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Special

Footprintless Flying

>> Report
European Business Trip

>> The Teacher
Alexandros Theloudis

>> Triangle
Kristy Jansen

ASSET Econometrics

See You Later, Alligator!

This is my last preface… ever. After a year of hard work, a lot of struggles and many lessons learned, we are finally saying goodbye and handing this beautiful magazine over to the next committee. But not without a banger. This Nekst is our biggest edition yet, with a whopping 56 pages! The committee members have perfected their skills to make the articles the most interesting or fun ones you have ever seen.

This last Nekst we felt the need to make it more fun than any edition before… hopefully we delivered. First off, we want to introduce you to the committee pets in 'Meet the Pets', a parody on the 'Meet the Crew' from the first Nekst of this year. We also introduce you to Alexandros, the teacher of what might be your new favorite Bachelor's course. Next to that, you will find a company interview with the Dutch company Belastingdienst! It will highlight the things you might have expected, and the things you would not expect regarding this company. On the more formal side, we have a Triangle and a Practical Report! And of course you can expect many more fun and refreshing articles for you to read during the summer holidays.

What my committee does not know (yet) is that I reserved some space in this edition to write a little thank you to the crew. A well-deserved thank you if you ask me. Making one edition of Nekst is not easy and takes way more time than one would expect. But it is very rewarding to see the printed versions. Even more rewarding are the kind words and compliments we received after each edition of Nekst was delivered. Therefore, I not only want to thank the committee, but also you, the reader! After all, you are what we are doing it for. I hope this Nekst will make you smile! And last but certainly not least, I want to thank our column writers Renée Peeters and the writers from the Zero Hunger Lab for the amusing texts time and time again!

Yours sincerely,

Juliëtte Tillie
Editor-In-Chief

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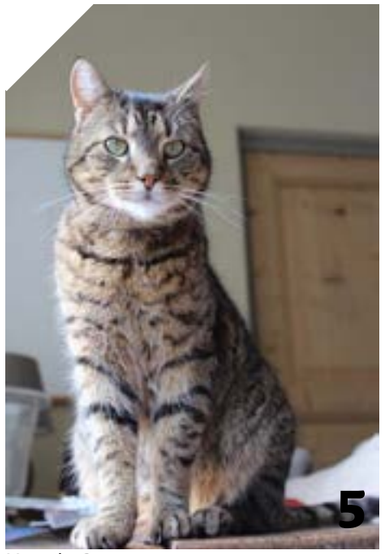

Meet the Pets

Interview: Belastingdienst

Event: Active Members Weekend

Familiar Faces: Roman Kazus

Event: European Business Trip

The Teacher: Alexandros Theloudis

Greetings from ... Seoul!

COLOPHON

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ASSET Econometrics

Dear Members,

I had hoped to write you this edition of the Dear Members from our glorious couch. However, to my own disappointment this is not the case. Nothing great will last forever and this is also the case for my board year. This will be the last time that I will have the honor of speaking to you all through Nekst. Therefore, it is appropriate to start reflecting on the past year. I want to do this by mentioning some of my personal best moments of this board year.

I have thought long and hard about which moments have been the most special, and ultimately came up with the following ones. The most unforgettable event in my board year was at the Oscars. I will never forget how Chris Rock jokingly called Jada Smith 'GI Jane', whereafter Will Smith walked on the podium and slapped Chris Rock across the face…

I almost had you there, right? No, in reality when I think about my board year one memory instantly jumps to mind. It was at the start of the academic year, when COVID-19 was temporarily gone. To celebrate this, we organized the Goodbye Corona Party, which was the first open party of Asset | Econometrics. Over a hundred econometricians joined the party, some of them accompanied by their non-econometrician friends. Standing at the entrance and seeing everyone pass by whilst handing them a little welcome gift is still one of my favorite memories.

Another moment that comes to mind happened quite recently. During the break of the legendary Astrics Beer Cantus I spoke to one of our members. He enthusiastically told me he had found a job due to the connections he made during the Econometrics Consultancy Tour. I think this perfectly illustrates what makes our association so great. On the one hand you experience the greatest parties imaginable, whilst on the other hand you get the opportunity to find your future employer.

I also really want to thank and show some appreciation to some of my colleagues. During the entire year I closely worked together with Joris, Floris and Patrick, and I was also fortunate enough to work together with Bram, Constantijn, Nienke and Ikie for a part of the year. Without their effort and hard work none of what we have achieved would have been possible. On a more personal note, I want to say that they are a big reason for why this year has been so unforgettable and I want to thank them all for putting up with me during the year.

