

SECTOR

Interview **Finaps**

Interview **Flow Traders**

As told by **Hande Karabiyik**

A week in the life of **Marc Stougie**

The Good, the Bad and the Ugly in Markov Chains
Ad Ridder



FLOW ■ TRADERS



Preface SECTOR

The academic year is nearing its end and it is time for the second edition of the SECTOR. This edition contains new articles, such as articles about experiences from two international students within Kraket and an overview on the first edition of the Diversity and Development Day! We start off with the two interviews held at Finaps and Flow Traders. For the company interview with Finaps we interviewed two members of Kraket that enjoyed the inhoudday at Finaps and decided to apply for a part-time job. Here, you can read about what attracted them to Finaps as employer. Next, in the interview with Flow Traders you can read about the life of a trader, namely Menko ten Cate. He tells us about his background and what he enjoys about trading at Flow Traders.

Moving on, the professors Bernd Heidergott and Ad Ridder write about research they have done in their respective fields. Additionally, we have an article from professor Hande Karabiyik. We interviewed Hande to find out what led her to pursue a career in the field of Econometrics and what brought her to the VU. Besides articles

from professors, there are numerous articles from fellow students. For instance, Marc Stougie, after successfully completing his masters along with a part time job at Sprekels & Verschuren, was offered a permanent position at S&V and describes his work week. Moreover, Loïs Stijssiger, Matthias Versfeld, Rajni Rasiawan and Martijn Smink tell us about what they do/did in order to develop themselves next to their studies.

Lastly, you can find information on this year's Forum event. It was a fantastic and well-organised day, where many first and second-year students had their first formal encounter with their potential employers. Not to forget the research career path, Bernard Zweers gave a talk on his life as a PhD candidate. As always, at the end of the SECTOR you can find an interesting and challenging puzzle to do, given by Mlcompany!

Content

- 1 Preface
- 3 Interview Finaps
- 7 Interview Flow Traders
- 11 The Good, the Bad and the Ugly in Markov Chains
Prof. Ad Ridder
- 14 Diversity & Development Day
- 15 Actor-based (=Social) Network Analysis
Prof. Bernd Heidergott
- 20 As told by
Prof. Hande Karabiyik
- 23 International Students
Why did they come to Amsterdam?
- 25 A Week in the Life of
Marc Stougie
- 27 Extra
Four students, four extracurricular activities
- 32 Tips & Tricks by Career Services
An interview with Tamar Pagrach and Friederike Terwyen
- 35 Forum
- 37 Puzzels
- 38 Publications & Agenda

Colophon

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FINAPS

Business solutions that work



Jaimie Rutgers

After combining a board-year with studying, he hopes to finish his bachelor next year along with working at Finaps.



Job den Otter

Alongside starting his master, Job looks to gain valuable experience by working at Finaps.

Interview - Finaps

Introduction

Kraket interviewed Jaimie Rutgers and Job den Otter in light of the In-house day and their future employment at Finaps. Both are Econometrics students at the Vrije Universiteit of Amsterdam. In this interview, they will share the ins and outs of getting to know Finaps as a great company to work for.

Could you give a short introduction of yourselves?

Jaimie: I am a third-year Econometrics Bachelor student and I live in Diemen. Due to my board year at Kraket it will take me 4 years to finish my bachelor. I hope to complete my Bachelor by the end of next year.

Job: I am currently in the last year of my Econometrics Bachelor. I live in Utrecht with my girlfriend and I will stay there for the time being.

Generally, I don't go to Amsterdam very often, but since I will be working at Finaps, this will change.

How would you describe Finaps?

Jaimie: I see Finaps as a small-scale professional company even though now it is not as small as it used to be. Finaps has a family atmosphere, it is truly "gezellig" (cosy). What I really like is that it is a creative company where everyone is very open and inclusive. Finaps goes beyond simply providing clients with data or software solutions. They distinguish themselves by creating front-running apps, using the newest software and working in a close partnership with their clients. After having visited numerous companies within this sector, I believe that this is what makes Finaps unique.

Job: I agree! What stands out to me is the diversity of the employees in all aspects!

How well did you know Finaps before you visited the In-house day?

Jaimie: I got acquainted with Finaps through my board year at Kraket. They are one of our main sponsors, so we had close contact throughout the year. In addition, I went to the In-house day last year so I knew them fairly well.

Job: I did not know Finaps very well until the In-house day.

Could you tell us more about the In-house day?

Job: We were welcomed with sandwiches for lunch. First, Finaps gave an introduction on what they do with an example of the project they are currently working on for ING. Shortly after we started the case where we had to create a beer app. It was a fun challenging case. The idea was that we would program both the back- and the front-end in a couple of hours.

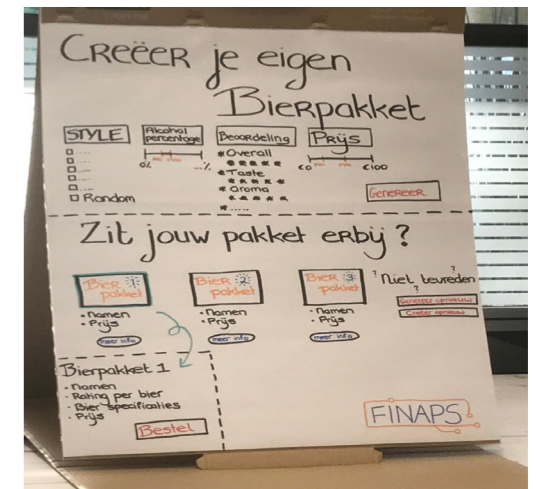
The front-end language, JavaScript, was not very familiar to us. For the back-end programming most of us are used to Spyder, but they used Jupyter Notebook. Jupyter Notebook makes it very easy to load programs via a server instead of sending individual Python files. The new front-end language, back-end programming and trying to understand the already written code made this case a challenge. Nonetheless, I believe that everyone did a great job and it was both an interesting and challenging case.

Jaimie: It was a challenging case indeed. I spoke with Lonneke Makhija - Managing Director and Founder of Finaps. She explained that Finaps used to work a lot in Mendix which is a very visual platform; "What you see is what you get". Because they are currently moving towards open-source software, they wanted to show this to the students. I believe this was the intention of the 'beer app' case. To get a feeling of programming was indeed very challenging, let alone to make something yourself. However, that doesn't take away that the idea behind it was very interesting. The whole idea of creating a beer application with a dataset containing customer reviews, types of beer, alcohol percentages, etc, was very intriguing. It was nicely tailored to students and many were able to come up with creative applications. I remember we had done something with a medical dataset last year, I definitely preferred this year.

What made the In-house day interesting?

Jaimie: I really enjoyed the challenge. When I was looking at the files, I wanted to understand what had been coded already and how it was operating. In addition, our group was simultaneously working on the front-end and the back-end from the start, which gave our group an advantage as we were able to finish both parts in time. I really enjoyed to sit down and focus on the coding, which at the start is just messing around and processing errors until it works. And the atmosphere was just really great. The In-house day gave me the feeling that we were at a mini hackathon.

Job: I was a little less concerned with the JavaScript side, but I did understand and learn parts of JavaScript. The atmosphere was great, I could really appreciate that all the employees are appreciated for their different strengths and weaknesses.



What department within Finaps will you be working for?

Jaimie: This has not been decided yet. On the website of Kraket they have 3 openings for Econometricians: Data Analyst, Business Engineer, and Technical Business Engineer. I will be working as Business Engineer.

Job: Finaps has just moved to a relatively new structure with teams. Each team takes on different projects because each project requires different skills. They are fixed teams with different specialties within each team. I do not yet know with what team I will be working, but I think I would prefer to work with Python and React over working with Mendix.



What do you expect to learn by working at Finaps?

Jaimie: I think the biggest aspect that I am going to learn is the more practical side of my education. I notice that what we learn at the VU is very theoretical. Most students have little insight into what they can do with all the knowledge they have gained during their studies. Specifically, I hope to make the transition from University to the job market more easily by gaining valuable practical experience.

Job: For me, it is mainly broadening my basic knowledge. Developing applications and websites are very basic, also in our study. However, it is something that I have zero knowledge of. I currently do not know how to create a website. Hopefully, I will soon.

How did the application process work at Finaps?

Jaimie: During the drinks of the In-house day I approached Lonneke and asked what the possibilities were for me at Finaps. We had a brief conversation that evening and as agreed, I contacted her shortly after via LinkedIn. Next, I was requested to send my resume, after which I was invited for an interview. The interview was with Marlies van Sonsbeek - Managing Partner. The interview was still a bit difficult because what I wanted and what Finaps wanted did not quite match yet. Together we puzzled and eventually, the right match came out, soon I will start my job at Finaps.

Job: I got a LinkedIn message from Lonneke after the In-house day and decided to pursue the

mutual interest and messaged Lonneke. I first had an interview with Marlies, which was mainly orientationally. To Finaps it was important that I could work a few days more a week, which is why I agreed to start working four days a week. Finally, we had a phone call and I visited once more after which I received a contract.

Lastly, which students would you recommend considering Finaps as an employer?

Jaimie: What Finaps has told me and what I also believe in are the following two aspects. Firstly, you do not have to be excellent at anything, you should much rather be open and ambitious to learn new things. There are many examples of employees who came at Finaps with the ambition to learn new programming languages, for example. Secondly, I believe the other aspect is creativity. Finaps gives you the opportunity to use your creativity, which is something I enjoy doing. In short, I believe ambition to learn new things and creativity are the two personality traits that would describe the students who would suit working at Finaps.

Job: I believe that they are looking for authentic people. People with an opinion who dare to say what they think, because this is important in a small company. Furthermore, you should be passionate about programming, otherwise, I would recommend you look for something else.

Jaimie: Yes, indeed you have to like programming. If you do not know JavaScript, then you have to like programming enough to dive down and learn it.

FINAPS

is hiring

Vacancy: Software Engineer

"People above processes"

At Finaps we believe that technology helps businesses to achieve their most ambitious goals. To realize this, we need **highly creative, talented** people who know how to inspire clients by creating strong data driven and software-based solutions.

Within Finaps we work with small teams who are responsible for client-interactions and for delivering sound software. This requires that we need people with various skills:

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- **High sense of responsibility**
- **Creative, a bit stubborn, and business-oriented**
- **Can-do mentality!**
- **Passion for software and data**
- **Motivated to specialize in upcoming technologies**

Within our teams we are always looking for uniquely talented people. If you have just started, or if you are already an all-round developer, **you just need to love engineering!**

At Finaps you will be challenged to develop yourself as a professional Software Engineer. You will learn various technologies and patterns, by working as part of an interdisciplinary team.

