Society of Mathematical Economic Students

MØF visiting

New York City

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Departments of Mathematical Sciences
University of Aarhus, Denmark

Contents

Introduction

Every year the Society of Mathematical Economic Students (MØF) at the University of Aarhus in Denmark plans a study tour with the purpose of gaining knowledge of how different corporations operate in relation to our two main fields of research, Operations Research and Finance. Every second year we travel abroad to gain this knowledge through visits at foreign companies. This year we chose to quit Europe after several destinations within the continent (Amsterdam, London, Brussels, Milan and Berlin) and crossed the Atlantic Ocean.

Fifty students participated in the visit to New York from the 9th to the 18th of October. Each student visited four or five companies. We wish to thank the below listed companies and institutions for their kind cooperation and the time they spent on our visits.

- General Re Financial Products
- Merrill Lynch
- Sigma Aircraft Management
- Den Danske Bank
- New York Stock Exchange
- Federal Reserve Bank of New York
- The University Transportation Research Center
- The Port Authority of New York and New Jersey
- Maersk Mercantile Logistics Inc.

This booklet contains summaries of the visits.

We also wish to thank the following companies and foundations for their financial support:

- Carlsbergs Mindelegat for Brygger J.C.Jacobsen
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On behalf of the Society of Mathematical Economic Students: Dan Bang, Malene Shin Jensen, Mikkel Bregnballe Kristensen, Mette Thor Hansen, Vibeke Christiansen, Michael Schmidt Nielsen, Peter Juhl Pedersen, Rasmus Brock-Faber and Martin Petersen.

General Re Financial Products

Friday the 15th october 1999 we had the privilige to visit General Re Financial Products in New York. The visit started at 1:00 pm . An employee, who's name we unfortunately didn't catch, started by giving an introduction concerning the activities of the firm.

General Re Financial Products (GRFP) is a 10 year old firm, that has 300 employees located in 4 different cities; New York, London, Tokyo and Toronto. The firm is dealer/marketmaker in plain-vanilla, exotic options, interestrate products, currency and equity derivatives. Further GRFP attach very much importance to arbitrage possibilities and is more concerned about losses than gains. Customers are asset/liability managers of large corporations, banks, mutual fonds and insurance companies. In order to deal with the products it should be mentioned that GRFP is rated tripel A (by Standard and Poor's guide to international rating - the same as Aaa by Moody's Long-term debt rating). This is the best possible rating (the rating implies that GRFP's capacity to pay interest and repay principal is extremely strong).

Then the subject was interest-rate swaps. A swap can be characterized by two bonds (one where you receive and one where you pay) and some default risk. By interest-rate swaps the two parties involved are swapping a bond with floating rates (LIBOR : London Interbank Offer Rate) against fixed rates. Moreover the default risk between the two parties, can be linked to the firms ratings (AAA , AA , A , BBB , . . .). Of cause the ratings have to be transformed to numbers and put into a model - then the swap can be priced. (Though it was mentioned that the default risk, wasn't that important in real life)

After a short break Leif Andersen took over. Leif Andersen (Ph.D from The Aarhus School of Business) started by giving us a short look at the computer system, with a closer look at the self designed programs for pricing the many derivatives. After this computer session Leif Andersen talked about a paper made by him and Jesper Andreasen (Ph.D from University of Aarhus). The subject was Jump-Diffusion Processes : Volatility smile Fitting and Numerical Methods for Pricing. The lecture used the normal setup for financial economics, like the methods from Duffie (Dynamic Asset Pricing Theory).

Futher information can be obtained at http://www.ssrn.com. We will spare you the details and only refer to the address, if you are interested in technical details.

Thanks to Leif Andersen and General Re Financial Products.

Merrill Lynch

12:00

We arrived at the World Financial Centre where Debbie Nikiper greeted us. We were taken to a conference room where we were given an introduction to Merrill Lynch by Patricia Rooney.

Today, Merrill Lynch is one of the largest financial management firms in the world with more than 900 offices worldwide. The company was created in 1820 and has since then grown to have more than 60,000 employees in 43 countries. Merrill Lynch is governed after the five principles: Client focus, Respect for the individual, Teamwork, Responsible citizenship and Integrity.

Merrill Lynch as an organization is divided into four groups, of which the Asset Management Group was given focus. It was from this group all the speakers came from. The Asset Management Group consists of four smaller groups of which MLAM (Merrill Lynch Asset Management) is the biggest.