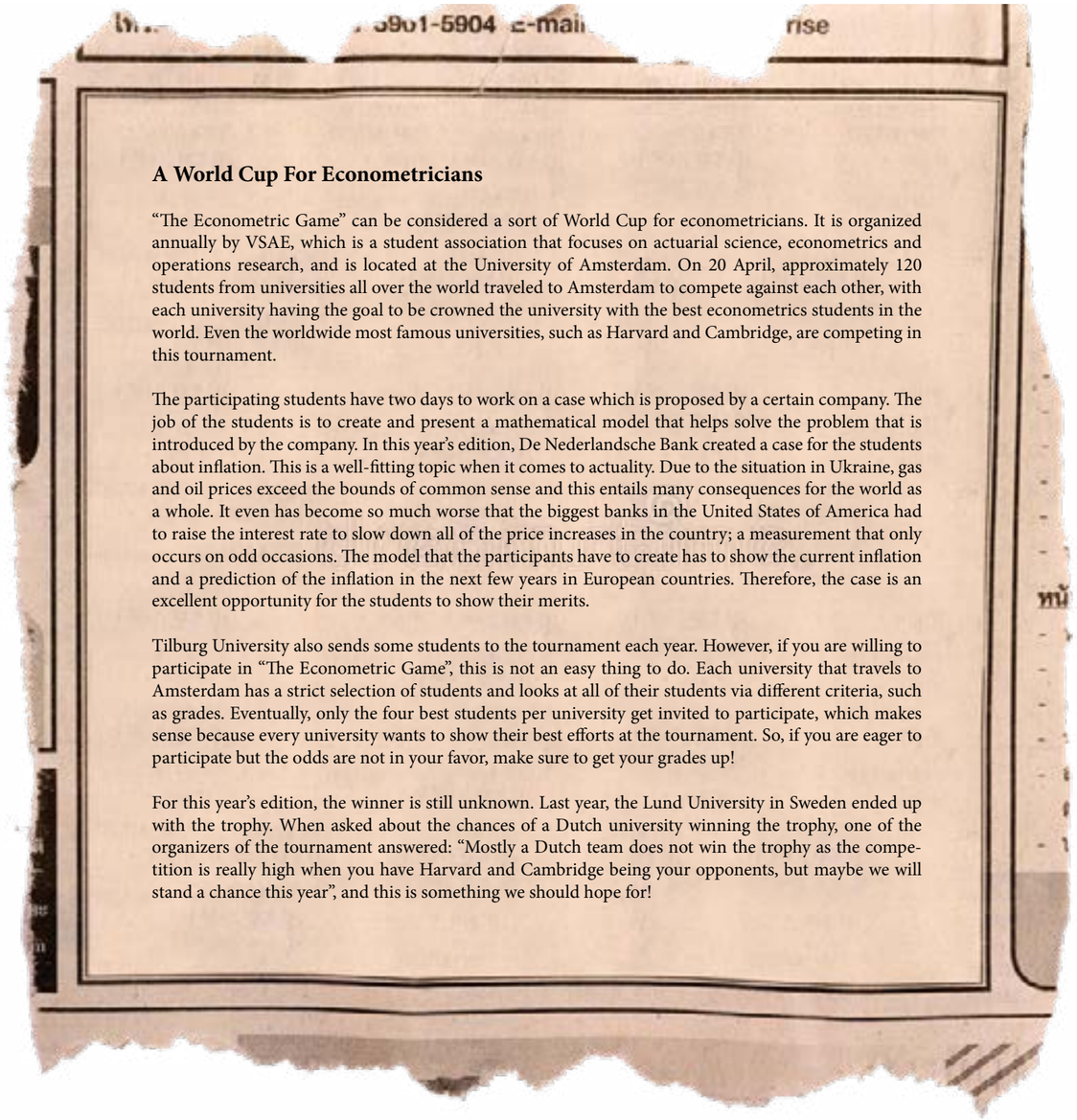
Furthermore, I also want to show some appreciation for all the active members that worked tirelessly to keep the association running. In particular, I want to thank Juliëtte and Meike for their efforts as Nekst editorial staff. I am looking forward to the last few weeks of my year, and I am even more excited for the future of this beautiful association. I will not bore you even more with my rambling so please enjoy this edition of Nekst!

Wout Temmink
Chairman Asset | Econometrics 2021-2022

The Latest

In this edition of the Nekst, "The Latest" is about some special tournament for econometricians which took place a few weeks ago in Amsterdam. In fact, Tilburg University was also represented at "The Econometric Game".

written by **Timo van Oorschot**



A World Cup For Econometricians

"The Econometric Game" can be considered a sort of World Cup for econometricians. It is organized annually by VSAE, which is a student association that focuses on actuarial science, econometrics and operations research, and is located at the University of Amsterdam. On 20 April, approximately 120 students from universities all over the world traveled to Amsterdam to compete against each other, with each university having the goal to be crowned the university with the best econometrics students in the world. Even the worldwide most famous universities, such as Harvard and Cambridge, are competing in this tournament.

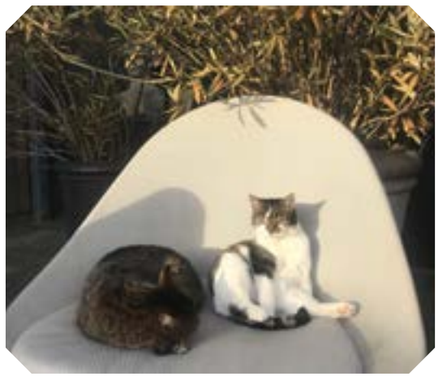
The participating students have two days to work on a case which is proposed by a certain company. The job of the students is to create and present a mathematical model that helps solve the problem that is introduced by the company. In this year's edition, De Nederlandsche Bank created a case for the students about inflation. This is a well-fitting topic when it comes to actuality. Due to the situation in Ukraine, gas and oil prices exceed the bounds of common sense and this entails many consequences for the world as a whole. It even has become so much worse that the biggest banks in the United States of America had to raise the interest rate to slow down all of the price increases in the country; a measurement that only occurs on odd occasions. The model that the participants have to create has to show the current inflation and a prediction of the inflation in the next few years in European countries. Therefore, the case is an excellent opportunity for the students to show their merits.

Tilburg University also sends some students to the tournament each year. However, if you are willing to participate in "The Econometric Game", this is not an easy thing to do. Each university that travels to Amsterdam has a strict selection of students and looks at all of their students via different criteria, such as grades. Eventually, only the four best students per university get invited to participate, which makes sense because every university wants to show their best efforts at the tournament. So, if you are eager to participate but the odds are not in your favor, make sure to get your grades up!

For this year's edition, the winner is still unknown. Last year, the Lund University in Sweden ended up with the trophy. When asked about the chances of a Dutch university winning the trophy, one of the organizers of the tournament answered: "Mostly a Dutch team does not win the trophy as the competition is really high when you have Harvard and Cambridge being your opponents, but maybe we will stand a chance this year", and this is something we should hope for!