This is who we are:

We strive for **excellence** no matter how complex the challenge

We are **flexible**

We act with **integrity**

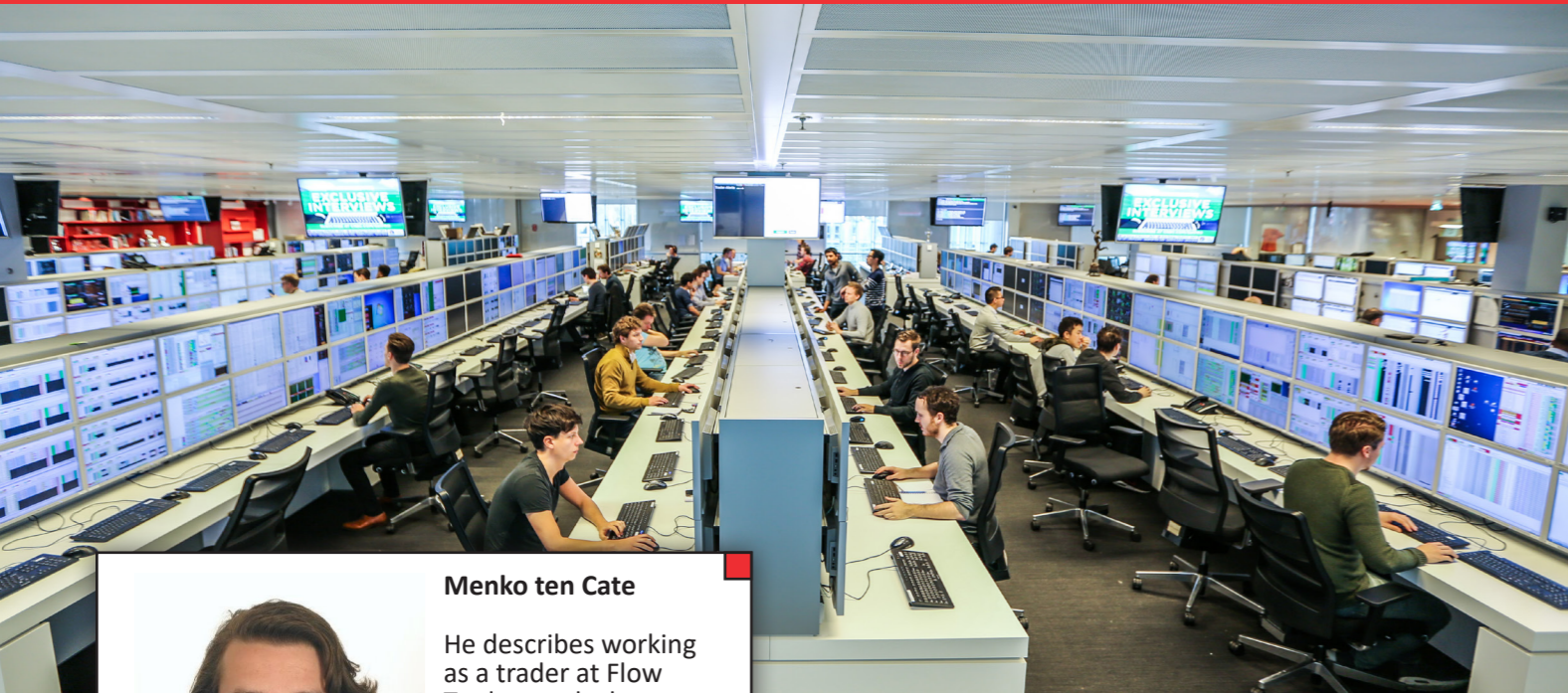
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For more information you can e-mail us at info@finaps.nl or call us on **+31 (0) 30 699 70 40**.

**Menko ten Cate**

He describes working as a trader at Flow Traders and what makes them special.



Interview - Flow Traders

Introduction

Hello, my name is Menko ten Cate. I grew up in Naarden and have always liked applying mathematics, that is why I chose to study Econometrics. I did both my undergraduate and graduate studies at the UVA. After completing my studies, I joined Flow Traders and have been working here for 1.5 years. At Flow Traders I am part of the developed markets desk. Here, we trade in ETFs consisting of equities from different developed countries whereas other desks might focus on ETFs tracking a single developed country, commodity, currency, bond or a combination of those. Let me explain ETFs. ETFs are exchange traded investment funds, which means that when you buy an ETF you buy a share in a fund which can be seen as a basket of securities. These baskets track an index, underlying security or commodity. Amongst others, ETFs enable investors to mimic trading in indices or stocks that would otherwise be too expensive. Flow Traders is a global leader in providing liquidity, specialized in ETFs. We are market makers; we provide liquidity by continuously providing bid/offer prices. In

doing so, we aim to quote accurate prices with the narrowest spreads. To do this we hire excellent traders, but also invest a lot in our own software development. This enables trades to be done quick and allows for continuous development of our trading strategies.

We trade on all major exchanges worldwide, in order to do so we have offices in Europe, Asia and the United States. Previously, employees at Flow Traders occasionally worked night shifts in order to trade on these exchanges. However, this is obviously not something we nor the employees desired. Next to trading on the exchange we do OTC (Over the Counter) trades, which means we directly trade with counterparties. Having offices all over the world has enabled us to maintain good contact with foreign companies.

The openness and transparency of Flow Traders is what has appealed me to Flow Traders. We all work on the same floor including the CEO's. This gives the feeling that you can approach anyone for help and with your ideas, also our glass meeting rooms give an indication of our transparency.

Additionally, we are very centred around teamwork. Each team consists of around 3 members that are jointly responsible of their own book. Furthermore, at Flow Traders there is little to no competition among the employees regarding work and performance. We work together to get the best results for the company and share in its benefits.

Are there possibilities to go abroad?

There are definitely possibilities to go abroad. As I mentioned Flow Traders has many offices all over the world. If you are interested to work in one of the offices outside the Netherlands this is definitely possible. You can apply to start full time at each of these offices. Moving around for shorter periods of time happens in general more after you have a few years of experience. This way you can best share knowledge that you obtained here with other offices. However, if you are very motivated it is possible to do this quite soon.

What do you see reoccur most from your studies?

Working as a trader is for most a lot less in-depth in terms of modelling and the theoretical aspects of modelling. The manner of thinking and problem solving that I learnt, is what I use the most. Although, many of the basics from financial markets taught at university is relevant. The most important part from my studies are financial arbitrage theories to price derivatives. In addition, basic regression models can be very useful to predict prices.

Does Flow Traders have a lot of Econometricians?

Yes, we have quite a lot of Econometricians. Over the years we are increasingly looking for employees with a background in some form of applied mathematics that have interest in the financial markets. For instance, studies like Physics, Mathematics, Computer Science or engineering have become popular. However, we still have some employees with a background in Economics or Finance, but they don't get recruited very often anymore.

What different departments are there?

First of all we have the traders, they determine which models to use and at what prices will be traded. Herein, we have traders that trade on the exchange and provide prices to the Sales Traders that mainly make OTC trades. Next, we have the

analysts. They keep track of macroeconomic events and movements in the market. They brief the traders every morning on macroeconomic events and the latest movements on different exchanges. Moreover, they give advice on relevant incidents throughout the day. Then, keeping watch over the total position of the company, individual trades that are made by traders and our exposure, we have the Risk department. Logically, we also have a Legal department, HR department and mid office that ensure all trades we make are lived up to and settled properly. Finally, we have the Software Developers. This is one of the larger departments and it is responsible for developing and maintaining the software we use. Continuously developing this area enables our traders to provide prices quicker than our competition. Mostly we program in Java, c++ and Python, however many other program languages are used. Traders are free to implement and adjust our software to develop their own specific trading strategies. All traders start with a training of three months, after which they choose the department they want to work for in consultation with their manager.

What does your typical workday look like?

Usually, I start at half past seven with breakfast at the office. We start off with morning checks and analysing what has happened overnight in the European market as well as the other markets. This permits us to adjust our pricing according to the latest market news and movements. At 9 o'clock the market opens and starts with the opening auction. This means that during the first few minutes there is an auction that determines the open price of the day for each stock. Generally, by 11 o'clock the market has settled a little and you have some time to work on your own projects such as improving trading strategies. On the other side if there is a lot of market movement you spend more time trading. As you can see there is a lot of dependency on the market. Therefore, we have implemented different 'warning' sounds in our systems that go off once more attention from the trader is needed. This allows our traders to divide their attention with more confidence and ease. At half past 3 the US markets open. In general, this also leads to more activity on the European exchanges and more underlying securities of our ETFs being traded in the US. At 17 o'clock the market closes, again we have an auction for the closing price. Lastly, I keep myself busy with some administrative tasks and together with my team discuss the course of the day and



what we can improve for the next. By this time it is between 18 and 19 o'clock and time to go home.

How much do you notice that you are competing with other trading houses?

Occasionally you can see who made the trade on the other side, but usually this is anonymous. Sometimes you can recognise a counterparty based on the behaviour of their orders and the sizes of their orders. We can always trade on their bid/offer price if we deem this beneficial.

Could you describe the selection procedure?

My selection procedure consisted of three rounds. First, I had to apply with my CV and convincing cover letter. If you are invited for the next round, you need to do a numeral test and capacity tests. One of the tests consists of arithmetic questions, where you have to fill in as many correct answers as possible within eight minutes. Finally, there is a case study conducted by senior traders. In this case, your way of thinking is very important rather than pre-knowledge about trading.

Do you also work on long-term projects?

In general, we are always trying to automate processes. Our objective is to write programs for the simple executions, so that we can focus on long term strategies and smarter algorithms. Speed of

execution is an important factor to compete with others. Therefore, we have many people working on the data connections in order to make business processes faster. In our work, differences of nanoseconds can be significant.

The average age of the employees at Flow Traders is 27. Why is the average age relatively low?

We are looking for people who are motivated and willing to learn new things. One of the reasons is that, in general, new graduates are more open to learn new things. Besides, the fact that we have a lot of young people working here, we probably attract more young people.

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The Good, the Bad, and the Ugly in Markov Chains



Ad Ridder

He is an associate professor in Operations Research at the department of Econometrics and Operations Research.

1 Introduction

Consider a discrete-time Markov chain $\{X(t), t = 0, 1, \dots\}$ on a state space S with transition probabilities $p(x, y) \doteq \mathbb{P}(X(t+1) = y | X(t) = x)$. The state space is partitioned into three (disjoint) sets, $S = G \cup B \cup U$, where G is the set of *good states*, B is the set of *bad states*, and U is the set of *ugly states*. It is assumed that the chain is irreducible, which means that all states are attainable from any state in the state space. Suppose that the chain starts in an ugly state, say u , and that we are interested in the probability that the chain reaches a bad state before a good state, while this probability is extremely small. We say that the event is a *rare event*. The rare-event probability is denoted by γ , which is supposed to be $\gamma \approx 0$. In the analysis we denote sometimes $\gamma(u)$ for specifying the initial state. Two examples will illustrate these concepts.

