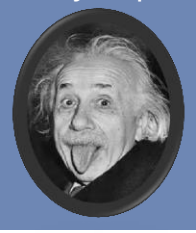
Strong IT-Know-how

- Programming
- Numerical methods
- Data bases



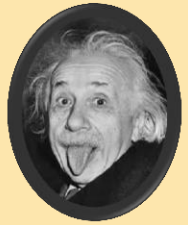
Good Understanding of Economics and Business Processes

- Developm. of economics
- Mechanics of financial crises
- Regulatory requirements



Good Communication Skills

- Presentation skills
- (Simple) representation of complex topics



What you would like to know

Summary

- The professional opportunities available to scientists (m/w), mathematicians (m/w) and business informatics (m/w) are
  - huge

  and
    - diverse.
- At d-fine you can discover them.

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