Meet the Pets!

of the Nekst committee 2021-2022

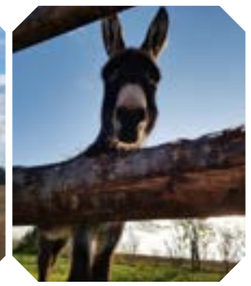


Jip & Perrie

Meow! We are Juliëtte's cats. She got me, Jip, for her fourteenth birthday. I am the smartest of the two. I taught myself how to open doors, can walk with you like a dog and even come with you to friends from the village, where I will patiently wait outside until we go home again. Perrie is my little sister. She came to live with us a year after me. She is a little bit of a weirdo. For example, she can teleport between closed rooms. I must admit though that I have never met a cat as sweet as her!

Frits

I am Meike's cat! My parents are the cats of Meike's brother. So when I was old enough he thought "why not give Meike a cat for her graduation". Well, it turned out that my real sweet owner is allergic to me. Too bad for her that I love cuddling and will never stop loving it! When she leaves me alone with nobody to cuddle, I will lay in the window at the front of the house and wait for the twilight to come. That is the moment when the garden begins to live and life gets exciting!



Zébulon

I am Zeepie, I am the donkey at the farm of Les Deux Sabots (the homefarm of Sara). They do not understand that I am a little kid from Pinocchio that is still in the donkey but that is fine because they still give me a lot of hugs! My two roomies are Lodewijk and Salem. I love them so much that I will never go far without them, that is why my people let me walk around the farm without any leash!

Mies

Hello, I am Mies and I love my humans (Sara and her family) even though I do not really need them: I can open the doors myself and there is really enough marvellous food on the farm. Actually, they should thank me more for saving them from the most dangerous monsters at night (that white rabbit of yours was a real devil!). They give me all the freedom I need and that is why I adore them so much (and also because they give me the leftovers sometimes, why would they not eat that!?).

Framboos & co

Hello everyone, I am Framboos, one of the "ex" fishes of Roel and his brother Stef. Two years ago I was swimming in a bowl with a lot of friends in the "boerenbond". January 3, 2020, I remember it as if it was yesterday, two boys entered the shop. I saw them come closer to my bowl and saw them looking at me and some other fishes. A few minutes later a big hand grabbed me out of my bowl and put me in a plastic bag (ew). I was disappointed by this change of setting and really scared about what was going to happen. Fortunately it turned out fine; I had a beautiful new fish bowl and shared it with only four other fishes! We had a lot of fun together and Stef and Roel gave us a lot of food. I think I became really obese during the time I lived with them. But every perfect story comes to an end: Roel moved to a new home and Stef did not like me anymore so they sold me to a new owner. Apart from the fact that they made big money on me and did not share, I can say I had a great time living there!

Snoet

Dear All, I am Snoet. I am the legendary cat initially adopted by Tamara's brother and his roomies; yes yes, I have lived in a student house… and I will say, it was not that bad. I mean, I could ask for attention and get it right away: all fine by me. Yes, they have tried to make me do the weirdest things but come on, I am not that stupid. Actually, I have learned from it: it is important to set your own boundaries. So now I am the one that asked for cuddles, and no way that it works the other way around! Luckily Tamara's brother had to move out so now I am homed, nourished and catered by his mom (as a real Queen should!).

The Question Is Not If, But How Your Work Has an Impact on People

written by Flora Poon and Timo Klabbers

On a sunny Monday afternoon, we are at Esplanade. The temperature is just right to sit on the terrace without a coat. We doubt a little whether the person we see walking onto the terrace is the man we are looking for. We approach him and luckily, he turns out to be the right one: Erik Driessen. Erik works as a business analyst at the Belastingdienst, the Dutch tax administration. Today we are going to interview him to find out more about the Belastingdienst as an employer and how data helps the Belastingdienst in their work.

Across from us Erik sits down, a man in his early thirties with curly hair and glasses. When he starts talking at a rapid pace, you can hear the enthusiasm bursting through. We can imagine that on birthdays, even the people who do not understand data analytics, like to listen to Erik. Not only does he work with large data sets during working hours, but he also dares to describe himself as a data art enthusiast. He even works on multiple projects in his spare time. One of his recent private projects is about visualizing and analyzing Avicii's lyrics. By doing so he was able to generate a digital signature.

From marketing to data analytics

We will start with telling you how Erik got to this point in his life. As a graduated student from ICT and Media Design at Fontys Eindhoven, Erik has never thought about working as a data analyst. He started his career as a website designer at a marketing company. Later on, while writing his graduation project about influential users on Twitter, he got in touch with the data department of the company. This was his first experience in the field of data analysis. The feedback from the company about the project was so positive, that he kept working in that department for about seven or eight years, working in multiple teams with different positions. Afterwards, in 2020, he came in contact with the Belastingdienst. His openness towards a new challenge gave him the drive to accept the offer to work as a data analyst at the Belastingdienst.

Since he has originally studied ICT and Media Design, his theoretical knowledge is based on the experience from the companies and departments in which he has worked in. Mainly his open mindedness towards the opportunities that he got, brought him all the knowledge he needed to do his current job.

On paper, Erik is a Business Analyst, a position where you mainly map out business processes. But the position is much more technical within the data department (Erik often refers to the department by its abbreviation DF&A, which stands for 'Datafundamenten & Analytics'). Everyone in his team does "a little bit of everything", but Erik focuses on the communication. In a small team with about five colleagues, Erik works on questions that are put forward by other teams within the Belastingdienst. His department, DF&A (around 350 employees), develops products based on data analyses that helps Belastingdienst to work more effectively. Here you can think of dashboards and models that help call agents to decide to set up a payment arrangement. Erik's team is predominantly busy with answering questions based on data that are put forward by the Small and Medium Enterprises (SMEs, Dutch: MKB) department. The team falls under a bigger DF&A department, which offers activities varying from designing risk models to supplying real-time information, and from answering questions from the Dutch House of Representatives to the Fiscale Inlichtingen en Opsporingsdienst (FIOD). In these activities, often someone from

Erik Driessen

Business Analyst

DF&A is involved. The Belastingdienst has one of the largest datasets of The Netherlands. The DF&A uses this data to make models, so the work of the Belastingdienst can be done more efficiently and added value can be delivered to citizens and companies.