Example 1 (M/M/1 Queue). Recall the M/M/1 queue with arrival rate λ and service rate μ , where $\lambda < \mu$. A busy period is the period of time during which the server is continuously busy. We are interested in the probability that the queue length exceeds n ever during a busy period, where n is large. This problem is cast easily into our formulation, by considering the discrete-time Markov chain embedded at the arrival and departure times of the queueing process. The state space $S = \{0, 1, \dots\}$ represents the number of customers in the queue and service, with transition probabilities

$$p(x, x+1) = \lambda/(\lambda + \mu), \quad p(x, x-1) = \mu/(\lambda + \mu) = 1 - p \quad (x = 1, 2, \dots).$$

The good, the bad and the ugly states are,

$$G = \{0\}, \quad B = \{n, n+1, \dots\}, \quad U = \{1, \dots, n-1\}.$$

When we denote the rare event probability by $\gamma^{(n)}$, then $\gamma^{(n)} \rightarrow 0$ as $n \rightarrow \infty$. □

Example 2 (Repair Systems). Consider a factory with n identical machines. Each machine fails after an exponentially distributed random time with mean $1/\epsilon$. The machines are highly reliable, meaning $\epsilon > 0$ but small. Immediately after failure, a handyman starts to work on it to repair the machine, which takes an exponentially distributed random time with mean $1/\mu$. After repair the machine is as good as new. There are enough handymen for all machines because the factory is down when all machines have failed. Suppose that at time 0 a machine has failed, then the interest is in the probability that the factory goes down before all machines are working. This problem is cast easily into our formulation, by considering the discrete-time Markov chain embedded at the failure and repaired times of the machines. The state space $S = \{0, 1, \dots, n\}$ represents the number of failed machines, with transition probabilities

$$\begin{aligned} p(x, x+1) &= \frac{(n-x)\epsilon}{(n-x)\epsilon + x\mu} & (x \leq n-1), \\ p(x, x-1) &= \frac{x\mu}{(n-x)\epsilon + x\mu} & (x \geq 1). \end{aligned}$$

The good, the bad and the ugly states are,

$$G = \{0\}, \quad B = \{n\}, \quad U = \{1, \dots, n-1\}.$$

When we denote the rare event probability by $\gamma^{(\epsilon)}$, then $\gamma^{(\epsilon)} \rightarrow 0$ as $\epsilon \rightarrow 0$. □

2 Monte Carlo Simulation

The rare-event probability is computed by running a simulation of the Markov chain. This is fairly easy to model and to program. The program generates N sample paths of the Markov chain, all starting from the same ugly state, say u , and ending either in a good state (score $Z_i = 0$ of the i -th path) or in a bad state (score $Z_i = 1$). The average of the Z_i scores is an unbiased estimator of the target probability,

$$\hat{\gamma} = \bar{Z}_N \doteq \frac{1}{N} \sum_{i=1}^N Z_i.$$

Commonly this is called the *Monte Carlo estimator*. Using the sample variance we compute the standard error of the estimator, and construct the associated confidence intervals. In our numerical experiments we set the sample sizes so large that the 95% confidence intervals have relative widths of 20% (in both directions 10%). An important aspect in simulation projects is the computation time needed for accurate estimates. In these Monte Carlo simulations, the computation times are proportional to the sample sizes, and these are proportional to $1/\gamma$ due to our criterion.

Example 3. In the $M/M/1$ queue we set arrival rate $\lambda = 0.8$, service rate $\mu = 1$, and let overflow level n be increasing from 20, 30, . . . In the repair system we set repair rate $\mu = 1$, $n = 10$ machines, and let the failure rate ϵ decreasing from 0.5, 0.4, . . .

Table 1: Simulation results for the $M/M/1$ queue and the repair system.

n	$M/M/1$ queue		ϵ	repair system	
	N	\bar{Z}_N		N	\bar{Z}_N
20	150 K	2.8067e-03	0.5	200 k	1.9100e-03
30	1.3 M	3.4000e-04	0.4	1.6 M	2.4500e-04
40	12 M	3.1833e-05	0.3	21 M	1.8095e-05
50	112 M	3.1875e-06	0.25	108 M	3.611e-06
60	1050 M	3.7810e-07	0.2	800 M	4.900e-07

The last row of the table took about 4 minutes for each of the systems, executed by programs coded in C on a MacBook Pro laptop with 2.4GHz processor, and 8GB 1333Mhz RAM. Larger overflow levels in the $M/M/1$, and smaller failure rates in the repair system become problematic, for instance $n = 100$ would take a sample size of about 7800 G which would take about 225 days, and $\epsilon = 0.05$ would take a sample size of about 20 T which would take about 18 days. \square

3 Complexity of Estimators

Consider any unbiased estimator $\bar{\zeta}_N$ of the rare-event probability γ based on N i.i.d. replicas of a single-run estimator ζ . The target is to get 95% confidence intervals having relative widths of 20%, which leads to (with 95%-quantile 2.0 in stead of 1.96),

$$4 \sqrt{\frac{\text{Var}(\zeta)}{N}} \leq 0.2\gamma \Leftrightarrow N \geq 400 \frac{\text{Var}(\zeta)}{\gamma^2}.$$

The single-run Monte Carlo estimator Z is a Bernoulli random variable with variance $\gamma(1-\gamma) \approx \gamma$ in the rare-event regime ($\gamma \approx 0$). Thus, indeed we need sample size N proportionally to $1/\gamma$, and typically, the rare-event probability decays exponentially fast. For instance in the $M/M/1$ queue,

$$\gamma = O(\exp(-\alpha n)), \quad n \rightarrow \infty.$$

Thus, the required sample sizes have an *exponential complexity*, see also Table 1. The research field of rare-event simulation is about finding estimators for which the required sample sizes have a *polynomial complexity*, or even better, a *bounded complexity*, or optimally, a *zero complexity*. The latter is obtained iff $\text{Var}(\zeta) = 0$. In the next section we shall show how we can construct an estimator with this property.

Diversity & Development Day

As is custom, the day started off with a coffee or tea to get everyone excited for day. Inaugurate speaker Wim Haan is the Diversity Coordinator at the VU. He talked about the VU's perspective on diversity and how they stimulate diversity. The main message Mr. Haan wanted to convey is the broadness of diversity. Diversity is not limited by any number of cultures or ethnicity, rather it is anything in which someone can differ from others. Therefore, the VU supports a very broad definition or call it guideline on diversity. Following up on the talk, everyone went to one of the two workshops organized for the day. One workshop was given by Career Services on networking. Here do's and don'ts during networking talks were discussed as well as appropriate ways to keep connected and broaden your network. The second workshop was given by AIESEC. This workshop was about leadership, it touched on the qualities of a good leader and how to be a leader and not a boss. The workshops were followed by a short break, after which Georgios Sarigiannidis from ORTEC talked about the role diversity played in his career. After studying applied mathematics at the TU Delft Mr. Sarigiannidis joined ORTEC. Currently, he is managing director at ORTEC where his team consists of roughly 200 employees. Before finding his success in the applied mathematics world at ORTEC his ambitions where to become a professional musician/composer. He tells his interesting story of when he was studying at the conservatorium in Greece and his interests in literature and poetry. In addition, he talks about the reasons for his career turnover and the role his broad and diverse interest has played in becoming managing director. Concluding, an interesting talk which left many amazed and intrigued.

After the lunch Geertje Zeegers from MIcompany told something about how MIcompany focuses on a

minority group, namely the women. Getting women inside a company is hard, especially in higher functions. MIcompany takes care of this group, by offering a specific Data Analytics growth path for female. This group calls itself Statistic Sisters. For these sisters, workshops are organised. These workshops focus on things that ladies can do better/different to improve themselves and grow within MIcompany. They also try to encourage women to apply to MIcompany.

After listening to Geertje's talk, the next event took place which consisted of different rounds. Firstly, there was a speed date session in which the students had 5 minutes to ask questions to different companies. The companies present were: MIcompany, ORTEC, Lynxx, Deloitte and Triple A. Also included in these rounds was a personality test, in which students had to fill in some of their characteristics, and as a result they might figure out something new about themselves. Furthermore there was a cv check. Where a specialist in this field looked over the cv and told how it could be improved, she gave good advice personally as well as general advice. Lastly, there was a possibility to let a photographer make a picture, which can be used as a good profile picture for LinkedIn or for your cv.

After the last round, the day ended with a networking drink. Where you had the possibility to further network with companies you had briefly talked to during the speed date rounds. Consequently, the students were able to expand their network, by conveniently using their newly acquired skills from the networking workshop. All in all, it was a well organized day with many learning and networking opportunities for all participants.





Bernd Heidergott

He is a professor of Stochastic Optimization at the department of Econometrics & Operations Research.

Introduction

My general background is stochastic simulation, (simulation-based) optimization, and Markov chain theory. Next to that, I have an interest in max-plus algebra, see [2,3], and in Non-Standard analysis. Although my current research activities appear to me as all being part of my big research question “How do we balance the need for conceptual models with the ad hoc nature of reality?”, I can think of no way of telling a coherent story, and as I cannot choose which of my interests is the most dear to me at the moment, I decided to briefly give an overview of the main research areas.

Actor-based (=Social) Network Analysis

One of my main topics of research is the analysis of social networks by Markov chains. To quote my colleague Ines Linder “You cannot talk with Bernd about social networks without him mentioning Markov chains.” This is quite right, as I am convinced that interpreting a weighted graph (after possibly re-scaling the weights) as Markov chain, constitutes a paradigm shift from the deterministic, graph theoretical point of view, to the probabilistic view that yields valuable insights. In a recent paper [1], Joost Berkhout, a former EOR master student and PhD from our department, and I developed a new algorithm for clustering Markov chains. This algorithm is suited for the analysis of hyperlink networks and social networks. More specifically, once the weights of the links between the agents in a given network (read: the transition probabilities) are determined, our algorithm finds the natural clusters in the network.

I use the word “natural” here carefully, as I believe that while it is open to discussion how to derive a Markov transition matrix P from given data on connections, once P is given, the decomposition of P into clusters can be achieved in a natural way. The algorithm is based on the fact that for an irreducible $n \times n$ Markov chain P the matrix $M \in [0, \infty)^{n \times n}$ of mean number of transitions of the chain from a node i to a node j can be obtained in closed-form. Interpreting the value M_{ij} as the distance between node i and node j provides the means for identifying node pairs that “lead to long paths.”

Technically speaking our algorithm can detect weak ergodic classes in nearly decomposable Markov chains. The following example is taken from a forthcoming paper in one of the Operations Research flagship journals. We consider the social network from [7]: a university-based karate club in which a factional division led to a formal separation of the club into two organizations. In other words,

the ‘natural’ decomposition of the social network consisting of the members of the karate club is known, a unique feature. Over time, the number of contact moments, such as joint training, participation in tournaments etc., between the karate club members has been counted. Figure-1 shows the clustering of the members of the karate club based on the interaction information (modelled by a Markov chain). The interesting aspect of this analysis is that the clusters identified by the algorithm describe what actually happened to the karate club, which actually split into two groups indicated by the font black and white font colors. The careful reader will note that node “9” is put into the wrong cluster. However, there is an actual story behind node “9” showing that “9”’s heart belongs to the white nodes but she was forced to stay with the “black” nodes due to personal reasons.

