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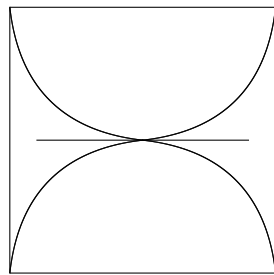
STUDY TRIP
LONDON

SEPTEMBER 19TH - SEPTEMBER 26TH 2013

Contents

1 Introduction

Every year the Society of Mathematics and Economics Students at the University of Aarhus in Denmark plan 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 Economics. Every second year we travel abroad to visit foreign companies. We have formerly visited cities like Frankfurt, New York, Bangkok and Brussels and this year we decided on London.

There were 52 students participating in the educational trip lasting from September 19th to September 26th. Each participant visited between 3 and 5 of the following companies.

- Bank of England
- Department for Business, Innovation and Skills
- Buro Happold
- Coru
- FactSet (Finance)
- FactSet (National economics)
- J.P. Morgan
- London Economics
- MVA Consultancy
- NERA
- Barclays
- Standard and Poor's

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:

- MØF
- Julius Skrikes Stiftelse
- Ole Kirks Fond
- Institut for Matematiske fag, Aarhus Universitet

On behalf of the Society of Mathematics and Economics Students:

Anders Friis Jensen, Andreas Eiskjær, Niklas Pedersen, Pernille Hornemann Jensen, Sara Winther Skriver, Morten Hykkelbjerg Nielsen, Victor Ulrich Rohde, Dan Zhang, Mads Rødgaard, Trine Zepernick, Pernille Kirk Jensen, and Morten Birch Biede.

2 Bank of England

We visited the Bank of England on Monday the 23rd of September

The Bank of England is the Central Bank of the United Kingdom. The visit began with a short presentation of the Bank and its main purposes which are monetary policy and financial stability. During the presentation we learned that the work form in the Bank consisted mostly of projects and these projects is closely tied to the economy so it is necessary to keep up with current events regarding the economy.

The next item on the agenda was a short introduction to some of the divisions in the Bank. Some of the divisions represented were the Markets, Sectors and Interlinkage Division, the International Economic Analysis Division and Supervising of banks. From each of the divisions a representative told us about their specific work tasks and about the job opportunities.

In the Markets, Sectors and Interlinkage Division a large part of their information comes from using questionnaires. The information obtained from the questionnaires is then used to analyze household debt and households worries about the future. Another part of their work is to analyze the worries of firms and what kind of risks firms are facing.

The UK economy is a small open economy which is easily affected by the events in other economies around the world. Therefore it is important for the International Economic Analysis Division to know the world economy's current situation, since this may have an impact on for instance GDP and consumer´s prices in the UK.

Supervising of banks is a division that examines what the outcome would be if a specific risk were to happen, for example if Greece were to step out of the EU. To ensure that banks in the UK are stable enough to cope with for example a crises this division performes stress tests of banks around the UK.

One thing that all the presentations had in common was that all the presenters loved working in the Bank, specifically because of its international environment

and they all really recommended us to apply there.

On behalf of the participants we would like to thank the Bank of England for a very interesting visit.

3 Department for Business, Innovation & Skills

We visited Department for Business, Innovation & Skills (BIS) on Wednesday the 25th of September.

Wednesday morning we were welcomed at BIS by Ricardo Bowman. He gave a brief introduction to BIS and what the department is about.

After the welcome and introduction Paul Jackson took over and gave an overview of the story of BIS. We learned that BIS has 3000 core staff working at a wide range of areas. Paul told us how important reputation is to BIS and how they work on renewing the language within BIS. He told us about the 30 partners who helps BIS getting progress and ended his overview by giving an example of how BIS helped saving General Motors from bankruptcy during the latest financial crisis.

Alex Shirvani gave a macroeconomic perspective to Paul Jackson's review. Alex included macroeconomic models such as the Solow model in his presentation, which was a very concrete example of how our knowledge from university is used in the real world. He gave a brief overview of the three parts of BIS (Business, Innovation and Skills).

Then Nadiya Sultan gave an overview of the job an economist does in the Business part of BIS. She told us about "Intellectual Property" which is any form of original creation that can be bought or sold, and how the Intellectual Property Office encourages innovation which is crucial for growth and employment.

