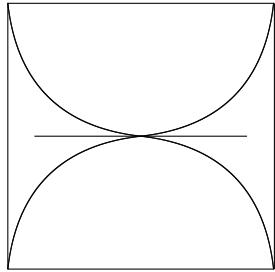


**SOCIETY OF
MATHEMATICS-ECONOMICS**



**STUDY TRIP
FRANKFURT AM MAIN**

SEPTEMBER 25TH - OCTOBER 2ND 2011

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1 Introduction

Every year the Society of Mathematics and Economics Students at the University of Aarhus in Denmark plans an educational trip with the purpose to gain knowledge on how different corporations operate in relation to our education, with the main fields being Operational Research, Finance and National Economy. Every second year we travel abroad to visit foreign companies. We have formerly visited cities like London, New York and Bangkok. This year we decided on Frankfurt am Main.

There were 49 students participating in the educational trip lasting from September 25th to October 2nd. Through these days we visited the following 12 companies:

- Bloomberg
- Commerzbank
- DB Systel GmbH
- Deutsche Bank
- Deutsche Bundesbank
- Deutsche Börse
- European Central Bank
- Fitch Ratings
- Frankfurt Consulting Engineers GmbH
- Lufthansa Systems AG
- Lupus Alpha
- SEB AG

This booklet contains a summary of each visit. We would like to thank the above mentioned companies for their kind cooperation and for the time spent on our visits. We would also like to thank the following companies and foundations for their financial support:

- Simcorp
- MØF
- Fonden Julius Skrikes Stiftelse
- Svend Bundgaards Fond
- Ole Kirk
- Institut for Matematiske fag, Aarhus Universitet

On behalf of the Society of Mathematics-Economics Students:

Anne Clemmensen, Anders Winstrom, Brian Juul Fleischer, Frederikke Lindgren, Henrik Dam, Jacob Dahl, Katrin Foldbo, Linnea Jørgensen, Martin Søgaard, Niklas Pedersen and Pernille Hornemann Jensen.

2 Bloomberg

We visited Bloomberg on Monday 26/9-2011

Bloomberg is a privately owned software distributor and news agency with their own reporters. The software can be used either via the internet ("Bloomberg Anywhere") or as a downloadable program on the client's own computer with an optional fancy Bloomberg keyboard. The price of a Bloomberg license is 1.655 USD per month, and this includes all the features, free training and updates, which means that even if you're only interested in some parts of the software, you get the whole package, as Nicole Meckelholt mentioned.

We saw how the Bloomberg software works in actions with Danske Bank and Carlsberg as examples. Some of the features we saw includes full comparison with the company's competitors, their market shares, where they make their revenues both geographically and product wise. The software could also reveal information about the security's suppliers and customers which normally isn't public available, so Bloomberg found these information through their own sources.

At the moment Bloomberg is developing a map to visualize where the suppliers and customers are to see, whether the company is heavily located in one area compared to another, and how local events, such as earthquakes, affect them.

In Nicole Meckelholt's department they hire a lot of graduate students where most of these use Bloomberg as a step stone to the financial world.

The visit at Bloomberg gave us an idea of how the Bloomberg software works and what information is necessary to make good investment decisions. We got a good impression of how our future work place could be like, and what line of business we can choose to work in as a math economist when we have fulfilled our studies, both overall and within the financial world. Furthermore we saw some real applications of the theory we have seen in the lectures, and saw that some of what we have learned is actually applicable in the "real world".

We have been told that if we choose the financial world there is a big probability that we run into this software and have to work with it as a client.

3 Commerzbank

We visited Commerzbank on Friday 30/9-2011

We were approximately 25 students visiting Commerzbank where we got introduced to the bank in general by Michael Yohannes. He told us about the structure and extent of the bank which included 1200 departments, 14.5 million private customers and a headquarter located in the city centre of Frankfurt in the form of a 300 meter high tower.

Yohannes presented us for the keywords of Commerzbank which where Team Skills, Social Skills, Structured Thinking and Broad Specialist Knowledge and we also got a view into the employee programs of the bank. A view that showed a very social bank in the way that they for newcomers in the bank have a bunch of good start-up offers. They have a buddy-program, a general introduction and a talk with a boardmember.