We have applied our algorithm in many situations and it gives miraculously good and insightful clusterings. A bachelor thesis applied it to football data with very nice results [4]. Currently, I do research on integrating Bayesian learning techniques into the algorithm for allowing improving the network model from observing data. Together with Ines Linder, I am involved in many projects on analysis of social or semantic networks

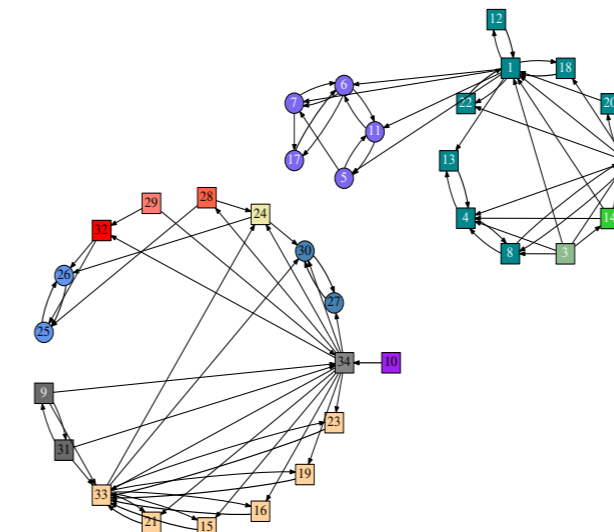


Figure 1: Analysis of Karate Club: Node colors correspond to strongly connected components and its font colors (black and white) indicate the two formed factions after the fission.

Other than visualization, we push for gaining analytical insights. For example, if we map the main characters in movies/books as social networks, can

we detect narrative patterns from time-dependent network analysis? We have obtained very exciting results by analyzing organizations via our Markov chain decomposition approach: underlying substructures can be brought to the surface and yield insight into the organizational dynamic. The study of opinion dynamics is also a very insightful topic. Sounds interesting? There are plenty of opportunities for writing bachelor and master thesis on this topic and to contribute to further development of this new approach.

Neural Networks with Noise

Neural networks are also one of my hobbies. In Figure-2 you see the layout of a typical neural network. Neural networks can be applied in supervised learning, that is, if for a given (input) data set, the correct output is known. The selling stories of neural networks are image and pattern recognition. However, this has to be taken with a grain of salt, as neural networks allow for so-called adversarial attacks. Indeed, in image recognition, for example, often changing a small fraction of pixels that do not alter the actual picture to the human eye, lead the machine to a miss-classification. Figure-3 shows an example where changing a fraction of 0.007% of the pixels fools the machine into a miss-classification.

Recently, I discovered together with colleagues from Peking University that by introducing randomness in the training and classification phase, standard neural networks improve significantly their resilience towards adversarial attacks. In our research we inject at each communication between the layers iid normal noise, see Figure-3. The training can now no longer be done via the deterministic backpropagation algorithm, but requires techniques from simulation-based optimization (remember, one of my hobbies). Specifically, we use a method called Score-Function method. The basic idea is to push the weights of the network into the noise distribution and to differentiate the noise distribution. How to turn such derivatives into an operationable simulation program is topic of the area of gradient estimation. The paper on this new approach [6] is among the top-10 most downloaded papers from SSRN¹ Top Ten List. A master thesis exploited our randomization approach even further (all you need are the techniques we teach in the master course “Optimization under Uncertainty”, which will have in the new study year the more appropriate name “Stochastic Gradient Techniques in Optimization and Learning”) and provided an approach to combine backpropagation with

¹ <https://www.ssrn.com/index.cfm/en/>

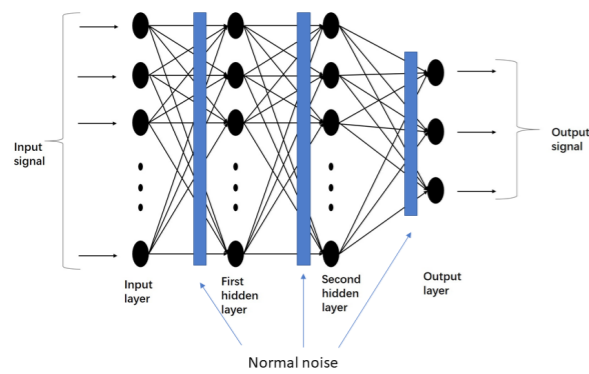


Figure 2: Schematic View of a Neural Network with additional Noise.

Score-Function based optimization that led to significant improvement against adversarial attacks.

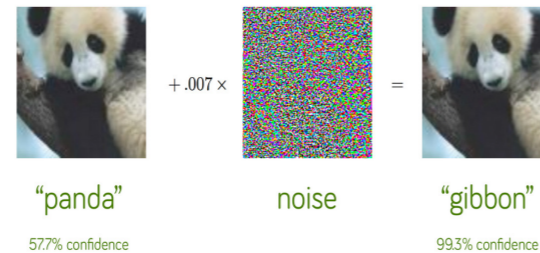
This is just the beginning. Especially the concept of “adversarial attack,” which is in essence an optimization problem (find the smallest perturbation that leads to a miss-classification), is conceptually very rich. There are plenty of opportunities for writing bachelor and master theses on this topic, and to contribute to further development of the ANN algorithm.

Data and Models

“All models are wrong but some are useful”, as a renown British statistician George Box famously said. Of course more complex models might be more accurate, but they may require solutions that are computationally involved and hence slow. Furthermore, more complex models usually also require cumbersome calibration techniques that can severely undermine their accuracy. Hence, in practice, there is a constant search for balance: between accuracy and speed, and between simplicity and complexity.

In the following, I will dwell more on this by means of an queuing example. Consider a single-server queue with infinite buffer capacity. Customers arrive to the queue from the outside according to a Poisson process with rate λ , and receive a service time following a log-normal distribution. Suppose that we have for n consecutive customers data available on their interarrival time, service time, and waiting time. From intensive studies the service time distribution is known to us², however, the arrival rate is not known. To gain insight into the validity of a model, we will compare two ways

of fitting the model. The first way of model fitting, called input fitting, estimates the model parameters from the input data. In our case, we use statistical



Source: Explaining and Harnessing Adversarial Examples, Goodfellow et al, ICLR 2015.

Figure 3: Example of an adversarial attack.

methods to estimate the rate of the Poisson process from the observed interarrival times. For the other way of modeling, called *output fitting*, we apply a MLE to the observed waiting times (read, the output) for estimating the arrival rate that makes the postulated model for the observed sequence of waiting times the most probable. The discrepancy between the output and input fitted arrival rate serves as indicator for the appropriateness of the postulated causal model.

We consider a single server queue with Poisson arrival process with rate θ_0 and lognormal service times. We vary the number of servers between 1 and 2. More specifically, we run a discrete-event (DES) simulation with two servers. Server 1 is always active. For server 2 the dynamic is as follows: whenever a customer leaves server 1 and there are at least two customers waiting in queue, server 2 becomes active with probability $p > 0$ and servers one customer. Once this service is finished, the server becomes inactive until started again via a customer leaving server 1. Note that p allows us to control the amount of model miss-match present in the model.

We take the true value for θ to be equal to 0.5 and define the service parameters such that the traffic load is roughly equal to 0.8, and we run an MLE for fitting a M/G/1 queue to the observed waiting time data. A dataset of $T = 100$ consecutive waiting times is generated. Then, 500 independent stochastic approximation runs are performed for solving the MLE for the case that $p = 0.5$ and $T = 100$, with fixed gain size of 5×10^{-5} , for this dataset. Figure-4 presents the corresponding histogram. More specifically, the histogram plots the values $\theta(\omega)$

resulting from running a stochastic approximation for realization ω and depicts the distribution of the limiting value of the stochastic approximation which is known to be normal distributed under, appropriate conditions.

Figure 5 shows the absolute difference between the true value of θ and the mean estimate for increasing values of p . When p increases, server 2 is opened more often. This means that the model mismatch enlarges if p increases. As expected, the absolute difference increases if the mismatch enlarges; see Figure 5. For example, if a deviation of at most 10% of θ is deemed acceptable, then the M/G/1 model is only acceptable up to values of p no larger than 0.38.

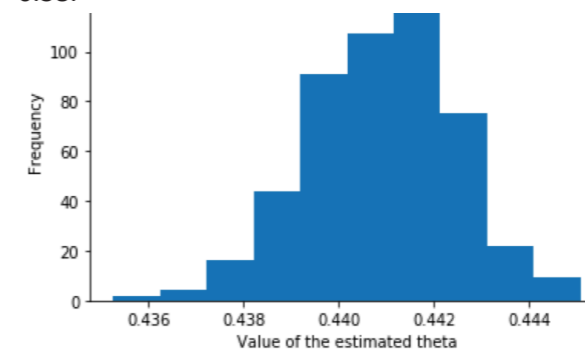


Figure 4: Histogram of the 500 estimated θ values for a dataset of 100 customers.

For a simple model such as the single-server queue the output fitting can be done directly, but for more complex models (θ may also affect the performance itself) this is a very hard task. In a recent paper, we developed a method that can deal with MLE in the case of complex structured systems, see [5]. This is just the beginning of the story. There is much more to investigate. For example, in which sense

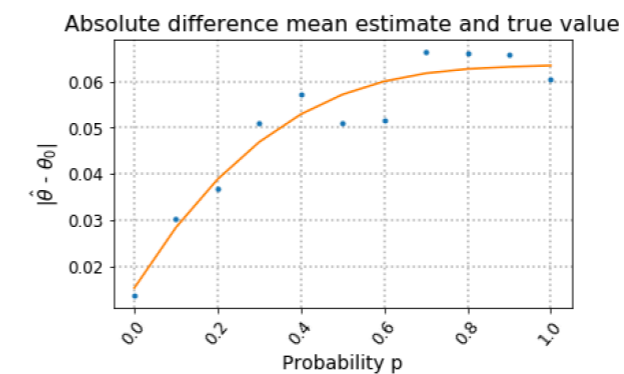


Figure 5: The absolute difference between the true value of θ and the mean estimate for increasing values of p together with a fitted third-degree polynomial.

is an output-fitted model reliable for answering “what if” questions? Also, is MLE for performance studies the right choice as it is known that MLE leads to inferior fits in the tails of a distribution? Minimizing the Wasserstein distance seems more appropriate here. Again, as always in research, more questions than answers.