David Rosenfeld gave an review of the Innovation part of BIS, and what a science economist does in the government. He told us which inputs, outputs and outcomes were important, and how they face different challenges in the analyses. He gave examples of different countries' contribution to the global research, and stated that some countries contributed with a large quantity of papers, but maybe not as qualitative as other countries.

We ended the visit by getting an overview of how to apply for a job in BIS. It was very interesting to visit BIS and see how some of the models we learn about is implemented, but sadly we had to leave early to catch the train and therefore

we did not get much time for questions. Fortunately they were understanding, and offered us to write them an e-mail if we had further questions.

4 Buro Happold

We visited Buro Happold on Wednesday the 25rd of September. Buro Happold is an engineering firm based in Bath, United Kingdom. On the final day of our study trip, we visited the London office, one of the company's 24 offices worldwide, and met with a few of the approximately 1700 employees.

Upon our arrival, we were greeted by Jim Coleman, who is head of economics at Happold Consulting, a subdivision of Buro Happold which specializes in areas such as urban development, infrastructure and economic planning. Jim Coleman presented some examples of ongoing and finished projects in which Happold Consulting has taken part in recent times.

Jingjin New Economic City is a planned city currently under construction near Tianjin in China. Happold Consulting has taken part in the project from the very beginning of the planning phase, particularly in developing an economic plan for the city. The main objective was to ensure the city a certain degree of economic independence from its much larger neghbour, Tianjin. This task entailed the search for viable economic sectors in which the city could specialize, as well as adapting the infrastructure and to some extent the architecture of the city to this main economic purpose.

A similar project is King Abdullah Economic City in Saudi Arabia. This planned city had already been partly constructed when Happold Consulting were asked to contribute to the project. The task for them was to make up for the lack of economic planning in the initial stages of the project, which had resulted in a city with many roads, but largely void of buildings. Buro Happold is now working on designing a viable and functioning economy for the city to grow to the Saudi government's target population of two million people. Projects like these combine require many different types of expertise and therefore require specialists from many different fields to work together, which is why Happold employs a diverse range of people such as mathematicians, engineers and economists, to name a few.

One project that was explained to us in particular detail was a redesign of the city of Detroit, which has experienced a tremendous decline in economic activity and population size over the last many decades. Buro Happold worked together with many other consulting firms and the US government to plan strategies for a better future in Detroit. Happold's role was mainly to examine how to save money on city infrastructure. In order to do this, they modelled population movements

over the next years under different scenarios - specifically to estimate how long it will take for the many existing low-density residential areas to be emptied out, so they can be demolished, saving money on infrastructure and upkeep.

The Detroit project required some extensive modelling, and this was the focal point of the last part of the presentation. We were told about different techniques in modelling for urban development, particularly the complex systems used often in Buro Happold, where individual agents are modelled and the emergent properties are examined. For this type of modelling, unlike traditional mathematical models, it's impossible to get a single optimal solution.

5 Coru

We visited CORU on Monday the 23rd of September. We had the pleasure to visit CORU (Clinical Operation Research Unit), founded in 1983, who is a research unit based at UCL (University College London). During our visit, Dr. Christina Pagel and Professor Martin Utley introduced us to some of the fields, that CORU research into. Their work consist of modelling and forecasting of different scenarios, such as: hospital operations (capacity of hospitals), vaccine programs, prioritizing of resources during a pandemic and stockpiling of flu vaccines.

The first part of the presentation regarded optimization of a hospital ward. This project was about improving the tools for the daily staff, in order to optimize the use of beds. In the daily life, the hospital missed a way to determine whether a bed would be available or not. With quite a few different patient types, it would quickly be rather unpredictable. So with the tools of modelling and with a huge amount of data in the back, the team was able to make a model that could forecast the "traffic" and make the job of the nurses much easier. In this study, a lot of the work consisted of being in contact with the daily department. The construction of the model itself was nearly not as time consuming as the process of implementation. The model might be simple to the developers, but they are not the ones to operate the software in the future, so a lot of work was put in to shaping the program as the hospital staff wanted it.