Dr. Oliver Maspfuhl talked about Dynamic Credit Portfolio Models - which handles the interaction between model and risk manager. This was a advanced review of different kinds of models and requirements that banks shall comply. Among other he walked us through the Hull-White Model and the Overbech-Schmidt Model.

The last speaker was Dr. Patrick Büchel. He gave us an insight in valuation models for Asset Securities, showed us the differences between fundamental value and the market price and the interesting aspects the financial crisis have had one ABS insurances.

The visit as a whole had levels of high technical character which was exactly what we were looking for. There's no question that we walked away with more interesting and advanced knowledge than we came with. Finally we got an insight of a bank that's not just money but people too.

4 DB Systel GmbH

We visited DB Systel on Friday 30/9-2011.

The visit at DB Systel began with a presentation of the company itself and its place at Deutsche Bahn as a whole by mr. Claus Cattepoel. As part of the DB Mobility Logistics branch of the DB concern, DB Systel develops all kinds of IT solutions for the company, for example the sales system for train tickets and the software for managing the more than 26 000 km of train tracks run by DB. We were also presented with the underlying ideas and goals of the company and the strategies used to improve the public image of DB and make everything run as effectively as possible.

We were also given a quick introduction to Small Solutions by Alexander Schmidt Rehschuh, which is a relatively new department at DB Systel devoted to making small software solutions to different problems within DB Systel. As a part of this we were also shown how to edit a list on a web side.

As a more practical part of the visit we were introduced to the "Automatenzentrum" where the ticket machines for DB are developed and tested. This was a rather long introduction to the process of purchasing train tickets.

Another aspect of DB Systel is the backup centre for all the IT of DB. This was presented by Mr. Heiko, who gave us a short description of the work done here and a quick glance at the centre itself.

Finally, Mrs. Marion Seitz described the job and education opportunities at Deutsche Bahn to us. Among other things, the company offers a trainee program and jobs in many different parts of the world.

There is no doubt that DB Systel is an interesting company which plays an important role in the continuous development of Deutsche Bahn. Nevertheless, the visit did not have much relevance for us as operations research students. What would have been interesting for us was a deeper look into the more practical logistical aspects of the DB concern - that would certainly have been closer to our field of research. Also, the fact that most of the talks were in German seemed to partly limit the understanding for most of us.

5 Deutsche Bank

We visited Deutsche Bank on Wednesday 28/9-2011

The visit started with a description of job opportunities at Deutsche Bank in Frankfurt, whereof there were practically none in Frankfurt, due to language barriers. Most Danes used to go to London instead.

The lecture proceeded with a film about the bank's history. The bank had mainly been an investment bank to begin with and just before World War One, the bank claimed to be the biggest bank in the world. The bank suffered large setbacks during the two world wars, but has been growing since.

After the film, our host asked questions about the film and the bank, and talked about the fields in which the bank is currently involved.

She said that the name "Deutsche" still brings associations to the Second World War in some parts of the world, mainly UK and US, and this makes it hard for the bank to enter the retail bank market in these countries. But in most parts of the world, Deutsche Bank is a strong and trusted name.

The lecture did not have much to do with investment or national economy. It was mainly a detailed presentation of the bank's history, and the prospects for Danes of getting a job at Deutsche Bank in Frankfurt were not good.

6 Deutsche Bundesbank

We visited Deutsche Bundesbank on Tuesday 27/9-2011

Tuesday morning we were welcomed by André Kühne from the strategic communications and public relations division at the Bundesbank. He gave us a lecture with the title "The Bundesbank's role in the eurosystem". This involved a brief review of the history of the Bundesbank and the problems it has been having e.g. the German hyperinflation during the 1920'ies where the money was more worth burning in heating ovens than actual currency. André told us that maintaining price stability is still the most noble job of the Bundesbank, but like with many other national banks, this job is now more in the hands of the ECB with the introduction of the Euro. As the Bundesbank works in cooperation with the ECB we also got insight in how the procedures are at the ECB, i.e. all countries in the Eurosystem has one member in the board, regardless of the size of the countries (economically, geographically etc.) but there is a specific voting system when regulations have to take place. After the lecture we visited the money museum also located at the Deutsche Bundesbank.

The visit at the Bundesbank was not very technical and did not have much focus on the instruments they use in their daily work and was therefore not of much relevance to math-econs, but it was still interesting to hear about the role of the Bundesbank in the eurosystem.