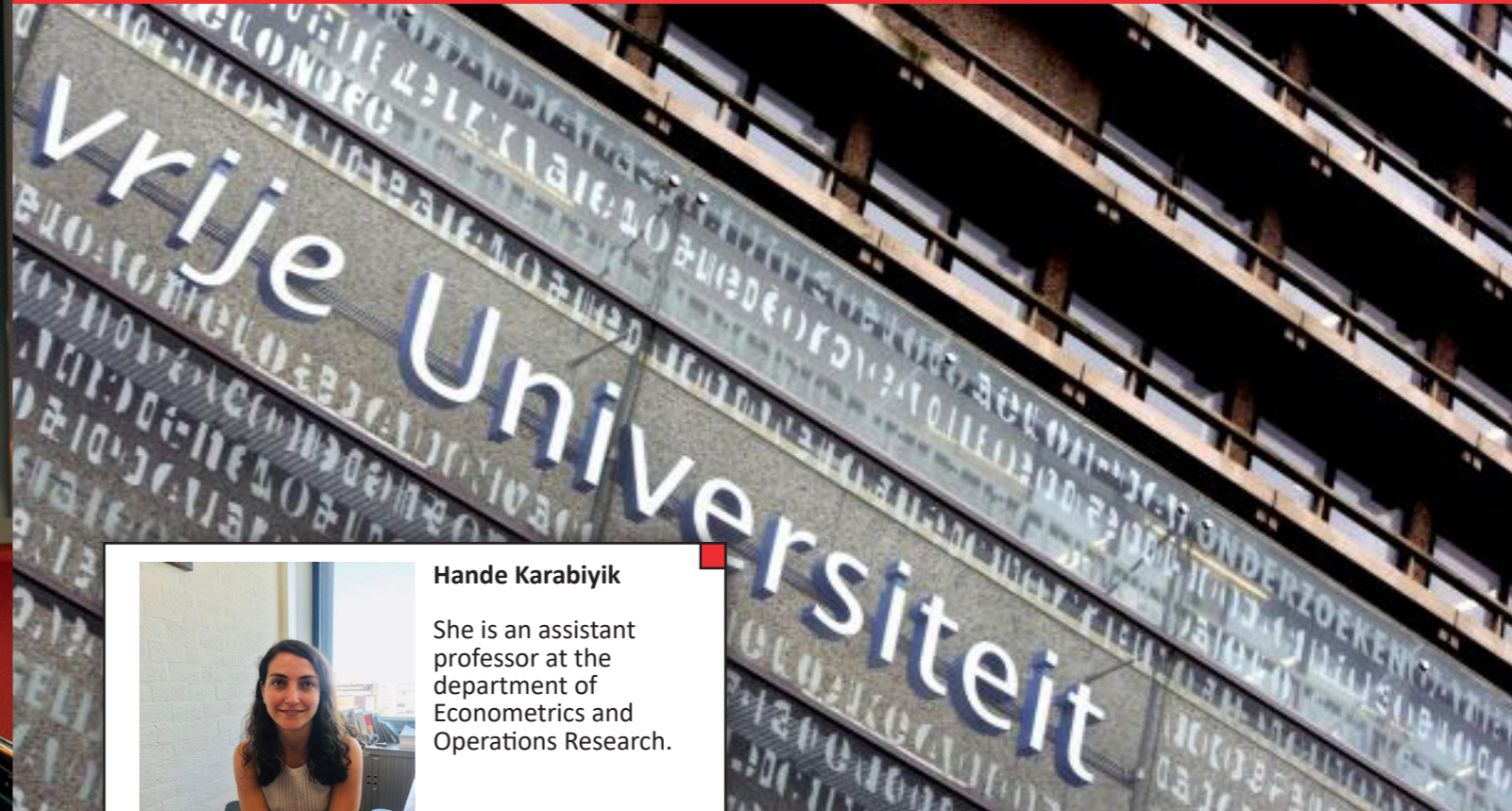
A Word of Gratitude to my Colleagues and our Students!

My research wouldn’t be possible outside our department and our educational programmes. Without my colleagues from Mathematical Economics, the research described in Section 2 would not have come to live. Also, the conceptual framework described in Section 4 is the result of many hours of discussion with my colleagues from econometrics. Much of the fun is in developing “crazy ideas” together with students who dare to go into uncharted territory with their bachelor and master thesis, and I am grateful to my colleagues and students who were willing to wander off together with me into the realm of the unknown.

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²This is indeed the case as intensive statistical studies showed that duration of calls are typically log-normally distributed.



Hande Karabiyik

She is an assistant professor at the department of Econometrics and Operations Research.

Could you introduce yourself?

I am an assistant professor at the Department of Econometrics and Operations research at the VU. I teach “Introduction to Data Science” and “Econometrics I” in our Bachelors program and the course “Multivariate Econometrics” in our Master program. I studied BSc Economics and Management at Istanbul Bilgi University and London School of Economics. Then, I finished my master in Economics at Istanbul Bilgi University. Upon finishing my masters, I started my PhD in Econometrics at Maastricht University. I finished my PhD in the summer of 2014 and moved to Sweden to do a post doc in Lund University. Finally, after my post doc, I started working as an Assistant Professor at the VU in September 2016. Since then I have been teaching and doing research at the VU.

When did you know you wanted to become an academic/researcher?

The bachelor program I studied was especially designed to prepare us for a PhD degree. It was offered by London School of Economics. The courses

were focused on scientific aspects and methods rather than practical implementations. This allowed me to develop a more research oriented mind set. My professors were also encouraging me to pursue a PhD degree. However, I did not want to jump into it without knowing what else is out there for me. For this reason, I did an internship in a consultancy company during the last year of my bachelor studies. After the internship, I knew for sure that I wanted to pursue a PhD degree.

When I finished my master, and received the degree of Master in Economics. Then, I made a bold move and started a PhD in Econometrics. Initially, it was very challenging. Upon starting my PhD, I realized that I was lacking a lot of knowledge in mathematics and statistics. I had to work a lot to close the gap. My efforts, together with the support of my PhD supervisors, paid off and I successfully received my PhD degree. The experience I had during my PhD convinced me to become a researcher, because it made me realize that I really liked the process of learning, discovering new things.

Why did you come to work in the Netherlands, and how is your experience here so far?

I obtained my PhD at Maastricht University. Maastricht is an energetic small town full of students and many things to do. I really enjoyed living in Maastricht. After my PhD, I moved to Sweden for two years, but I always wanted to come back to the Netherlands. When I started working at the VU, I was, of course, happy to pursue my career in a prestigious university, working with outstanding researchers but also, I was happy to be back in the Netherlands. Amsterdam is a gorgeous city. I feel lucky to work and live in Amsterdam. It is very welcoming to foreigners. It offers so many things to its people.

What is it like to be an assistant professor at the VU?

Being an assistant professor at the VU gives me the opportunity to do the things that I enjoy and love. Firstly, I enjoy doing research in econometric theory at the VU. Econometric theory research, besides being fun, has many applications that vary from economics to climate research. This gives me the flexibility to conduct research on a wide range of topics. The research environment in our department is really encouraging and welcoming. In collaboration with the Tinbergen Institute, we organize seminars and workshops. We invite researchers from all over the world. This leads to many fruitful collaborations. Secondly, I enjoy teaching. Transferring knowledge to students who are eager to learn is a source of joy and satisfaction. I always feel enthusiastic about teaching, especially when I see that the students are enjoying and appreciating what they are learning.

What is the topic of your research?

My research focuses on panel data econometrics. This topic is also a part of the course “Multivariate Econometrics” that I have been teaching in the Master program. Research on the estimation and inference on panel data models is becoming more and more popular as panel data sets are becoming more available. My research, in particular, is about the estimation and inference of large panel data models with cross-sectional dependence. A large panel is a panel data set where there are many cross-section units and many time periods. These panels are called macro panels. Cross-sectional dependence is a feature of most panel data sets

that arises when cross-section units are statistically dependent on each other. This can happen, for example, when a common unobserved shock affects all the units. As an example, we can think of a data set for GDP of the EU countries over the last century. This is an example of a panel data set. The time series of individual countries can be dependent upon each other due to technology shocks, oil price shocks, demand shocks etc. This leads to cross-sectional dependence. Cross-sectional dependence creates problems while estimating the panel data models. Together with my co-authors, we are proposing methods to overcome the problem of cross-sectional dependence in large panels. This theoretical research has many applications. Besides building methodologies, I illustrate my work via some small empirical applications. These empirical applications cover the fields of economics, corporate finance, finance. For example, in one of my recent papers, we first develop a method and then use that method to estimate gravity equations of bilateral trade among 15 European countries. In another empirical application, we use a dynamic panel data model to investigate firms’ behaviour of choosing their leverage ratio.

What are your near future plans regarding your research?

Currently, I am working on multiple projects. Recently, with my co-authors, we finished a comprehensive review study on the analysis of cross-sectionally dependent panel data models. This work will be published in Annual Review of Economics. Working on this review study allowed me to see what is still missing in this literature, which questions are not yet answered. In the near future, I will focus on these questions. I am planning to continue working on cross-sectionally dependent panel data models. In terms of empirical applications, I am planning to shift some focus to climate data as I believe that it is urgent and relevant to find answers to “climate-human interactions” related questions.

How is your research related to the courses you are teaching at the VU?

I teach three courses at the VU. Two bachelor courses and one master course. “Introduction to Data Science” course provides students the basics and foundations of probability theory. Together with statistics, probability theory forms the basis of any econometric theory research. “Econometrics I”

course teaches students the basic regression model, it can be considered as an introduction to econometrics. In this course, students work on the estimation of a very simple econometric model. Most econometric theory research starts with a model and continues with developing methods to estimate that model accurately. These two bachelor courses I teach are related to my research as they contain the simplified foundations of what I am doing in my research. “Multivariate Econometrics” course covers the topic of analysis of multivariate stationary dynamic processes, nonstationary processes, cointegrating systems and large panel data models. These topics are all closely related to my research. In my PhD thesis, I focused on nonstationary, cointegrated panel data models. It is a pleasure for me to teach this course as it gives me the opportunity to talk about my research and to learn more about my research topic.

What do you advise Econometrics students who are interested pursuing a PhD degree in Econometrics?

A PhD in econometric theory is challenging. It requires a lot of knowledge in mathematics and statistics and a slightly less knowledge in programming. However, students of EOR and EDS programs of the VU are lucky. Upon graduation, they will be equipped with all foundational knowledge that they will need to start a master in Econometrics. The Master in Econometrics program we offer at the VU, further prepares the students for a PhD degree. The education provided in the EOR, EDS and Master in Econometrics programs covers econometrics theory and its empirical applications. Students who are interested in pursuing a PhD degree should focus on the theoretical knowledge more. Starting as of the early stages of their studies, they should talk about their intentions of pursuing a PhD degree with their professors and ask for their advice. I believe, it is also a good idea for these students to visit workshops, seminars and conferences during their master studies. For instance, we, as the econometrics group, are organizing Brownbag seminars on Thursdays, in which our colleagues and guests present their research to other members of the group. It would be useful for the master students who are interested in pursuing a PhD degree to attend these seminars. This is not only get informed about the research topics of the econometrics group at the VU but also to see how econometric theory research is done.

What can you tell us about the new Econometrics and Data Science specialization?