Another part of the presentation was a study of the next epidemic. The goal was to analyse, on what background people would receive paediatric intensive care in a situation where not everyone would be able to be treated. In this case, the goal was to optimize the Toronto Triage Protocol's goal: saving all (or as close to as possible) the people receiving resources. The job here was to redefine the objectives, and especially look into the code blue patient, those too ill to receive treatment = left to die. By using queueing theory, they were able to, without using any input data, create a model that gave a criterion for when triage would be beneficial to the population level.

We went further into details about epidemics on the following presentation, where they had been studying if it was possible to mitigate the effects of an influenza pandemic by vaccinating against pneumonia. Again there had been developed a model of how effective a vaccine would be compared to not having one. Furthermore the importance of the severity of the epidemic was also crucial to this study, since the vaccine would only last for 10 years, so the question was, would it be

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most beneficial to get treated for the first upcoming epidemic or maybe postpone vaccine. This would matter on a time horizon of 50 years or more, since it would not be possible to treat everyone.

The visit was a very nice opportunity for us to see how you apply operational researching tools to some real life situations. With the base in the medical sector we saw how both modelling, queueing theory and statistical analysis was used. We also got to hear about their recent experience with the media which had been less fortunate. On a research about heart surgery of children, their analysis had been misinterpreted and caused a huge debate in the English media. This had been a tough lesson, but nonetheless they had learned from it, and wanted to pass on some hard earned knowledge regarding publishing academic papers.

6 FactSet

We visited FactSet on Wednesday the 25rd of September.

FactSet Research Systems are a software company focused on providing the financial information necessary for investment analysis. The company is based in Connecticut but their first European office opened in London in 1993. They are the distributors of the FactSet platform, which is an analytical application known for its customisability.

Other than developing the FactSet platform, which an entire floor of software engineers handle, each customer works with a consultant from FactSet, ensuring that clients are getting the most out of the system. Newly hired consultants go through a rigorous training scheme consisting of 5 weeks of new hire training, work at the Project Pool, 1 week helpdesk preparation training, work at the helpdesk, and 1 week preparing for accounts before the consultant is ready to handle their own clients.

We were welcomed by Sarah, who is a campus recruiter at FactSet. She would be with us for the entire visit, tying everything together as well as talking to us about FactSet more informally between presentations.

The first presentation was by Annika, who is a consulting manager in the UK and in the Nordics. Annika started off by giving us a more formal introduction to FactSet, telling us about the fast growing company and how their aim is to provide the best data to make the best decisions. She also told us that FactSet have a broad range of clients, and that their most important source of clients is investment management. We talked about the fact that FactSet have won several awards. They have won awards for customer service and among many other awards they have been ranked on FORTUNE's "100 Best Companies to Work For" 2009 through 2013. Additionally, they have a high employee retention rate, averaging around 90

Next, we were given a presentation on life as a consultant at FactSet by Kirsi. She gave an overview of her schedule in a typical week, contrasting life as a consul-

tant to life at e.g. an investment bank. Furthermore, we talked about how as a consultant, one gets exposure to the whole finance industry, and receives responsibility early in ones career.

Finally, Andreas gave us a demonstration of the platform that we had been talking about. He gave many examples of features a typical client would be interested in and also talked about the key differences between the FactSet platform and competing products.

All in all, it was clear that there is a very friendly atmosphere at FactSet, and everyone we talked to seemed happy to be working there. It seemed like a good choice for people who are deterred by the hours and competition at investment banks or like spending a lot of their time helping clients to better make their financial analyses.

7 FactSet

We visited FactSet on Tuesday the 24rd of September.
We were welcomed by Sarah Scadding, who presented us for the agenda and the three presenters.

The first presentation was by Nina, who is a consultant manager. Nina gave us a generel presentation of the firm. FactSet was founded in 1978 in US and have their headquarters in Norwalk, Connecticut. They have 31 locations in 13 countries and have over 6,400 employees. They have 2,500 clients globally and 50,000 users worldwide.

FactSet is an analytical software and content company which provides market data to investment professionals and they combine distinctive technology, content, and unmatched service to improve decisions in every part of the investment process.

FactSet clients consists of two sides; the buy side and the sell side. On the buy side there are Portfolio Managers, Wealth Managers, Performance Analyst and Risk Managers. On the sell side there are Market Data Analysts, Research Analysts, Brokers, Traders and Mergers & Acquisitions Teams.

One of the things that sets FactSet apart from ohter campanies are their software and service, every client has a consultant relation. The consultants job is to answer day to day queries and provide solutions to their clients.