7 Deutsche Börse

We visited Deutsche Börse on Tuesday 27/9-2011

At Deutsche Börse we started out with a very nice presentation about the history and origin of the place, this presentation lasted for about an hour. In that hour we were among others introduced to the story about how the place was founded back in 1585. In addition to that, we were explained how the DAX was introduced in 1988.

The DAX is a German index consisting of the 30 major companies trading on the Frankfurt Stock Exchange. It is important to notice that the influence in the DAX is not split in 30 parts, but it is calculated for every company. As an example Siemens has an influence of 9.5% on the value of the DAX. Also, the companies have to fulfill standards to stay in the DAX. Prices for the DAX are taken from the Xetra system, which is created for the Frankfurt Stock Exchange, but now used by over 13 stock exchanges around the world.

The Xetra system is a completely electronic system, which has replaced the routine where the trader goes to the broker, and the tradition of the outcry on the floor. Now Xetra covers 98.2% of the trades, while "the floor" only covers 1%. This development is also seen in the actual existence of the shares. Compared to the past, where the share existed in the form of a paper, everything is now electronic. This way stock trading is safer, easier and cheaper.

After the presentation we were led to a room viewing the trading floor. This room had a floor with tiles which were representing every company in the DAX. The name of the company then lit up when a share was sold. It lit red if the share had lost value, and green if it had gained value. In addition, the walls were covered with a big map of the world, here news of the different parts of the world were displayed.

8 European Central Bank

We visited the European Central Bank on Tuesday 27/9-2011

After a heavy security check we were welcomed at ECB by Iris Mayer, Per Nymand-Andersen, a fellow Dane from CBS, working in Statistics and Matteo Ciccarelli working in Research.

Per then introduced us to his work at ECB in the aspect of yield curves. After a short introduction to the theory of yield curves and the different models, Spline Based Models and Parsimonious Parametric Models, he explained the process of obtaining a yield curve: from cleaning and selection of the data to descriptive statistics and yield curve estimation. The final curves are both for internal use in ECB and for publication on the ECB web site; a new yield curve is put on the web every day. Throughout his presentation he showed the steps of the process through examples from his daily work. Per ended his presentation by showing us some of all the other statistics the ECB create for the European Union.

Next Matteo told us about the importance of econometric models; the ECB mainly use models for forecasting and policy analysis using many different models. When working with these models the aspect of model and data uncertainty also needs to be mentioned. In order to obtain some robustness Matteo told us how they at ECB combine several theoretical econometric models. The idea is to compute the posterior model probability and assign a weight to each of the models used in the analysis.

Along his presentation of his work he also emphasized the importance of including judgement into the models and that you need to find a way to measure that judgement.

Next he talked about some effects the recent crisis have had on macroeconomic models; the importance of non-linear dynamics and financial features along with including judgement in the models. Throughout the presentation we were introduced to many econometric models that the ECB is using.

As a last presentation Elodie Lafitte explained the employment opportunities at ECB.

Among many interesting facts and insights of the work of the ECB, we left the visit with a better understanding of the use of economic/econometric models in real life. There was a good combination of already known and new theoretical aspects to the visit. The discussion with the hosts about use of models in the future along with new challenges in the field expanded the visit also to include interesting subjects as neurofinance and behavioral finance.

9 Fitch Ratings

We visited Fitch Ratings on Monday 26/09-2011.

Jens Schmidt Bürgel, the managing director of Fitch Ratings Frankfurt, welcomed us and introduced us to his job, the history of Fitch Ratings, the market which Fitch Ratings is operating on and what Fitch Ratings actually does. He gave us Fitch Ratings definition of a Credit Rating which they developed themselves and later sold to Standard and Poor's. Jens Schmidt Bürgel also told us about the economic crisis and how it had influenced Fitch Ratings. During the crisis people trusted the ratings with no concerns and did a lot of investments based on those ratings alone. The problem, as Jens told us, is that the ratings alone are not enough, because there are a lot more factors in the investment decision than only the credit rating. So as he explained an AAA rated company is not a totally risk free investment.

After Jens Schmidt Bürgels introduction Georgy Kharlamov, Analyst at Fitch Ratings, was given the word. He told us about his job as an analyst and the mathematical theory behind the analytical models he is using, such as the Copula Theory and how he uses Monte Carlo simulation.