The life of a data analyst

According to Erik, one of the best things about his job is explaining the results to the customer: "If you notice that the customer is getting excited about the product, the project becomes more fun. I see it as a kind of Venn diagram: you have the data side and the world of the customer and there is an overlap between them. As a data analyst you sometimes have to compromise, but the customer must also be curious about your world. When that happens, you work on fun projects."

When we ask Erik whether he prefers to explain his work to other data analysts or to colleagues who do not have much knowledge of data or analytics, he states that he enjoys the latter category more: "I always enjoy sparring with someone, but in that regard, it might be nicer to explain it to someone with very little experience. You are then very much challenged to explain in such a way that what you want to tell comes across right." Sometimes Erik has to make a choice: does he tell everything in detail, with the risk that somebody will not understand everything, or does he simplify the story, but then not everything will be explained. He finds it most important that people get enthusiastic about his ideas and results, because then they will take the time to also understand the hard parts.

Erik needs a lot of data to answer the questions he gets. This data is received by the Belastingdienst in many different ways. Data from individuals, small and medium-sized enterprises, and multinationals are collected on a legal basis. It is important to note here that a legal basis is required here in order to gather data, haphazardly gathering data is not allowed. There has to be some kind of binding goal here. Much of the gathered data can be used to extract information through models and analyses. Another team within his department first prepares the data and puts it in a modern system. This way, the time spent on data preparation by analysts is greatly reduced. Fun fact: the Belastingdienst has access to six petabytes of data. That is six million gigabytes, or the same amount of data used when you would stream Netflix movies for over 600 years.

Of course, all this data owned by the Belastingdienst, is very sensitive to privacy. The fact that they have access to that data does not mean that you can use that data just like other ordinary things. There are strict legal requirements before they can use the collected data. As noted before, there has to be some kind of objective, and haphazardly gathering data is not allowed. Erik is happy that he does not have to do so much with these legal frameworks and that he and his team can focus on developing models: "The good thing is that a lot of noise is kept away from the development team. Before we get a question, all kinds of checks and balances have already been done." However, during a project, legal questions may arise. The department Erik works at can count on the support of a dedicated privacy team: "The great thing is that those teams are very approachable. You can always walk into their office at any time."

Belastingdienst as employer

At the Belastingdienst, there are many vacancies, particularly in the data analytics department where Erik works, where they are often looking for more eyes and brains. There is simply not enough capacity to catch up with all the questions of their clients. Therefore, they have to make a selection of the most important orders and they have to refuse others.

Erik would love to welcome some new colleagues from a younger generation. He does think that working for the government has three main advantages. First of all, the working conditions are good. Currently he works for four days, such that he is able to spend more time on his own data projects. Furthermore, working for a government institution has social value to him. Previously, when he was working for a marketing company, he was doubting the reason behind designing models and analyzing data. Nowadays, he is designing models that can help the Dutch society. Last but not least, the working environment is open and all his colleagues are approachable. Erik explains that he has many individual meetings with his colleagues and his clients to get to know each other. No matter what your position is or in which team you are working, everyone is available to have a meeting with you. This has particularly helped him with the transition to becoming a professional data analyst.

Development

Talking about big differences when working for the Belastingdienst, Erik names one more: the products are carefully made, but that often takes a little more time. "The government has many more standards and much more regulations. It is a good thing that these rules exist, because that way we can make more valuable products, but these products take longer to be ready for use."

The products and models made by Erik almost by definition affect people. He therefore emphasizes the importance of maintaining this level of care. "You are dealing with very sensitive data. When we set up a process, or make a model, the question is not whether it affects people, but how." What he means here is that the goal of the models is mainly to help people in fulfilling their fiscal obligations in an easy way.

Twice a year, a three-day Hackaton is held by the data department within the Belastingdienst in the context of innovation. In this event, you are allowed to work on any project of your preference. This may be an analytical question or a new technical development that you want to apply. The only restriction is that you may not implement the result of your project. This means that you are not allowed to change any processes within the company based on the outcome of your research. However, if your investigation is interesting enough, you may get into a process which could lead to new product production. That is, first getting a follow up of three weeks to deepen your research. If your feedback is positive, you will get another three months to design a test product, which could be finalized to a fitting model within the system of the Belastingdienst. According to Erik, it is unique to see a company so actively involved in finding renewal ideas to improve their processes. According to him, innovation is a topic that is quite difficult to utilize in a company. Giving all employees the chance to find new methods and to do their own research is something he admires a lot.

For the future, the Belastingdienst in general would like to improve outdated IT systems. This is something they are currently working on, but it is a difficult task. As you could imagine, it is not possible to simply turn off the system for a period of time. They have to improve the program and at the same time maintain the old system until they can make the transfer. For the data analysis department specifically, Erik thinks that the future will bring more data, more advanced models, and larger computers. Nevertheless, we are still living in a world in which some companies are limited in their understanding of complicated models. The key is to find the golden ratio between building more developed, but at the same time intelligible programs.

In short, despite the fact that most econometricians do not immediately think of a job at the Belastingdienst, it is an employer that can supply you with interesting work. The large team with incredible amounts of data gets very diverse questions. And finding answers to these questions can have an immediate impact on the people involved. In addition, the Belastingdienst offers a lot of room for personal development and innovation, with the hackathon being one of the most appealing examples.

No Time to Waste

In the previous columns you learned about Sustainable Development Goal 2 of achieving Zero Hunger by 2030. It is good to know that 'Zero Hunger' is an abbreviation. The full definition of SDG2 is: 'By 2030, end hunger, achieve food security and improved nutrition and promote sustainable agriculture.' In fact, this consists of five more detailed subgoals: 2.1 end hunger of the poor, 2.2 end malnutrition, 2.3 increase food production, 2.4 ensure sustainable food production, and 2.5 maintain genetic diversity of seeds. For a full description of these subgoals, just google 'SDG2 zero hunger'.