After the general introduction of FactSet we met Lars, who is now as a consultant. Thomas told us about "A day in the life of a consultant". A consultants job at FactSet is to visit clients in their offices to provide on-site support, guidance and training. They work on large scale projects that optimise FactSets clients' workflow and train clients in using FactSet He mentioned travelling as one of the advantages of working at FactSet, he is travelling about every two weeks. Also meeting with clients is one of the advantages. Not one week looks the same and he has to use a variety of skills. He also mlikes responsibily which comes with the job. He told that FactSet is a very nice place to work, and he enjoys the view into the investment world and that his job gives him opportunity to learn new things.

After that we met Annika from investment management team. Annika showed

us the FactSet platform and told us a little about how to use it. The FactSet platform is one of the things that sets them apart from other companies. It is customisable so there is a solution to everyone. Annika had just finished FactSets training program, which every newly hired has to go through before getting their own clients.

FactSet was a very national and friendly company and everyone seemed very happy about being employed at the firm. It seemed like a good place to work if you have an interest in finans and enjoys building relationships.

8 J.P Morgan

We visited J.P Morgan on Tuesday the 24rd of September.

We were bid welcome by Morten and Malene, who both have similar backgrounds to those of a math-econ student from Arhus university. They had arranged the presentation and acted as the representatives from J.P. Morgan. They are both employed as quants.

We began with a short presentation of J.P. Morgan history and some general intuition about how the bank is run and what the different departments do. We learned that J.P. Morgan is one of the worlds largest international banks. It consists of two separately working banks that each handle their own areas. J.P. Morgan handle things like asset management, corporate and investment banking, while Chase handle things like retail, customer cards and commerce.

Next we went into details about quantitative research at J.P. Morgan. We were told that the essential idea for QR is to calculate "What should it cost!?". A typical set up:

$$Sales \rightarrow Trading \rightarrow QR$$

Sales receive an order, traders check if its possible and then QR calculate a price. Behind that broad question lies a large array of calculations including things like risk calculations, programming and building models, calculating weights and so on. Lehmann Brothers were given as a scare-example of the importance for a good QR department.

Finally we talked about the possibility of one of us being hired at J.P. Morgan. Globally the are just 365 quants, though Morten and Malene insisted that there is plenty possibilities for quant positions. We were told that we have a good back ground, but supplementing with a C++ course was advisable.

In total the presentation was very educational. We were given a good insight to the everyday life of a quant at J.P. Morgan.

9 London Economics

We visited London Economics on Tuesday the 24rd of September.

Our visit at London Economics, at Shelton Street in the middle of London, started with an introduction by Dr. Gavan Colon and Rasmus Flytkjær. Dr. Gavan Colon is Phd in economics from University of Oxford 2000 and has previously worked as a lecturer at University College Dublin and University of Oxford, among others. Rasmus Flytkjær is cand.scient.oecon from Aarhus University 2011. They told us about London Economics, as one of the leading microeconomic, financial and strategic consulting firms in Europe. They are specializing in economics and policy, where cost-benefit analysis, multicriteria analysis, simulation and statistic analysis are central methods for the firm. Dr. Gavan Colon explained the general tools used such as Information gathering, Data processing, Spreadsheet modelling and Presentation of results. They often use programs as Excel, PowerPoint and Stata in the proces of a project.

They cover about 13 different areas (Aerospace, Behavioural and experimental economics, Business analytics, Competition economics, Consumer behaviour and protection, Education and labour markets, Energy, Financial services and capital markets, Health and social care, Justice and legal affairs, Productivity innovation and new economy, Public policy and economics and Regulatory economics) where Rasmus Flytkjær is in to Aerospace economics. He did projects as Google Lunar X PRIZE Market Study 2013, about a competition getting out in space, and a project by Norway Ministry of Trade and Industry. Here his objective was to assess the socioeconomic impacts of Norway's participation in ESA and the national support funds between 2004 and 2010. Further more, it was to determine whether this space-related expenditure has led to a net cost or a net benefit to the Norwegian economy.

Dr. Gavan Colon's area is Economics of Education and Labour Market economics. He did a cross-country study on the apprentice system in 14 countries including Denmark, where he commented on the fact that you can not compare countries directly. As an example he talked about jobs for youths and the logic link between higher age and higher fees. Further more, he did a project about if the changes to higher education funding in England is cost-effective.