The assets of MLAM consists of almost equal shares of equity and fixed income, dollars and foreign currency and the customers of MLAM are approximately 50% retail and 50% institutional.

The product that was given the most attention was the so-called mutual funds. A mutual fund is (simplified) a collection of stocks and bonds sold together as one, typically all the stocks and bonds of the mutual fund have something in common, e.g. they are all from the same country, specialized such as stocks in IT companies alone or purely money market funds such as FX.

Mutual funds have many obvious advantages:

- Diversification
- Highly regulated
- Organizations such as SEC and IRS uphold strict laws for mutual funds.
- Liquidity.
- Professional management.
- Reduced cost.
- Access to global markets.

After the insightful introduction we had a small break.

1:00 pm

Mr. Edwards then talked about ”Management of Risk in Investment Portfolios”. Risk was defined as the uncertainty about future rates of return. This risk should be controlled and limited, this is done by diversification and hedging. Important elements in risk management are: Identification, Quantification and Modification of risks. Risk management needs to be an integrated part of portfolio management because of the legal and regulatory framework in which the portfolios are managed.

The steps of the management process of the portfolio and the risk was laid out. Each of the steps in risk management was discussed:

- Establishing risk neutral position. Set up a benchmark portfolio that encapsulates the guidelines of the investment e.g. how much risk is the portfolio allowed to be exposed to. These benchmarks can be derived from market indices or from a series of liability cash flows and they should reflect the risk neutral position.

- Identifying the sources of risk. Sources of risk can be market risk (changes in the term structure), credit risk (country and spread risk), accounting / operational risk (valuation and tax treatment risk) and legal / regulatory risk (compliance risk.)

- Measuring investment risk. The three different methods currently used in measuring investment risks of MLAM are as follows: Factor analysis. (Sensitivity measures) Break down each factor that affect portfolio performance and try to estimate to what extent they deviate from the benchmark. Common factors are: Country/currency exposure, term structure exposure, sector exposure and credit exposure. Scenario analysis. (Stress testing variables)

- Test the portfolio performance under different scenarios such as Parallel interest rate shifts, Changes in yield spreads, Changes in market volatility and Changes in prepayment estimates. This method of analysis is extremely useful in analysing worst-case scenarios but it is an arbitrary and subjective process.

- Historical analysis (Value-at-Risk measures - VAR). VAR measures the maximum estimated loss in the market value of a portfolio based upon a certain confidence interval within a specified investment time horizon.

- Setting effective risk limits. Under factor analysis, limits are expressed in summary measures and allowable deviations. Under scenario analysis limits are expressed in minimum total return terms or maximum allowable deviations from the benchmark. Under Value-at-Risk limits are expressed in maximum allowable loss in absolute terms or relative to the benchmark.

- Managing with control limits. The portfolio manager then does the day to day handling of the portfolio under the risk limits set by the risk managers.

- Return analysis and attribution - reporting. The aim of return analysis is to break down realized active return into components such as: Yield, spread differentials Treasury curve parallel shift, twist. Spread and volatility changes.

Return attribution is important as it helps understand performance and combined with the risk model it can be used to compute measures of risk-adjusted performance.

The benefits from risk management are obvious:

- Awareness of risk and potential consequences.
- Ability to set acceptable limits on worst-case outcomes.
- Evaluate performance.

2:30 pm

After a short break Norman McClave gave us an introduction to credit risk management. Credit risk is defined as default risk of the counterpart and their payments and it is driven by a number of factors:

- Terms of transaction.
- Country of risk.
- Industry and operational environment.
- Concentration of transactions. (lack of diversification.)
- Portfolio risk.

Credit risk is long termed, has extended and less visible feedback and is hard to observe.

3:00 pm

Chris Reagan gave a presentation of his work with quantifying risk. When quantifying Portfolio risk the risk manager will face two important questions:

- What does the risk manager want to diversify against?
- What is the portfolio risk driven by? (e.g. prices of gasoline)

Chris Reagans job consisted of helping the portfolio managers quantify the credit risk of their portfolios.

3:25 pm

After the presentations we were taken for a brief tour of the Merrill Lynch museum ”The world of Merrill Lynch”. Here we saw the five principles and got a guided tour of the timeline which shows the history of Merrill Lynch (among other events how in 1941 Merrill Lynch was the first Wall Street firm to issue an annual report and in 1977 introduced the Cash Management Account (CMA)) and the history of the rest of the world set up against the development of the stock market. After this tour we had an overlook of the fixed income trading floor which was very big and we were told that there was a similar sized equity trading floor.