These five subgoals indicate that food distribution in countries experiencing famine is only part of the challenge, although this is the picture that many people think about when hearing about hunger. Food aid is the last resort to help people in acute need, but luckily there are many other and more strategic actions that can be taken to achieve food security for everybody by 2030.

At the Zero Hunger Lab we currently run projects on four of the five topics, only the genetic diversity of seeds is yet to be taken up. We try to contribute by distilling optimization problems from the subgoals and using the results to help our partners to make better-informed decisions. One of these projects focuses on increasing food production. Or, more precisely, it aims to increase the percentage of produced food that reaches its intended goal of human consumption.

The project is called ZeroW, is funded through the Horizon Europe program, and it aims at developing and testing food system innovations that will reduce waste by 50% by 2030 and to near-zero by 2050. In the project we collaborate primarily with Wageningen University, but also with a large consortium of around 50 European research institutes and companies.

The situation is as follows: while today more than 800 million people are food insecure according to the definition of the Food and Agriculture Organization of the United Nations (FAO), at the same time globally about 35% of all food biomass that is produced for human consumption is wasted or used for other purposes. This amounts to 1.3 billion tons of food per year. Or: 1.6 tons per undernourished person.

In the project we will work on quantitative models to analyze the effectiveness of concrete interventions to reduce this unacceptably high level of food waste. Two prominent examples are strengthening the role of foodbanks in food supply chains and optimizing diets to minimize the use of natural resources.

In addition to this, there are many more fundamental questions to be answered in the project. I will end this column with just listing some of these questions, without providing an answer.

The prevailing definition of food waste focuses on biomass weight, which assumes that the social burden of discarding a kilo of cucumber is the same as discarding a kilo of beef. Should the definition of food waste be modified to focus on nutrients instead of weight? Should it also consider the amount of natural resources used to produce and transport the wasted food?
Food waste percentages are higher in the developed world than in developing countries. Is food too expensive in certain parts of the world, and too cheap in others?
800 million people in the world are food insecure, while 1.5 billion people are overweight. Should access to food consumed by the latter group be considered as food waste?
Dutch supermarkets are becoming better at reducing food waste, which results in declining donations to food banks. Is food waste reduction at supermarkets a good thing?

If you are interested in this type of questions and in the modeling that is needed to provide possible answers, please reach out to me for a BSc or MSc thesis project at Zero Hunger Lab.

Frans Cruijssen
Frans Cruijssen (1979) studied econometrics in Tilburg and received his PhD from the same university in 2006. After a fourteen-year stint in business, he returned to Tilburg in 2020 to join the Zero Hunger Lab.

Active Members Weekend

Foute Fitnessers
Astrics' favorite group, the 'Foute Fitnessers' started the AMW with a lot of enthusiasm, despite being a bit late, oops. That enthusiasm was visible throughout the weekend as we continued to win medal after medal and ended up winning the trophy. We would like to thank the AMW committee for organizing an incredibly fun weekend!

Tokkie Turners
The throwing of tires with the boys was very manly.

Sexy Snelwandelaars
An unforgettable AMW for our group. On Friday, we recorded a top notch prestation during the Crazy 88. On Saturday we ate a full bucket of lemons, but nonetheless we lost. Bram rocked his sexy speed walkers outfit. We 'hobbled' through the weekend with our speed walkers walk. By the way, eating 14 brick cakes is difficult.

Pikante Pingpongers
It was yet again a great successful weekend, with loads of nice memories! From playing 'Floenkyball' to mattresses hanging from the ceiling. Thanks to everybody for the amazing weekend.

Baldadige Basketballers
The Baldadige Basketballers were the notorious gnome army, this AMW. After hard toiling and a lot of enthusiasm, we could crown ourselves the winners of the losers! AMW was just as awesome this year, as any year before, and maybe even a little bit better.

Kwakkelende Kwallenvangers
We had a rough start of the day, but when we got to the accommodation and saw Patrick's mattress, everything was okay. There were a lot of fun activities and we really got to know each other in a different way. Thanks to the committee for organizing this amazing weekend!

Zwoele Zwerkballers
AMW 2022 was amazing for us Zwoele Zwerkballers. After riding our brooms through Eindhoven, we had an amazing and fun weekend. Special shoutout to the Waardeloze Wielrenners, as we stole a lot of their medals.

Achterbakse Après-Skiers
We all enjoyed AMW very much. Starting with the classic breakfast on Friday, we tried hard to gain points for the Crazy 88 in Eindhoven and with the other activities. Sadly we came in second to last, but luckily the committee arranged plenty of nice evening activities to get over our loss, which we all enjoyed. A big thanks to the committee for the organization!

Waardeloze Wielrenners
As the worthless cyclist, we lived up to our name. Let's say 'participating is more important than winning'. Despite the fact that we ended at the very last place, we really enjoyed the weekend! Lots of games of jeu de stoel, nice people, a delicious bbq and fun water slides made this weekend memorable!

Take Your Career to the Skies

written by **Matthijs Kroesen**

If you are an observant reader, you will have noticed that the column 'Familiar Faces' has covered three well-known Asset | Econometrics alumni this year. We thought it would only be fitting to end this last Nekst-issue of the year in style with Roman Kazus! Although Roman has been a bit less active in committees of Asset | Econometrics than the previous participants of 'Familiar Faces', he is still a famous personality within our study association. Roman showed up at many activities, even while not being active at Asset | Econometrics. Maybe you have heard of his mythical story of the amazing (and quite possibly illegal) club in Athens that did not exist anymore the day after! Fortunately, he realized in the final years of his studies that being active was worth his time, and the International Business Tour (IBT) and Europe Trip committees were the lucky ones that were blessed by Roman's experience. Enough chit-chat - let us hear what Roman's career path has been, what he is doing nowadays, and how Asset | Econometrics has helped him in his career.