An other interesting part of the visit was in the end where Dr. Gavan Colon and Rasmus Flytkjær told us about how we could start our career and how Rasmus did. It was a very interesting and motivating visit, and we got a great insight in "working-life" of London.

10 MVA Consultancy

We visited MVA Consultancy on Tuesday the 24rd of September.

At MVA Consultancy we were introduced to the Market Director for Rail, Aidan Eaglestone and a colleague Murray Stevenson. They both made a representation of their employment at MVA Consultancy. Then we were asked to make a formal introduction of ourselves.

Aidan Eaglestone introduced MVA Consultancy with some short facts. MVA Consultancy is a part of the Systra Group which operates in the UK, France, Ireland and Abu Dhabi. It has around 350 projects, each at a price of 50 million pounds. MVA Consultancy is a Business Consulting company with focus on all kinds of transport systems - rail, bus, roads, air and maritime.

Aidan Eaglestone came up with an example of one of their latest works - the HS2 (High Speed 2) program. Then he told about his educational background. After Aidan Eaglestone's presentation, we had a break where two other colleagues Claire and Alexis came into the room. They walked around and answered our questions, and were happy to tell about their background and how they came to work for MVA Consultancy.

Then Murray Stevenson went on with his presentation. He first told about the topics he had worked with and was working on, one of them was the Eurostar. Murray told us that The Eurostar had previously been arriving and departing from Waterloo station, but was then moved to King's Cross. Murray then analyzed Waterloo station to see if it could accommodate four new local trains which would be using the platforms the Eurostar occupied earlier. He then had a look at elevators, escalators and stairs to see if they could accommodate the stress that 4 additional local trains would bring into the station. Furthermore he had to take security measures into account e.g. how long it would take to evacuate a platform in case of emergency.

He also told us about a few other projects he had been working on, HS2, London Olympics, Transport for London LTS model and Rail franchise bids. Then he talked about the everyday life at MVA Consultancy. He told us that they had flexible working hours and wore t-shirts on Fridays. Murray Stevenson used a long time to explain the latest work with the London Olympics, and that he liked to watch the sense of the work he and his colleagues were doing under the games.

In all ways every person we met during the visit at MVA Consultancy seemed very happy and interested in their job. We were very welcome to email questions

to all of the employees, and they would be happy to answer us. It was an interesting visit at MVA Consultancy which led to many considerations of our future degree courses at the university.

11   NERA

We visited NERA on Monday the 23rd of September.

NERA is a economic consulting firm based in New York, but with offices all around the world, the biggest outside New York being the one in London. NERA's team of economists work with different microeconomic issues, and provide strategies, reports and policy recommendations for governments and corporations.

Because of a late cancellation from another firm we arrived all 50 students at NERA in the center of London. Here we were received by Senior Consultant Søren Tang Sørensen and Consultant Robin Brejnholt.

Søren Sørensen, who has a PhD in economics from Aarhus University, started the presentation out by introducing us to NERA, and to some of the working areas of the company.

Afterwards he continued with his line of work, auctions. He has been working with auctions e.g. concerning natural gas capacity and with telephone companies regarding spectrum auctions.

NERA consult both auctioneers and bidders regarding the auctions, and he tried to give us an idea on how an auction is set up, and what the difference between consulting the auctioneer and the bidder is.

Next he told us about a specific case he had worked with, where he helped Orange in Switzerland in a spectrum auction. That kind of auction is called a Combinatorial Clock Auction where you bid in 3 steps, and each bid you give in the preliminary rounds reveals information on your valuation. In the third step the winners and prices are determined. The result of this specific auction Søren had consulted on gave a view of how important consulting firms has become for the bidders, because the auctions get more and more complicated and a big insight in game theory is needed to get a good result.

Robin Brejnholt, cand. polit of Copenhagen University and MsC in Financial Economics from Oxford, continued the presentation with one of his projects. He had been involved with green energy in Europe, and had evaluated the contract between wind farms and the energy company. Because the force of the wind will vary the price of electricity will vary as well, and an investment in a wind turbine can be compared to a call-option on gas or coal. These contracts that Robin was to evaluate are made up in a way to spread out the risk of no wind between the wind farms and the electricity company, and his job was to figure out how the contract should be constructed.