Back in the conference room we ended our visit at Merrill Lynch. This was our first visit with an American company and we did not know quite what to expect. But it was a very interesting and very well-organized visit.

Sigma Aircraft Management LLC

On Thursday the 14th of October we visited Sigma Aircraft Management LLC in their new Manhattan office.

Sigma Air is currently trying to develope the market for aircraft investment to include the private investors too. They help investors to place money in the aircraft market and help financing a deal, i.e you bring 20% of the cash Sigma Air raises the remaining 80%. The working areas of the company also include asset and lease management, investment structuring and of course market analysis. For smaller investors having only capital Sigma provides the infrastructure, so to speak.

First we were told about the characteristics of the aircraft market: Aircrafts are global and illiquid assets and investment in the market is associated with high risk. Furthermore investing in aircrafts differs from investing in the stock market because of the amount of paperwork related when closing a deal and the amount of money (typically around $20 millions) needed to buy an aircraft.

Naturally Sigma Air has several reasons to invest in aircrafts. First of all the risk/reward rate is very attractive if it is done right and as an informed player in the market Sigma Air can capitalize on the imperfection of information in the market. Sigma's knowledge also helps them predict the market and thereby reducing the risk of the investment.

Sigma Air mainly deals with so called 1st and 2nd tier airlines such as SAS, Lufthansa and Maersk. In addition they primarily invest in narrow body aircrafts as opposed to wide bodies(jumbos), which to a higher extend are associated with risk.

The visit was very interesting and we are happy that Jan Melgaard, Anders Hebrand and Max Bachrach took the time to get us acquainted with the aircraft market eventhough they were in the middle of a renovation.

Den Danske Bank

On Wednesday the 13th of October we visited the New York branch of Den Danske Bank (DDB), where Carsten Frost made a presentation of DDB in general and the NY branch in particular.

DDB is the largest bank in Denmark but in NY the bank didn't open until 1985 and today it has only 72 employees. While the danish department do all kind of banking, the NY branch only operates with

- Corporate banking
- FX and the money market.

Another difference between Denmark and USA is the policy of employement. In the states you hire people when you need them and fire then when you don't. In Denmark we employ people for as long as possible, even try to find new jobs for them in other departments so they can stay in the firm.

The NY branch's business strategy, both in the US and multinational, is to lend money through syndicates to high rated firms, which imply that they don't need additional information about the firm and thereby can operate entirely from NY.

After the presentation of the company Erik Hulvej took over and made a presentation of his job, which primary concerned currency options. He presented

- The history of options from the seventies till now.
- The basis option profiles.
- How to price an option.
- Some hedging strategies.

At the end of the presentation he talked about the volatility smile, how nice the theory is, and how practice is different.

Finally Jens Peter Nedergaard talked about the career opportunities in DDB. He told us that their recruitment policy concerning specialized jobs has changed during the last few years, so that the ratio of people with an academic background is growing. He also defined the perfect risk manager as a person who knows the matematic background behind the models and understands the behaviour of the market. The latter is especially important when the market is illiquid, because then the matematic models fail to apply.

We were very delighted to see how the financial theory was applied in practice, and finally we would like to thank DDB for a very educating visit.

Federal Reserve Bank of New York

On Friday 15th October we went on a guided tour to the Federal Reserve Bank of New York.

After a short introduction we were seated in a room where we were told about the Fed's main duties. Mainly the Fed controls the monetary policy in the US and is also responsible for the disposal of damaged notes.

After this we watched a video on how the Fed receives money from the banks, checks them for forgery and packs them so as they are ready to go back out to the banks. All this happens automaticly to ensure optimal security.

We then walked on to the 9th floor and listened to a speach on how monetary policy works. The Fed has three main monetary policy tools. These are open market operations, discount window lending and reserve requirements.

The Fed stores gold bars for 60 different governments and international agencies which adds up to 700,000 bars equivalent to 9,000 tons. 5% of the gold belongs to America. Each bar contains approximately 99.5% pure gold. There are two reasons for the 60 governments to store their gold in the Federal Reserve Bank of New York. Firstly it is stored there free of charge and also it makes it easy to trade gold in between the countries. We were transported by lift down to an unknown floor nearly 80 feet under the ground, where we were able to see the gold.

We do thank you for a very interesting and most educational visit.