This new specialization is exciting and offers an up-to-date study to its students. With the rise of “Big Data”, companies have started needing more and more data scientists. This specialization is built to provide its students an education that is required to start working as data scientists. Besides econometrics, this specialization focuses on data science methods that is not covered under the topics of econometrics. For example, with courses such as “Database Fundamentals and Applications”, “Data Structures and Algorithms”, “Machine Learning”, students learn how to collect, condense and analyse Big Data sets. Econometrics and Data Science specialisation offers its students an ideal combination of computer science methods and statistical data analysis, that allows you to tackle the most challenging problems in business, economics and finance.

How are you involved with the Econometrics and Data Science specialization?

I am teaching a first-year course in the Econometrics and Data Science specialization (EDS). This is a course that I developed especially for data science students. It is a probability theory course for data scientists. I meet with the students of EDS on their first day of school. This gives me the opportunity to help them throughout their adaptation process to studying at a university. Besides this, I am a part of the teaching management team of the EDR/ EOS programs. I am involved in organizing events for prospective students, such as the introduction days, taster days and matching days. During these days, together with Kraket, we provide information to prospective students about our study programs EDS/EOR and about student life at the VU. I am happy to be a part of this specialization as it is a very promising, growing study.

The Econometrics study is starting to become more popular to international students. The master was already available for them, and since the start of the Econometrics and Data Science track in 2017 there is also the possibility to do a Bachelor at the VU. This academic year the Econometrics and Operations Research track became entirely English, hence available for more international students.

Rainer Jean Edouard Adelman



Rainer JE Adelman is a Luxembourgish Econometrics student in love with his subject.

My name is Rainer Jean Edouard Adelman and I am one of the international students in the Master of Econometrics and Operations Research at the Vrije Universiteit Amsterdam. I am from Luxembourg and did a Bachelor in Economics and Management at the University of Luxembourg (Uni.lu). When you do a Bachelor in Luxembourg, you are obliged to do at least one semester abroad. I decided to go during my fourth semester to Rome at the Libera Università Internazionale degli Studi Sociali (LUISS). I had one introductory class in econometrics with Professor Ragusa. I was instantly intrigued by the subject and fell in love with it. During my fifth semester I decided to do a second semester abroad, this time in Saint Petersburg at the National Research University – Higher School of Economics Saint Petersburg campus (HSESPB). I profited to take as many econometrics courses as I could and ended up with four Master classes that dealt with econometrics. After I finished my second semester abroad, I knew that the only way to continue the studies was with a Master in Econometrics.

I was instantly intrigued by Econometrics and fell in love with it.

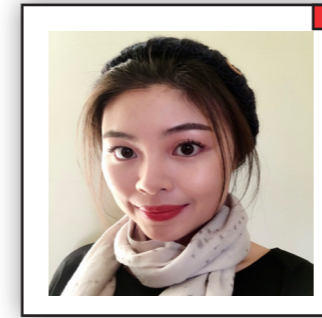
Since the science of Econometrics started in the Netherlands and I have always been keen on learning de mooie Nederlands taal, the choice of country was quite obvious. After having been in Rome and

Saint Petersburg, I wanted to go back to a bigger city with more action. I decided to apply at the Vrije Universiteit Amsterdam as I found the study track with the specialisation in Financial Econometrics the most convincing of all the universities I read. And luckily for me, I got accepted right away.

Comparing the VU with my previous universities, the most obvious difference is the time schedule allocated to the courses. Whereas HSESPB had a similar approach by using quarters, in which courses would be divided into four quarters, the Uni.lu and LUISS had the more classic approach of dividing the academic year into two semesters. The VU, as most universities in the Netherlands, is quite different with the system of six periods. This was something I had to struggle with in the beginning, but after some time I got used to it. In my opinion the canteen is a very important part of a university, as hungry students are unproductive students, and I have to say that I find the canteen of the VU not bad, but slightly overpriced for the quality.

Amsterdam as a student city is a very nice one, which I absolutely love. Even if it is very windy, which makes even mild temperatures quite chilly, and even though it is quite expensive; once you know the nice spots to go to, it is a very enjoyable city to live in.

Pingping Wu



After completing her law studies and working for a year she decided to become a student again.

Funny enough, I'm again a bachelor student at VU. My name is Pingping Wu and I am in my first year of the bachelor Econometrics and Operational Research. I still remember the day I had my graduation cap on, I was celebrating with a couple of friends on the square of the campus, I promised myself, "this is the last day of me being a student. Enough!" What drove me back to school after a few years of life that were full of work and business? My academic interests have always been math related and it was honestly a big pity that I had been studying and working with the law for years. I felt a very strong urge to search for the next challenge and determined to go back to uni to fulfill my dream.

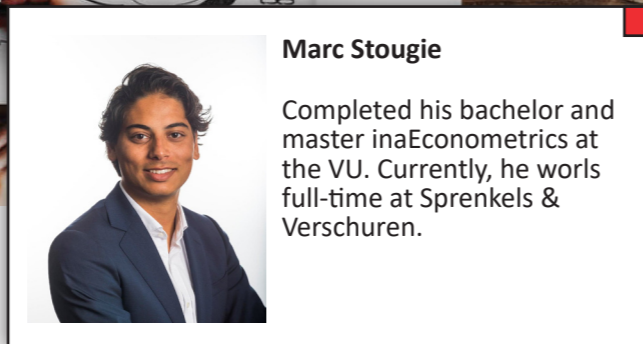
I might be one of the very few international students with this study, however, it never made me be excluded from the local students and social circles. Studying in a foreign country gives me a great joy and is a valuable experience for me. The idea of studying overseas is extremely appealing to many, and the Netherlands is a student-friendly country with an environment that enables me to adapt quickly and remain on my feet, despite the many challenges and difficulties I may come across. The first days are always the most exhilarating. Although I experience many culture shocks, I am still excited about the new environment. It came as a shock when I saw a man cycling in a suit – this is something you would rarely see in my country, if at all. It still brought me great joy when I went to fetch my own bicycle even though my bicycle skills are extremely limited.

We make no secret of the fact that three years studying at a VU towards the Economics Diploma is a challenging experience. It doesn't matter what circumstances prevail, I have to fight tooth and nail to make it work. In the meanwhile, I enjoy every

second I spent on study, and with friends. Besides the busy study, I also manage my own consultancy company which I have had since I came to the Netherlands. Sometimes a little while away from the study does help me to keep a clear mind and from there I obtain more energy and interests to go on.

As a second time doing a bachelor, the days of my student life are much more than studying. I struggle to take time away from the never-ending demands of study and to flout the pervasive culture of overwork. Besides learning Kosmala ideas I also have many other hobbies and they are to me as important as study and work. I like playing music, dancing, traveling, learning languages and eating if it counts. I have to say that my hobbies help me a lot, and they offer me a break from the stress and provide a sense of accomplishment when I am stuck in a rut at study or work. Beyond offering the brain a breather, pastimes can also lead to inspiration. Frankly, I can concentrate on study better after a hangover, not immediately of course.

I am happy with my decision of joining school again and satisfied with the achievements I've made till now regarding the scores and my better going business. It might be something my mum says when opting for a different flavour of crisps at the supermarket, but it's true; change, variety, and new experiences are what make life worth living.

**Marc Stougie**

Completed his bachelor and master in Econometrics at the VU. Currently, he works full-time at Sprenkels & Verschuren.

A week in the life of Marc

As of two months, I am living together with Loïs—my girlfriend—in the center of Amsterdam. This week started without Loïs, since she was on a studytrip to Morocco with Kraket. On Monday I went to work early, so that I could finish work on time to enjoy the nice weather at the end of the day. Normally I work for several clients a day at Sprenkels&Verschuren (S&V). S&V is a consultancy firm which is specialized in actuary and investment. I work in the actuary department and this week is a busy week with a lot of deadlines. This resulted in me working late and not being able to enjoy some sunbeam. That night, my brother came to my house. He also lives in Amsterdam, which is nice because he is able to stop by at any time.

On Tuesday, I was working on a presentation that I had to give the next day. A report had to be finished that day as well. Tuesday evening is normally my time to play bridge. I play bridge in Amersfoort with my other brother in a bridge club. However, this time I skipped the practice, because Loïs came back from her studytrip (and Ajax was

playing that night in the Champions League).

Tuesday evening is normally my time to play bridge.

The next day started with me giving a presentation in Hoofddorp. We had advised the employer about a new pension scheme, and now we had to inform the employees. After that I worked the rest of the day in the office on some calculations for a request of a client, which had to be done with priority. That evening Loïs and I celebrated my birthday which she missed due to her study trip. She took me to a fancy restaurant with a nice view over Amsterdam.

On Thursday, I usually play indoor football with friends in the sport hall at Uilenstede. This time I had to skip since some colleagues organized a pubquiz. After having dinner with almost all my co-workers, we went to the pub for the quiz.

On Thursday, I usually play indoor football with friends in the sport hall at Uilenstede.

Friday is my study-day. Since I work as an actuary consultant, I think it is important to have a degree in actuarial science. Therefore, in January I started with a postmaster in Utrecht at the Actuariële Genootschap. Next to following mandatory lessons on Friday I need to spend an average of one day a week with studying for my course. The classes of this Friday were rescheduled to another day. This was nice since I had some unfinished work.

Friday is my study-day. Since I work as an actuary consultant, I think it is important to have a degree in actuarial science

That weekend it was Easter weekend. This was a nice occasion to visit my parents as well as Loïs' parents. Not that we really need an occasion; both our parents are always happy to welcome us. On Sunday, we went to the beach in Noordwijk where we stayed for the rest of the day and evening. So, I was overcompensated for the sun I missed on Monday.



Extra

The life of a student is more than studying. Extracurricular activities make the students who they are. Think about the development of communicative or organisational skills and other practical tools that they do not learn just by studying. In this column, some fellow students talk about what they do besides studying Econometrics and Operations Research. Maybe their stories will inspire you to look further yourself!

Loïs Stijsiger



Next to her master in Econometrics she has a part-time job at Triple A - Risk Finance.

After completing my bachelor's degree, I still had no clue where I would like to work when I finished my master. That's actually the reason why I was very interested in being a "working student". This way, I would be able to discover my interests in the working environment. After considering multiple consultancy firms, I chose to get started at Triple A – Risk Finance. I was seated at their table at the LED that year, so I already knew quite a lot about the company beforehand. At Triple A they have various business lines where you can work as a working student. As I had no distinct preference, I started working in the business line Pensions, as someone was needed there. From the start, I worked two days a week alongside my studies, since I thought this would give me a better insight in the company. Also, the consultancy part of the work was what attracted me to work there and it is easier to work on client projects when you work more than once a week.

In econometrics, we don't learn anything about being an actuary, but I was open to the idea of learning new things and broadening my horizons. Whenever you start working somewhere, there is always a lot to learn, and personally, I'm still learning. However, I am lucky to receive a lot of guidance in my learning process. During my time

as a working student, I have worked for many different companies and different projects. This is what I enjoy most; the tasks are dynamic and every day is different.