Roman started his studies in Tilburg with a Bachelor's degree in Econometrics and Operational Research (EOR), exactly like the majority of Asset | Econometrics. After graduating his Bachelor's without any significant issues, he continued with a Master's degree in Business Analytics and Operational Research (BAOR). To additionally improve his Master's experience, Roman also studied abroad in Denmark during the first semester of his Master's. This so-called exchange was at Copenhagen Business School. After acquiring a lot of Danish impressions, Roman went back to the Netherlands for the second semester.

Before even graduating from BAOR, Roman got the insight that he wanted to extend his years of studying for a while longer. Also, he wanted to deepen his knowledge in a similar but different subject and challenge himself. He started a second Master's degree at the Eindhoven University of Technology, named Industrial and Applied Mathematics (IAM). While the Bachelor's and Master's in Tilburg were already quite technical mathematically, this Master's elevated the technicality even further. While econometrics focused on the practical sides of mathematics (for example statistics or optimization), IAM's curriculum consisted more of theoretical mathematical subjects, like solving differential equations. Roman found the challenge he sought in this Master's. Besides studying, Roman also worked part-time at Building Blocks two days a week as a data scientist, which was sometimes a bit more than what was comfortable. He wanted more free time. He delayed taking some courses to make sure he could handle everything. After taking some well-deserved rest, Roman wrote his second master thesis for Eurotransplant. The topic of this master thesis was organ allocation: what is the probability that a patient survives when he gets some organ from a random donor? Roman made a model which calculates this for different persons; you can imagine that someone has a higher probability of surviving if he gets an organ from a healthy 20-year-old than a 50-year-old that has smoked his entire life. Also, some characteristics of the receiver of an organ are taken into account. This model is nowadays used to decide who has the highest probability of surviving when receiving a new certain organ, and thus who is suitable to receive a new organ.

Roman Kazus

Graduated Master BAOR

Age: 26

For BAOR he wrote a thesis on autonomous driving vehicles. The ultimate goal was to optimize the efficiency of the traffic flow of these vehicles and to make them cooperate. These goals were achieved by reinforcement learning: this technique entails creating a code such that the vehicles 'learn themselves'. For example: with reinforcement learning, vehicles learn how to break and how to increase their speed on their own. All of this was simulated in a virtual world (at the physical Schiphol, no autonomous vehicles are deployed as of yet). The research was meant to find out how to instruct these vehicles in the best way.

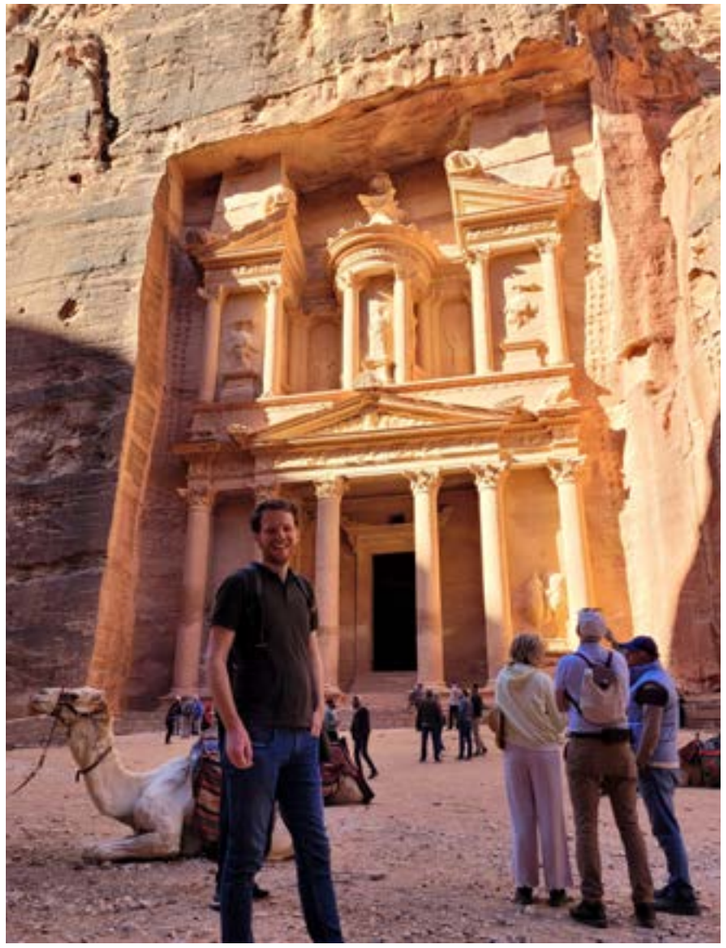
After graduating both of his Master's, Roman's student time was over. A new phase of his life had arrived: it was time to get a serious office job.

Roman started to work at the same place he wrote his final master thesis: Schiphol. As a data scientist, Roman tries to fully digitalize the airport with his team. The goal is to make an exact 'digital twin' of Schiphol. A digital twin is a virtual world where everything can be simulated. It is designed to approximate the real world as closely as possible. For example, take the queues at the security. Sometimes these queues are very long, and new lanes may need to be opened. When a person decides what to do in such a situation, mistakes tend to be made very quickly (we are all human after all). When you simulate this situation in a digital twin 10,000 times, and one solution appears to be the best with the most amount of simulations, you can be fairly certain that this solution is the best solution for the problem. For example in the queueing problem, the solution may be to open two new security lanes. In a digital twin, you can also change a small thing about the situation and simulate everything all over again. If this change leads to significant improvement in most of the simulations, you can say with high certainty that the change you made was an improvement to the situation. The benefit of digital twins is that you can test a change in a virtual world before you implement it in the real world. If a change happens to have disastrous consequences, you know that before they affect the real world. This way, better solutions can be implemented for problems relevant to Schiphol. Nowadays, artificial intelligence (AI) like digital twins is purely used as insights, while the real decisions are still made by humans. The goal is to increase the role of AI gradually until the AI can make decisions on its own.