Transportation Research Center - NY City College.

The College.

City College has 4000 graduate students and more than 1000 faculty members. The College spans from Engineering Sciences and Architecture to Liberal Arts. It is located in Harlem in New York City between 131th and 141th street, covering an area of 35 acres. Transportation Research Center is a branch of the School of Engineering. Entering Campus is like entering another time. The buildings and Halls are kept in a traditional American college style with a mix of old and new architecture. The campus appears quiet and safe even though located in a busy part of Harlem.

Transportation Research Center is a professional school which serves both as an educational and research center. Most research is done in collaboration with both private and public institutions.

Our visit to Transportation Research Center on Tuesday October 12th began with a brief introduction by Professor José Holguin-Veras, Ph.D., followed by a guided tour on campus by Victor Ochieng (Graduate student, Ph.D.) Hereafter we were introduced to some of the ongoing projects.

Ongoing projects.

Freight and Passenger Trip Length Distribution.

By Ellen Thorson.

The project is based on data collected in Guatemala City. The purpose was to gain insight in the distribution of trip lengths as a function of vehicle load. The insights can be used in e.g. aggregated models on traffic flow in a region. If data were divided into two groups after truck-type, the distribution of trip length more or less followed an exponential distribution. One cause of error was a nearby harbor, which generated many trips terminating outside the region.

Freight Transportation and Environmental Degradation.

By Victor Ochieng.

The research project is a collaborative effort involving the community, Columbia University and City University of New York. The objective of the study is to investigate and identify the correlation between traffic and pollution and to propose strategies for minimizing negative impacts of truck traffic. The project examines the costs and benefits of having a logistics center located in a populated area.

Some of the proposed strategies are to change traffic lights in order to reduce the number of stops on vehicle routes. This is an easy way to reduce pollution without reducing traffic.

At present time the project is in an intermediate phase where further data needs to be collected.

Truck Trip Generation at Container Terminals.

By Yamilka Lopez.

The background for this project is a simple linear regression model to estimate the number of trips generated as a function of the size of the terminal. This project seeks a linear regression model based on TEU. One TEU equals one 20ft container. At present only 7 terminals have responded to the request for data, thus the foundation for an extensive analysis is scarce. However, at this stage a strong corellation between TEU and trips generated is found and it is concluded that models based on the size alone are not sufficient.

Optimal Space Allocation and Pricing at Intermodal Terminals.

By José Holguin-Veras.

This research deals with price-differentation at container terminals. Faced with a limited amount of space to store containers and larger ships in the future, it is essential to reduce container dwelling times. This can be done by price-differentation. The differentiation is between high and low valued containers. It was found out that optimal container prices meet the following equation:

$$\frac{P_j^* - m_j}{P_j^*} = \frac{1}{\left|\eta_{P_j}\right|} + \frac{l_1}{H_j P_j^*} \tag{1}$$

with P_j^* being the optimal price, m_j the marginal cost, η_{P_j} the elasticity of dweeling time to price, l_1 a Lagrange Multiplier and H_j the stack-height of containers. Equation (1) is the Inverse Elasticity Rule found by Hansen in 1927 plus a correction term caused by capacity restrictions. Among the results were that containers that cannot be stacked high should be charged a higher price as should containers with high marginal costs. One problem is to obtain the elasticity of dwelling times since this is a new area in research.

Other projects.

Mr. Holguin-Veras briefly introduced two other projects using optimization methods. These were:

- Optimization of Ultra-high Density Container Storage Systems.
- Optimization of Priority Systems for Port Networks.

Port Authority of New York and New Jersey

On October 13th 25 students from the Society of Mathematical Economic Students at University of Aarhus (Denmark) visited The Port Authority of NY and NJ at the World Trade Center.

After breakfast the agenda of the day was:

- Overview of the Port Authority by Mr. James C. Renish
- Financing P. A. Projects by Mr. Cherian George
- Economic Forecasting by Mr Eugene Spruck.

The Port Authority of NY and NJ is a self supporting public agency whos purpose is to control the main part of the infrastructure of N.Y. and N.J. Among other things they control the subway, the 3 airports, JFK, Newark and Laguardia, and the six innerstate tunnels/bridges that connects NY and NJ

The Port Authority's sources of revenue is bonds, fees and charges from the airports and terminals and other fees and tolls from bridges/tunnels. They are not receiving any funds from the state of NY and NJ The share holders are mainly the state of New Jersey and the people of NY and NJ.