He ended his presentation by giving us an example of a rating and how the capital structure is for senior, mezzanine and junior notes. Then Georgy Kharlamovs' superior was given the word and we discussed different issues and had the opportunity to ask questions.

From this visit we learned a lot, and it gave us a very good insight in how ratings agencies work, and how the mathematical theory we are leaning at the University is used in the real world. It was inspiring to meet a person who recently graduated. They managed to present the theory in a way we found appealing, and it has helped those of us who have not chosen our master program yet to get a view of how finance is working in real life. We found it very interesting to hear how Fitch Ratings managed the economic crisis and how ignorant people blamed Fitch Ratings when they during the crisis rated a company AAA and people invested in this company and the investment turned out not to be riskless. We enjoyed hearing about what a rating agency really is and what we should not expect from it, and to understand that it is not the only guideline you should use when you want to do an investment.

10 Frankfurt Consulting Engineers GmbH

We visited Frankfurt Consulting Engineers GmbH on Tuesday 27/9-2011.

After being received at Frankfurt Consulting Engineers' offices in Hochheim am Main west of Frankfurt followed an introduction of the company by Dr. Wolfgang Mergenthaler, an introduction of the employees as well as an introduction of us, our background, and our education. FCE had prepared four different presentations for us.

The first presentation was held by Mr. Bernhard Mauersberg and was about sequencing and scheduling projects. The presentation was based on a production optimization example where the objective was to sequence the production of a given number of cars with different combinations of features. The problem – which was an example of the travelling salesman problem in disguise – was solved by FCE by applying the concept of simulated annealing, thus giving occasion for a discussion on local versus global optima and good versus optimal solutions.

Inventory control and management was the topic of the second presentation that was held by Mr. Jens Feller. This was done by three cases: Aircrafts, end-of-production and whole sale of spare parts. These jobs had been a success story for the company, and the focus of the presentation was on the "art" of creating a suitable cost function in the optimization problem by penalizing the right expressions.

Lunch was ordered to the office, and students and employees had a chance to mingle a bit while eating. The third presentation covered pattern recognition applied to short term wind predictions and was held by Mr. Yavor Todorov. This presentation was particularly mathematical and covered topics such as time-series, data-compression, neural network algorithms and self-organizing maps.

Finally Mr. Sebastian Feller held the last presentation of the day on the topic of the company's hazard prediction project. We were shown methods of detecting anomalies while monitoring certain conditions. Applications of this were given in examples of power plants and gas-turbines.

After the last presentation we were invited to a wine tasting at the local "Hochheimer Hof" which also created a nice framework for a more informal discussion on applied mathematics, our education and other subjects.

The visit at FCE Frankfurt Consulting Engineers was a very rewarding experience and was full of relevant examples of applied math. Especially the eye-opener on the many qualities of simulated annealing was brought back to our studies in Aarhus. Also the necessity of mathematicians being able to and good at programming was noted. This visit was definitively a highlight of our stay in Frankfurt and is recommendable to all students with an interest in applied mathematics.

11 Lufthansa Systems AG

We visited Lufthansa Systems AG on Wednesday 28/9-2011.

Lufthansa Systems offers airline companies solutions for optimizing navigation routes and cost minimizing. Our visit at the company started with an hour presentation of how they use Operations Research on a daily basis. The presentation was held by Sven Schlobach and he has been in Lufthansa for about 10 years. He told us about how Lufthansa Systems produces a program called Lido which other airline companies use. Almost 40 % of all worldwide flights are performed by Lido. Lufthansa Systems main competitors are f:wz/Sabre and Jeppesen.

Planning a flight begins 4 hours before takeoff and here one of the essential calculations is fuel level. Lufthansa Systems has chosen to use Djikstra's algorithm because this method finds the optimum in 100 % of the cases, although the optimal solution is often not used. Lufthansa Systems is the only one among their competitors using forward iterations. The advantage of this method is that they know the departure time so they can avoid extra fuel, but a disadvantage is that this method needs more iterations.

The constraints in the optimization problem are costs (fuel costs, time related costs, overflight charges), fuel, time and distances. There are also other restrictions, e.g. some airways are only available in certain height levels and some even have rules attached to them. Also tail wind has a great influence because a lot of fuel can be saved when using the wind in the right way.