You can imagine that the process of designing a digital twin of the scale of an entire airport is an enormous task. For this exact reason, the big project of making the digital twin is divided into smaller tasks. For example, Roman is working on an app called Notifly. This app is designed to inform local residents about the predicted amount of flights over their area. This app is especially relevant for Schiphol, since the weather conditions constantly change due to the location near the coast, thereby changing routes for the airplanes to fly. With his team, Roman created the Notifly app which informs local residents based on their current location how many airplanes will fly overhead in the next 24 hours. The local residents can schedule their activities based on Notifly now. Also, Roman has worked on personalizing the advertisements on the Schiphol app based on the flight numbers of the passengers.

As mentioned before, Roman started relatively late with being active at Asset | Econometrics, known as Astrics. Luckily for us, he turned around in the final years of his Master's and was the treasurer of both the IBT committee and the Europe Trip to Prague. Unfortunately, COVID-19 showed up, and the IBT was canceled. After this disappointment, Roman continued to take a seat in the most prominent committee of Asset | Econometrics. Deservingly, he was ridiculed to be the biggest civilian on the Europe Trip committee (even bigger than Lotte!). Although the first attempt of this trip was also canceled due to COVID-19, the second attempt succeeded, and a trip never to be forgotten was realized (even though there were some small problems with plane tickets). Roman has learned a lot from being active at Astrics, mostly in the social aspect. In a workplace, you need to have the capability to work with other people and to be a true team player. A happier workplace leads to better results in the job. Roman has learned to cooperate with other persons in his committee, and he daily uses that in his current life.

All in all, Roman is a versatile person with an interesting path in life. Do you see yourself making a digital twin of something, like a human body, after your studies? I certainly do! Do not forget to enjoy your student life as well though; as a wise man once said: "although I have already grown into quite the adult, although sometimes I'd like to play little boy games."



What drives long-term investors' demand for bonds and how does this demand in turn affect bond yields?

This is a key question in the current asset pricing literature, where the aim is to simultaneously understand demand or quantities and asset prices. The question is also very relevant for governments and corporations, because it has direct implications for their cost of borrowing. It also has important implications for central banks in light of quantitative easing programs to understand how these programs are absorbed by financial markets. In my study, I use detailed data on bond positions of pension funds and insurance companies (P&Is) in the Netherlands to study demand shifts and their causal effect on bond yields. In particular, I exploit a reform in the regulatory discount curve that makes liabilities more sensitive to changes in the 20-year interest rate but less so to longer maturity rates. Following the reform, P&Is reduced their longest maturity holdings but increased those with maturities close to 20 years. The aggregate demand shift caused a steepening of the long-end of the yield curve with a decrease in the 20-year yield of 10 basis points and an increase in the 30-year yield of 20 basis points. My findings have important policy implications, as they indicate that the regulatory framework of long-term investors affects the governments' cost of borrowing.

Introduction

Recent literature shows that long-term investors, such as pension funds and insurance companies, affect yields (e.g., Greenwood and Vayanos, 2010; Domanski et al., 2017; Greenwood and Vissing-Jorgensen, 2018; Klinger and Sundaresan, 2019). Because of data limitations, the literature so far primarily uses price data alone to study the implications of demand effects on yields. As a result, there are two important questions largely left unanswered. First, what are the *quantities* behind observed yield effects? Second, what *drives* the demand for long-term bonds in the first place? For instance, to what extent is this demand driven by economic versus regulatory incentives and what is the role of investors' constraints?

To study demand shifts and their causal effect on yields, I use the Dutch pension and insurance market as a laboratory. I exploit a regulatory reform that the Netherlands introduced in July 2012. This reform changed the regulatory discount curve at which P&Is had to value their liabilities. With the reform, the long-end of the curve became *more* dependent on the 20-year interest rate and *less* dependent on longer maturity rates. The new discount curve uses market interest rates for maturities up to 20 years, while the interest rates for maturities that exceed 20 years equal a weighted average between the 20-year rate and a fixed rate: the Ultimate Forward Rate (UFR). The UFR makes liabilities more sensitive to changes in the 20-year interest rate but less so to changes in longer maturity rates.

This feature, in turn, creates incentives to move away from very long-term bonds towards bonds with maturities close to 20 years. Theory suggests that this effect should be particularly strong for P&Is with long liability durations, as those are most heavily impacted by the reform.

Data

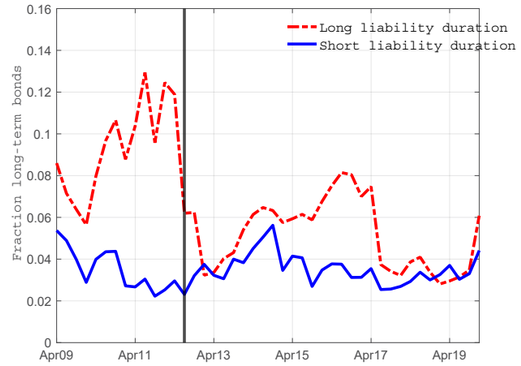
I use data on Dutch security holdings (SHS) for several types of institutional investors, such as banks, insurance companies, investment funds, and pension funds over the period 2009q1-2018q4. The data provide bond holdings of each institution with the International Securities Identification Numbers (ISIN). The SHS database is linked to the Centralised Securities Database (CSDB) to obtain relevant market information, such as debt type, maturity date, and yield-to-maturity. Next, I link the holdings data to the supervision databases. The supervision databases are from mandatory annual and quarterly statements that P&Is report to the DNB. P&Is report, among other things, solvency positions, liability durations, and the value of their assets and liabilities.

Long-term bond holdings and the regulatory reform

Figure 1 shows the average fraction of long-term bonds in the bond portfolio for P&Is over time, where long-term bonds are defined as bonds with maturities of 30 years or longer. Two quarters after the DNB implemented the UFR, there was a sharp decline in long-term bond holdings for P&Is with long liability durations. Long-term bond holdings slightly increased again towards the end of 2014 but remained substantially lower than the pre-UFR levels.