He made simulations on how more wind farms would affect the price of electricity to see what kind of production will be preferred in the future. He also analysed how the output of a single wind turbine was correlated with the total output, and was thereby able to simulate the wind turbines effect on the price. From this information he could give a suggestion to how the contract should be formulated, so that the risk was optimally spread out.

The visit at NERA was a very rewarding experience and gave us all an insight in the use of microeconomic and mathematical theory in practice. The projects were relevant and presented in a interesting way displaying how we as math-economists can use our knowledge from the lectures.

12 Barclays

We visited Barclays on Tuesday the 24rd of September.

Søren Willemann, math.eocon/Ph.d. from Aarhus University and head of European credit strategy, began with a brief introduction of Barclays. Founded in 1690 by quakers, the bank has since developed into a multinational bank with about 150.000 employees in 50 countries. After buying Lehman Brothers following their disclosure in 2008, Barclays is now the only bank, with large operations in both London and New York. The Investment bank has around 24.000 employees in 35 different countries, divided into different business areas such as mergers and acquisitions, trading, research etc.

Then Caren Marks from human resources followed with a presentation of the career opportunities at Barclays, such as the graduate programme and the possibility of an internship of either 9 weeks or several months.

After Caren, Søren continued with a case study of credit default swaps(cds). He explained how Barclays has created a model to pick out some favourable/unfavourable stocks/cds's by ranking them according to different measures, such as P&L, sharpe ratio, equity and betas etc. Then they will make a delta hedge to eliminate market risk, go long in the favourable/short in the unfavourable, and earn money if their predictions hold. So far this method has not lost money. The research department where Søren works, earn money from proposing strategies like this to costumers.

After Søren, Jakob Sønderby with a master in financial economics from London, followed with a case study of examining a convexity trade, also known as the volatility smile. He explained how he helps pension funds etc. to hedge against volatility in e.g. interest rates or rate of return in stock positions. This is in order for these companies to be able to meet their obligations.

Then Daniel, a participant in the graduate program, explained how it was to be a graduate at Barclays, followed by an unformal Q&A session.

13 Standard & Poor's

We visited Standard & Poor's on Monday the 23rd of September.

Roberto Rivero, the head of marked development at Standard & Poor' London, welcomed us at the McGraw Hill Financial building. He introduced us to the company and the market, in which they are operating. Rating agencies like S&P offers the services of assigning credit rating, which is a rating of the debitor's ability to pay back debt. S&P is the biggest out of three rating agencies worldwide with a market share of 48%. Roberto Rivero told us about the rating scale, where the best possible rating is AAA (outstanding). Even though an AAA rating is the best one and only very few issuers have assigned it to them, the AAA rating is still not a risk free investment. The clients that pay for the rating service are the issuers, hoping to get a good rating and in this way to optimize their cost of funding (since a better rating implies the potential for a loan at a lower price). Roberto Rivero told us that the rating S&P assigns to issuers is an independent opinion. This fact can help investors in decision making and makes it possible to compare different companies. However an investment strategy based only on the ratings is not necessarily a stable strategy, since there are more relevant factors that have to be taken into account. Finally he told us about the whole workflow that is essential for assigning a rating to a given company.

After Roberto Riveros presentation Arun Kumar (M.Sc., Financial Mathematics) the director of the Quantitative Analytics team in London took over and stated the more technical part. He told us about the two main analysis they use; the probability of default analysis where they use the Merton distance to default theorem and the loss given default analysis. In the loss given default analysis they use the Black-Karasinski model to simulate forward interest rates and Monte Carlo simulation to make a stochastic cash flow analysis. He also told us that for each rating the given issuer must be able to survive a given recession. In order to prove the ratings, they analyse how the different issuers would develop through a given recession. We ended our visit with the opportunity to ask questions and networking with Roberto Rivero, Arun Kumar and some of their colleagues.

The visit gave us a great insight in the work of a rating agency. Specifically we learned how some of the mathematical theory, which we are taught, as well is

applied in the rating process. They managed to present some rather complicated theory in a way so that people, who were not very far in their education, still understood the main points. This was mixed with a couple of anecdotes of people's reactions to some specific ratings. All in all it was a very interesting and educational visit.