Currently, I'm spending a full week at the office, as I'm also writing my thesis there. Writing a thesis at a company appealed to me, because then you are able to apply (some of) the econometric theory to a real world problem companies face.

You will definitely learn a lot from the experience and it's a nice change from full-time studying.

I would encourage everyone to work alongside your studies, just to get to know what it's like to work at such a firm and to find out what you enjoy doing, as the choice is enormous. You will definitely learn a lot from the experience and it's a nice change from full-time studying.

Matthias Versfeld



Next to his master in Econometrics Matthias Versfeld has a part-time job at Deloitte.

Hi everyone, I'm Matthias, 22 years old and currently busy with completing my master in Econometrics. My opinion is that regardless of your capabilities, studying alone does not prepare you for the working life which awaits everyone. Therefore I always try to do extra things next to the theoretical challenges in university. For example I did several committees at the study association Krakket, completed an internship at the Royal Dutch Soccer Association (KNVB), worked part-time at ABN Amro as a data scientist, went abroad to South Africa and now I'm working three days a week at Deloitte as an analytics working student.

My opinion is that regardless of your capabilities, studying alone does not prepare you for the working life which awaits everyone.

Since Econometrics & Operations Research is a very theoretical study, the gap between career success and academic success is huge. At econometrics, programming packages are a sin. We want to write every likelihood ourselves, whereas in real life it is way more efficient to use a StatsModels/scikit-learn package to do all the calculating in a single line of code. This is a disadvantage and advantage at the same time: we are not up to date with all of the latest data science techniques and way of working, but we do actually have the capability to understand the underlying models, and see if the potential

model is miss-specified or not. Furthermore, on the working floor communication and social skills are key. However, during lectures you do not learn how to write a proper and clear email, nor how to behave correctly and efficiently in a meeting. These things are examples of what I learnt, and what I am still learning in my role as a working student at Deloitte.

Deloitte itself is an enormous organization. My first day was an introduction day at a congress center. Which was to my surprise fully packed with new hires, this perfectly describes how big the company is. At Deloitte, I work in the Technology & Data Risk team. In this team there are a lot of very smart people present, coming from several backgrounds like Econometrics, Business Analytics, Mathematics and Computer Science. The project I work for is called DocQMiner, an AI solution to get structured data out of unstructured documents. We train our models to recognize certain data points in for example lease contracts, like counterparty names, start dates and asset descriptions. At DocQMiner, I am currently working for the product operations team. Which means I prepare environments for clients, train our models based on their data and much more. On a daily basis I work with programming languages like Python, SQL and VBA. All skills which I was not familiar with before I started working at Deloitte. The (senior) consultants enjoy teaching me new skills and the partners are always open for a coffee to talk about the last developments. Furthermore I do have calls and meetings with (potential) clients from all over the world, which helps me develop myself a lot and makes me confident that I will be ready for working life after handing in my master's thesis.

Rajni Rasiawan



Next to her master in Econometrics Rajni Rasiawan started a full-time internship at the ING to write her thesis.

Hi, my name is Rajni Rasiawan and I'm a master student (Financial) Econometrics. I have always liked to do extracurricular activities besides my study: I was active in several committees at study associations Kraket and Extensus, studied abroad in Singapore and currently I am doing an internship at ING.

For six weeks we attended classes at the Chinese University of Hong Kong

However, I would like to elaborate more on the summer school that I participated in last summer: the Netherlands-Asia Honours Summer School (NAHSS). This is a program for honours students from all Dutch universities, developed to strengthen the relationship between Asia and the Netherlands. Hundred students from different universities and disciplines were selected for this program. For six weeks we attended classes at the Chinese University of Hong Kong. I followed the courses Asian Business and Chinese Medicine. Completely different from the theoretical econometric courses that I am used to, but that made it very interesting. The classes mainly consisted of discussions about related articles, presentations and field trips. International students from all over the world were enrolled in these classes, which lead to interesting discussions where different (cultural related) perspectives were shared.

In addition to taking courses, I worked together with a group of eight students selected for the NAHSS on a research project for ABN AMRO.

Our assignment was to recommend promising opportunities to traders of the Commodity Trade & Finance department to make their portfolio more sustainable. Especially the collaboration with students from different disciplines and universities, made for a new and exciting experience. During the program we visited many Chinese and Dutch multinationals (ING, Rabobank, Philips, Huawei and many more), where we got presentations, talked to Dutch expats and learned more about the Chinese work ethic. We even visited the headquarters of Huawei in Shenzhen, which consists of a very impressive campus providing housing for more than 30,000 employees!

In our free time, we had the opportunity to explore the many sides of Hong Kong

In our free time, we had the opportunity to explore the many sides of Hong Kong and made trips to Taipei and Shenzhen. We ended the trip with a business week in Shanghai. This year I am the VU representative of the NAHSS. So if you want to explore China in this unique program yourself, don't hesitate to ask me any questions regarding this program!

Martijn Smink



Next to his final year of his bachelor in Econometrics Martijn Smink became the chairman of Kraket.

Hi all, my name is Martijn Smink and currently I am combining the third-year of the bachelor Econometrics & Operations Research with a board year at study association Kraket. Before telling you all about doing this enjoyable, but also rather intense combination, I will not be modest about giving you some little insights into my student life and how I ended up being chairman of Kraket.

My student life is a relatively long one now. After doing a bachelor's in Economics & Business Economics at the University Utrecht I felt like I was not done studying and I was still up for a few more challenges. The thought of doing a master's immediately after finishing the bachelor, and hence start working at the age of 22, finding out I was more into the mathematics and econometrics courses, the better job prospects by doing the study Econometrics, and the fact that I went through the program quite well to say so, made me choose to start with the bachelor Econometrics & Operations Research. A decision that I have never regretted.

From day one, I have been a very active member at Kraket, joining committees and attending lots of activities. In the second-year of the bachelor I increasingly felt the ambition to do a board year at Kraket. After a total of five years studying, I was getting more bored and felt I wanted to do something different and challenging. Besides, I also felt the need to develop myself in other ways. Hence, I chose to apply to become the new chairman of Kraket and, fortunately, I was chosen to do so. A completely new journey started full of new challenges and great moments that were lying ahead.

One of the challenges was to combine my study with being chairman of Kraket, since a board year at Kraket is only part-time. I never thought it would be possible to pass all third-year courses,

writing a bachelor thesis and being chairman of Kraket in one year. Nevertheless, I followed both courses in the first period under the guise of 'we will see what happens'. I always had the thought that I would rather stop following a course when it becomes clear it is too much, too stressful or simply not doable than only following one course and realizing at the end of the period that I would have been able to follow that second course.

And so, an exciting year started which would turn out to be an awesome one. Especially, at the start of the year there were some struggles as expected. I encountered situations I had never encountered before, and I had to deal with problems I never had to deal with before. There were some teething problems to adapt to my new role and duties. At that moment, studying was really on second (if not third) place. Despite having very little time to study, I passed both courses and from then on it all went very well. I found the balance between studying and the responsibilities and duties of being chairman.

During the day, I could be mostly found in the association's room doing the tasks that needed to be done as chairman. Attending meetings, having lots of contact in person and via email, keeping track of the other board members, help them where necessary, and doing many 'non-function like', general tasks. In the end, it turned out the latter took the most time of all. In the evening, I either had activities with Kraket, some (mandatory) drinks or I had to study. In the weekends I had the most spare time, although there has not been a single moment this year where I simply had nothing to do. There was always something to do, something to check, some meeting to prepare or something to help someone else with.

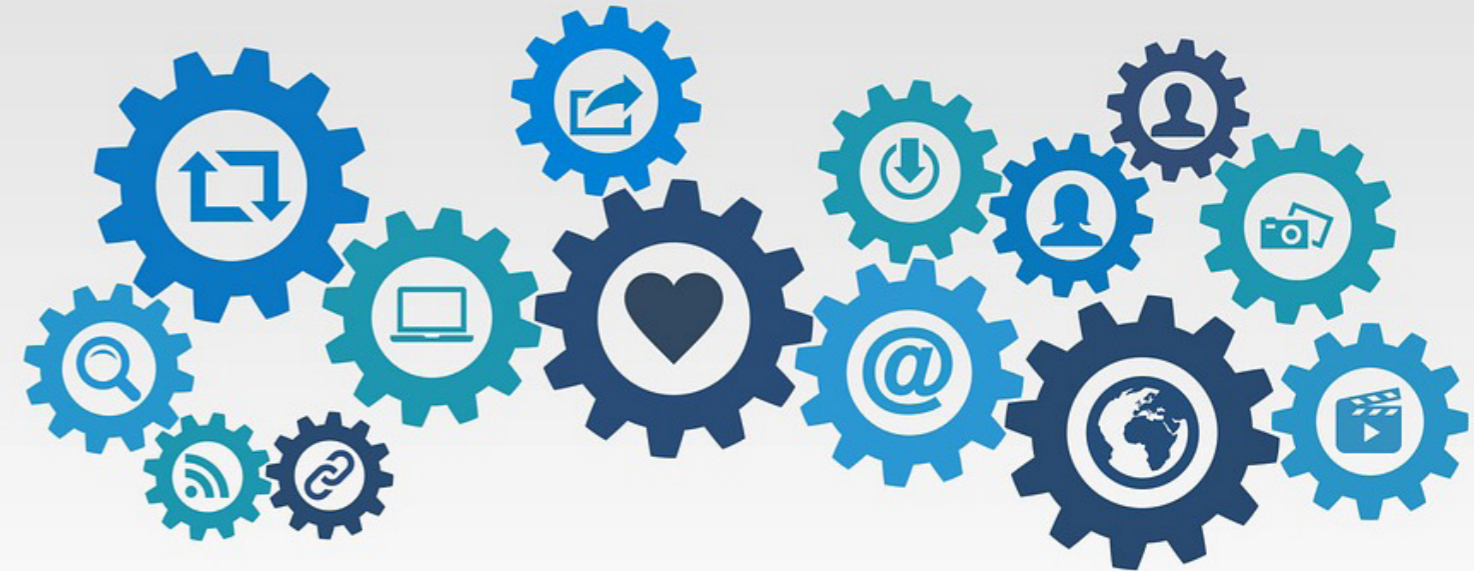
Overall, I can tell it was an extremely busy year with many activities, duties and responsibilities. However, I enjoyed it a lot, and for that reason I got a lot of motivation to keep going and to combine it with my study. Besides, and fortunately for me, I have had some great fellow board members, which made my life as chairman a lot easier. So many thanks to Marit, Dave, Jesse and Robin for making this a very wonderful and unforgettable year. It was my pleasure being chairman of Kraket and I am truly grateful I had the honor of doing it all. Once again, a decision that I have never regretted!



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Career Services Interview

Nowadays social media is becoming increasingly important. Not just for socializing, but also for the job market. Searching for a job or employee and adding connections are things that happen on LinkedIn. But how to use this medium the best? We asked Tamar Pagrach and Friederike Terwyen from SBE Career Services.