Some of the projects Porth Authority is involved in are improvement of channels, painting of bridges and ventilation in tunnels.

The NY and NJ area have a more complex population than the rest of USA which makes forecasting more difficult. One out of three habitants is not born in USA.

The location of the residential areas and the location of jobs determines future planning of infrastructure.

Forecast are mainly based on level of personal income, because this has a big influence on air traffic which is the biggest source of income of the PA.

For more information see: www.panynj.gov

Mercantile Logistics

Thursday the 14th of October we visited the headquarters of Mercantile in the state of New Jersey. We were welcomed by Mr. Michael Christensen, who gave us an overwiev of the days program and a brief introduction to Mercantile.

Mercantile, founded in 1978, is a part of the A.P. Moller Group and is Maersk Line's biggest customer. The company has a yearly revenue of 600 million dollars and about 2000 employees. Mercantile operates in the field of logistics and deals with; airfreight, supply chain management, warehousing and distribution, forwarding and groupage, and local services. From the start in the late 70's the focus was on utilisation of available container space at overseas origins, but later value-added services were included. Among these were; local transportation, customs clearence, co-ordination with shipping lines, and barcoding.

Then we were told of Mercantile's view on logistics, "the process of strategically managing the movement and storage of materials or products and related information from any point in the manufacturing process through consumer fulfillment and back."He emphasized that supply chain management is not just about streamlining this process, but also about connecting people. The more communication there is between suppliers, distributors and customers the less chance of misunderstanding and divergence in expectance about what is to be delivered. Logistics also means aligning strategies to achieve common goals as well as physically redesigning the movement of goods to maximize value and minimize costs. Next he talked about the benefits of outsourcing logistics. The company can keep focus on what they do best. Besides it will free up human resources within the company which can be used to set focus on other activities with higher payback. Mercantile can provide a better service through specialization and economies of scale. The client can reduce uncertainty of costs by making a contract with fixed price for a given service level. The cost savings can be redirected to strategic, core buisness operations. Finally he gave a simple example of how a reduction in inventory holding resulted in cost savings.

Next we were introduced to one of Mercantile's clients, Federated, which is one of the largest operators of department stores in the USA with more than 400 stores in 36 states. Among the stores that Federated operates are Macy's and Bloomingdale's. Federated, motivated by their wish to reduce cost/processing time and to improve sales, wanted a global service provider which could offer them a phase-in transition plan. This was exactly what Mercantile could offer, and they were chosen among five other companys, even though their price were not the lowest. What Mercantile came up with was a program including:

- Centralized Information Network
- On-Line Global Systems
- Dedicated Federated-Specific Support Teams Regionally
- Local Offices Supported by Regional Headquarters

Mercantile, in collaboration with Federated, came up with a three phased plan. First phase included the implementation of physical handling and documentation flow operation in Asia and Europe and an efficient exchange of information. The second phase included improvements in transportation and implementation of the de-consolidation program (Hudd). In the third phase logistics cost were to drop and the delivery reliability should increase. Furthermore Federated was to share the benefit with Mercantile. This means that Mercantile gets a part of the amount Federated saves because of the lower logistics cost. This is another motivation factor for Mercantile. One of the things needed was a ”vendor performance standard”meaning that the vendors were suppose to add barcodes to all their cartons, provide the relevant documents, use quality cartons, etc. After phase two the program should be reviewed, to find out what went wrong/right, find where improvements were needed, and measure the performance. In the evaluation of the results after phase one and two, it was mentioned that the on-time delivery percentage had increased from 46 in August 1998 to 90 in June 1999. Then we were told about the current goals. These included implementation of an air program and implementation of the program in Central and South America.

Then Mrs. Kathy Reilly, a former employee at Mercantile who now works for Federated, gave a short introduction to the client's perspective. She told us a little about the structure of the Federated organization and what their expectations to the project had been. She too stressed the importance of information flow and told how Federated had been able to close distribution centers, reduce warehouse staff and reduce transportation costs.

After a nice lunch we departed to Seacacus Deconsolidation and Distribution Center for a tour at the facility. The center receives goods from the vendors and processes them to the warehouses in the region. This processing includes a number of different things; barcoding the cartons, checking the cartons for defects and for the right quantity according to the documents, and packing for the stores. The area was about 7,000 square feet and 60,000 cartons are processed every day.

We would like to thank everyone involved for an interesting and well organized visit.

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