Because of increasing fuel prices and competition planning cost efficient routings is of great interest. At the same time there is a lot of overcrowded airways and Lufthansa's solution to these problems is Freeflight. Here every flight has its own trajectory. This solution entails more computation time but use of less fuel. The increase in calculation time occurs because of many and complex constraints.

The presentation gave a very good view into the everyday-use of Operations Research. The material he presented was something that we were all able to relate to, which really helped to show what kind of work we as Math-Economics could have at Lufthansa Systems.

Afterwards we were on a one and a half hour tour through their IT-lab, where we were told about how their security system works.

12 Lupus Alpha

We visited Lupus Alpha on Thursday 29/9-2011

Our corporate sponsor Simcorp had arranged a visit to the Frankfurt based hedge fund Lupus Alpha. Lupus Alpha is an owner-managed, independent asset management company that offers institutional and retail investors specialised investment products in small mid cap funds and the so-called absolute return strategies.

At Lupus Alpha we were greeted by Andreas Bley and Christoph Nau and after a short introduction, the first presentation commenced. The first presentation was an introduction to Lupus Alpha, the services that they offer and the asset management industry in general. The presentation was very interactive and enlightening in particular for the students that were unfamiliar with the asset management concept. The software Simcorp Dimensions was highlighted many times during the presentation as key ingredients of Lupus Alphas success.

After a break, which included a nice meal, we continued with a presentation by the quantitative researcher Ben Wottge about his work for Lupus Alpha. Ben has a degree in economics and a background in econometrics. His presentation involved several examples of ideas for trading strategies that had been implemented into applicable strategies. Among those an example of how Lupus Alpha had developed a model that exploited that implied volatility has a tendency to be larger than realized volatility.

After the exciting presentation from Ben Wottge, part time employee and Ph.d Yuliya Playkha from the Goethe University in Frankfurt continued with a presentation about her current project. The key task for her project was to derive a model that could be used to determine the right mix of Lupus Alphas different funds in order to meet the risk profile of Lupus Alphas different clients. Her project was mainly based on the mean variance approach, which should be familiar material for the students who had finished the finance and investments course.

After the presentation Yuliya gave a short presentation of how the financial world interacts with academia. Yuliya had a strong belief that academia could learn a lot from the financial industry and that the most brilliant ideas were still kept secret in the industry rather described in various financial journals.

After the presentation by Yuliya we were split into two groups and given a guided tour around the office of Lupus Alhpha by respectively Christoph Nau and Andreas Bley. The tour included a short stop at Lupus Alphas trading desk. Afterwards Christoph Nau gave the final presentation about Lupus Alpha's use of Simcorp dimensions and about the new software development business line, they had developed on demand from other asset management firms. Christoph Nau highlighted that the software developed by Simcorp allowed Lupus Alpha

to have much faster processes than the traditional asset management firms that uses several different systems.

After the final presentation we enjoyed a cold beer with Christoph and Andreas in the warm October sun and the soothing atmosphere of Lupus Alphas domicile.

13 SEB AG

We visited SEB on Friday 30/9-2011

Thomas and Niels from the asset management division of SEB made a presentation of what SEB in Frankfurt does. As an intro they briefly went through the history of SEB from the founding in 1856 to today.

Then we were told what the asset management division invested in; the Frankfurt division has a strong focus on property investment which is not the case for SEB in the Nordic countries and The Baltic states where the focus instead is on investment in Asia.

To make an example an interesting case of investment was written on a paper and we were then to get to the same conclusion of what to invest in. So we were asked in which part of the world we would invest, in which specific country and in what business. Our answer was "an Indian cement company", indeed what was written on the paper. After this exercise we went briefly through SEB's products etc.

The question of what a property fond is was explained and the difference between investing for institutions or individuals, and of course how one can invest in property. The advantage in property investment is the security, the advantage against inflation. SEB's product gives a very stable yield which is due to a aim of a bit lesser but more secure and stable return all times instead of a bigger return when things goes up and a big loss when things goes down.

One of the top products is the Danish mortgage bond fond because of its stability and safety in times of a crisis. We asked where people like us with a very theoretically based background would work in the SEB, and they answered that most of them would be working in the headquarters in Stockholm. But still a lot of people working in SEB Frankfurt had a strong theoretic background. The most important thing was to be able to apply the theory into praxis. So maybe SEB in Stockholm could be worth a visit in the future.