SBE Career Services helps students to make the transition from university to the labour market. By giving workshops and coaching. Career Services prepares students for the next step.



Friederike came to the Netherlands as an international student. Therefore, she understands the challenges and benefits of living in a foreign country and taking the first steps to the labour market. With a background as a psychologist and coach, she started her career as a recruiter. In this role she gained experience with LinkedIn.



Tamar has a background as a lecturer and policy adviser at the VU. Four years ago she started working for Career Services. For this role, she completed a professional coaching degree.

Why would you recommend to create an account on LinkedIn?

Tamar: LinkedIn is the most widely used online platform for networking. It gives you the opportunity to present yourself, look at it as an extension of your CV. I definitely recommend creating a profile.

Friederike: I believe that it is more than a networking platform. Any organization that is interested in you will most likely look up your LinkedIn profile; perfect opportunity to portray yourself. Likewise, users can research organizations and find out about job opportunities. Hence, I recommend making an account if you want to be

found, or want to search.

What is the best way to use LinkedIn?

Friederike: There are a lot of ways to use LinkedIn, it is important to know what you want to achieve. You could use it as network, to find a job or to gather information. LinkedIn provides an excellent platform to do all of the preceding.

Tamar: You can use it to present yourself, to be visible to the world. Therefore, I recommend you to have your profile on public. If you worry about privacy, then don't be on LinkedIn. The whole purpose of LinkedIn is showing the world that you exist and what you have done.

However, LinkedIn is a professional tool, so choose the information you show wisely. If you are not interested in recruiters contacting you, you can turn off specific settings such as these.

Is it important to make a lot of connections? And what type of connections should you have?

Friederike: Generally, in the beginning you do not have a lot of connections. As a starter nobody expects you to have a lot of connections so don't worry about this. But you can already start making connections now: friends, your fellow students etcetera. At some point in the near future these people will have jobs in companies or countries that might be of interest to you. Don't hesitate to make connections, it can only help you.

Tamar: Mostly you should be able to find at least 50 connections. Think about people in your programme, your thesis supervisor, lecturers, your friends from secondary school. Having these connections in your network can be valuable in the future. Opinions on who to add or who not to add differ per person. For me it is important that I am associated to the person in some way, for example through school. I do not necessarily need to have spoken to the person before.

Friederike: I have a different rule. A lot of people sent invites, but I don't accept everybody. I am more selective in who to accept. For me it is important that I personally know the people in my network, instead of adding hundreds of connections.

Tamar: If you want to add someone that you don't know that well, then it is also nice to leave a message saying where you met. Leaving a personal message really helps. Especially if you did not speak to the person before. It is also good to use the same rules online as offline. When you approach someone you don't know that well, be polite.

Profile picture: what are the do's and don'ts when it comes to this picture?

Tamar: It has to be a professional picture, no holiday pictures. Preferably, have a picture made for the purpose. You want to use a picture where you smile, show your teeth. Research shows you are more likeable when you show your teeth and

when you smile genuinely. Also be aware of what you wear. Think about the industry that you are interested in and adapt your picture accordingly.

Friederike: If you want to work for a formal organisation and that is your target, then choose more formal clothes. If you want to work in a start-up perhaps you can choose a more casual picture. Another tip is not to make a close-up from a part of your face, recruiters want to see your whole face. Too zoomed out makes the picture vague, a nice balance would be a picture with your face and part of your chest. Finally, think about the background. Generally something quiet is preferable.

Why should you add an introduction or summary to your profile? And what should you write?

Friederike: It is a good way to create a red thread. It leads people through your profile. Where do you want to go? What is your motivation? Don't just write your name and what you did, but make it personal by putting the "why" in it. Why did you do things in such a way?

Tamar: You can add certain things you want to highlight. It is always good to have a goal in your summary. Write a clear goal, not something like "I am looking for a next challenge" because this is vague, everyone has a different definition of a challenge. Be as specific as you can.

What kind of working experience do you put on your profile? Only relevant? Or also things such as a holiday job?

Tamar: At the start of your career I recommend you to put all your experience in there. Try to think about what you learned from the position, and what competencies or skills you did develop that can be useful in your future career.

Friederike: Be specific, point out what you are good at. For instance, you could indicate that your student-job has taught you how to manage your time efficiently. This way even though the work itself might not be relevant it shows your are capable in dividing your attention and working hard.

Tamar: At some point, later in your career, certain experience may no longer be relevant to mention.

Sometimes it is not clear where to add certain information. For example, is a committee work experience or volunteer experience?

Tamar: I would say: You place everything you do next to your studies, but do not get paid for, under volunteer experience. If you get paid, you add this under work experience. In other words, internships and student-jobs go under work experience and committees are volunteer experience.

What type of skills are useful to put on your profile?

Tamar: You can always change the skills that LinkedIn automatically assigns to you. For example Dutch is not something I would like to be endorsed for when it is my native language. You can put it under languages only. So I would say, select skills based on what you want to show. Think: "what is important for recruiters to see when they look at my profile" and select those.

Friederike: Well, I would keep Dutch as a skill as it might be useful in some cases. Think about how you want to be found and by which target group. If Dutch is an important skill for that job, you can leave it in. Recruiters have a special search tool in LinkedIn, where they can add search words. The more words that match with their description of the ideal candidate, the higher you come in their ranking. So if they are looking for a person that speaks Dutch, they may use that as a search word as well. Nonetheless, it might be better to put it under languages instead of under skills.

Tamar: I agree that the keywords are important. However, your profile will become boring if it is only an enumeration of keywords. You should try to weave in as many keywords as possible into your story, but stay authentic. The search algorithm of LinkedIn starts scanning for keywords at the top of the page. The earlier you introduce the right keywords, for example in your heading, the higher you will appear in the search of recruiters. So use important keywords in your title, or introduction and not just in skills. For skills I would rather go for skills that you actually want to show and highlight extra on your profile.

Do you recommend to add interests?

Tamar: Yes. But I would make them very specific. If you say "I like traveling, reading and cooking", that is not very original. This applies to a lot of people. Make it specific by sharing something personal about your travel for example "I visited 33 countries". Or say "I am really into rock climbing holidays". Saying that you like sports is also vague. Do you like watching sports? Playing sports? And which sports? Be specific!

Friederike: I agree. It could be that the interviewer has the same interests as you, and it could help to break the ice during an interview.

Do you want to learn more about LinkedIn? SBE Career Services offers workshops about how to professionalize your profile. During the workshop you will get tips and tricks, work on your summary and receive feedback. You can also schedule an appointment with one of the career coaches for individual feedback.



Forum

The first speaker of the day was professor Koopman. He told about educational possibilities at the Tinbergen Institute, to give an impression of the different possibilities to pursue after your bachelor. After his talk, Dylan de Haan talked about his company Alkmaar in a Box and his experiences as a goalkeeper in the indoor eredivisie competition. Next, we moved on to the second round of the day. Here, the second-year students and older had the choice between the company Milliman and AG&AI (Actuarial society & Actuarial institution). Milliman explained what they do, their company culture and goals. AG&AI explained about what the society stands for and the variety of courses they offer in the field of actuarial. On the other side for the first year students there were two orientation speakers. Pieke Geraedts started, he talked about his internship experience at the ING in London and the combination of working & studying. Then Bernard Zweers talked about PhD life and how he came to the conclusion that after several non-research working experiences he wants to do research.

Preceding a wonderful lunch with time to further chat to one of the companies or speakers, we moved on to two talks from professors. Harold Houba discussed in light of mathematical economics a simplistic version of poker, delving into optimal

actions and reactions of the game. Next door, Jeffrey de Deijn, a PhD candidate at ORTEC and VU, told us about his research in sports analytics - mainly football - and the upcoming role of data science in sports. Subsequently, it was time for the workshops of the day. This year's workshop topics were: 'Dress to impress', 'Ace the interview' and 'Taking risks'. Finally, it was time for the last round of the day. Again for the second-year students and older there were two companies present. This time employees from IQVIA and Mindshare told us about their work and the company. IQVIA is a global company focussed on bettering healthcare making smart use of data analytics, Mindshare is a global media & marketing company. For the first year students there were two orientation speakers. These were: Marc Stougie, who has a full-time job at Sprenkels & Verschuren, and Ruben Konijn, who next to his master in Econometrics works part-time at Building Blocks.

Lastly, it was time for a few drinks. After an interesting day with many different companies and speakers it was time to enjoy and review the day.



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Puzzles



Barbecue

It is international men's day and therefore a puzzle about a barbecue. On our roof terrace is a large, elongated barbecue with space for 20 pieces of meat next to each other. On this memorable day, we have happily packed bacon and hamburgers. Everyone knows that you can never put two bacon slices next to each other; because of the fat that comes from that, the coal gets too hot. Adjacent to a bacon strip you always have to put a hamburger (except at the end).

In how many ways can we completely fill the barbecue (so 20 pieces of meat next to each other)?

Chips

On the table are 127 chips, of which all have one white and one blue side. Of the 127 chips, 40 are lying blue side up. The assignment is to while being blindfolded divide these chips into two groups, with both groups having the same number of chips with the blue side facing up. You may only slide or turn the chips.

How can you ensure that while you are blindfolded there are as many chips with the blue side up in both groups?

Answers edition 9-1

Carnaval in Tullepetaone City

The answer is 0.2%

We know the 1st to the 4th bar they visit are all different. When choosing the 5th bar, they can choose from 8 pubs: the 1st pub, plus the 7 pubs they have not yet visited. When choosing the next bar, there are still 8 bars to choose from (the 1st and the 2nd bar and the 6 bars they have not visited). This will continue until they choose their last bar; then there is only 1 more pub they haven't visited yet while they are still able to choose from 8 pubs. This creates the following probability: $7/8 * 6/8 * \dots * 1/8$.

Publications

Baştürk, N, Borowska, A, Grassi, S, Hoogerheide, L & van Dijk, HK (2019), 'Forecast density combinations of dynamic models and data driven portfolio strategies', Journal of Econometrics.

Huang, JP, Heidergott, B & Lindner, I (2019), 'Naïve learning in social networks with random communication', Social Networks, vol. 58, pp. 1-11.

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Koopman, SJ & Lit, R (2019), 'Forecasting football match results in national league competitions using score-driven time series models', International Journal of Forecasting.

Opschoor, A & Lucas, A (2019), 'Fractional integration and fat tails for realized covariance kernels', Journal of Financial Econometrics, vol. 17, no. 1, 17, pp. 66-90.

Agenda

June 6 - Inhouseday PwC

On June 6 PwC organises an inhouseday for Kraket members. A great opportunity to get to know PwC better.

October 9 - Caseday

On October 9 the annual Caseday will take place. An opportunity for 3rd year bachelor students and higher to get to know companies through different cases. More information will follow after the summer.

SECTOR is a publication of



Kraket is the study association for Econometrics and Operations Research at the Vrije Universiteit in Amsterdam. The name Kraket stands for 'Kritische Aktuarissen en Econometristen'.