Figure 1: **Long-term bond holdings by P&I type**

This graph shows the average fraction of the bond portfolio that is invested in bonds with a maturity of 30 years or longer for P&Is with long liability durations (higher than the median) and for those with short liability durations (lower than the median) over the period 2009q1-2020q1.



To align theory with the data, I use a difference-in-difference specification which compares long-term bond holdings before and after the implementation of the UFR. I conjecture that P&Is with long liability durations decrease long-term bond holdings more compared to investors with short liability durations:

$$\begin{aligned} w_{it}^{B} &= \alpha + \beta_1 D_{2011q2,i}^{L} \times \mathsf{UFR}_t + \beta_2 \mathsf{FR}_{it-1}^{-1} + \beta_3 \mathsf{FR}_{it-1}^{-1} \times \mathsf{PF}_i \\ &+ \beta_4 D_{it-1}^{L} + \beta_5 \mathsf{AUM}_{it-1} + \nu_i + \lambda_t + \epsilon_{it}, \end{aligned} \tag{1}$$

where w_{it}^{B} is the bond allocation of P&I i at time t; UFR_t equals one after the implementation of the UFR and zero otherwise; $D_{2011q2,i}^{L}$ is a time-invariant characteristic that equals the liability duration as of 2011q2; FR_{it-1}^{-1} is the lagged inverse of the funding ratio minus one; PF_i is a dummy variable that equals one if the investor is a pension fund; D_{it-1}^{L} is the lagged liability duration; AUM_{it-1} is the lagged total AUM; ν_i is the fund fixed effects; and λ_t is the time fixed effects.

Table 1 summarizes the results. P&Is with long liability durations decrease long-term holdings to a larger extent than the ones with short liability durations. At the same time, P&Is increased their bond holdings with maturities varying between 15 and 25 years, while they did not change their holdings of bonds with maturities less than 15 years. The effects are also economically important. The total decline in long-term bond holdings approximately equals €9.15 billion. This decline is equivalent to a decrease of 29 percent relative to the pre-reform long-term bond holdings. Similarly, P&Is increased their 20-year bond holdings by €12.37 billion or 25 percent relative to the pre-reform 20-year bond holdings. To give additional support for the economic effects, I have reestimated the regression based on Dutch government bond holdings alone. The aggregate decline in 30-year Dutch government bond holdings equals €2.53 billion, which is equivalent to 21 percent of its amount outstanding.

Table 1: **Long-term bond holdings and the regulatory discount curve**: This table presents the results of the main regression described in Equation (1), with the dependent variable the fraction of the P&I's bond portfolio invested in a certain maturity bucket, UFR equal to one as of 2012q2 and zero otherwise. Standard errors are clustered at the investor level and the corresponding t-statistics are in brackets; $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

	Holdings $T \geq 30$		Holdings $15 < T \leq 25$		Holdings $T \leq 15$	
	(1)	(2)	(3)	(4)	(5)	(6)
UFR	0.0012		-0.008		0.0107	
	[0.32]		[-1.07]		[0.62]	
D_{2011q2}^{L}	0.0031***		0.0024		-0.0036	
	[4.12]		[1.33]		[-1.37]	
D_{2011q2}^{L}×UFR	-0.0014***	-0.0014***	0.0019***	0.0026***	0.0006	0.0001
	[-4.07]	[-5.08]	[3.38]	[6.29]	[0.49]	[0.06]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	No	Yes	No	Yes	No	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	2274	2274	2274	2274	2274	2274
adj. R-squared	0.1514	0.6242	0.1404	0.6662	0.0652	0.7182

The effect of demand on bond yields

Figure 2 displays the 30-20 government bond spread. The spread increased significantly after the announcement of the UFR and remained at a higher level thereafter. In this section I show that the increase in the 30-20 year bond spread is the result of both an upward pressure on the 30-year yield as well as downward pressure on the 20-year yield. In order to reach this goal, I estimate the demand curves of the other investors that hold Dutch debt and thus have to absorb the demand shock that is caused by the Dutch P&I sector. Using the demand curves, I can measure their price elasticities of demand which, in turn, allow me to study price effects.

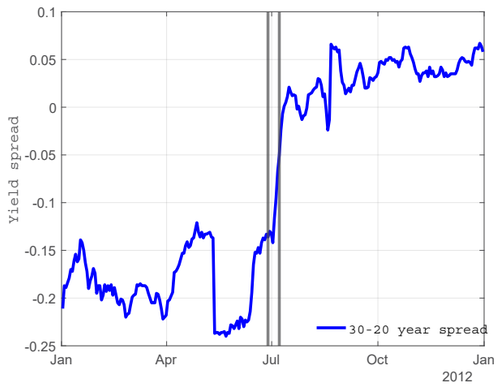
To estimate demand curves, I apply the asset demand system developed by Koijen and Yogo (2019). Formally, investor i's investment in Dutch government bonds within maturity bucket h is denoted by $B_{it}(h)$, and the investment in the outside asset is denoted by O_{it}. The portfolio weight in the framework of Koijen and Yogo (2019) is then defined as:

$$w_{it}(h) = \frac{B_{it}(h)}{O_{it} + \sum_{h=1}^{H=7} B_{it}(h)} = \frac{\delta_{it}(h)}{1 + \sum_{h=1}^{H=7} \delta_{it}(h)}, \tag{2}$$

where $\delta_{it}(h) = w_{it}(h) w_{it}^{-1}(0) = B_{it}(h) O_{it}^{-1}$ and $w_{it}(0) = 1 - \sum_{h=1}^{H=7} w_{it}(h)$ equals the fraction invested in the outside

Figure 2: **Dutch government bond yield spreads: UFR**

This graph shows the 30-20-year Dutch government bond yield spreads around the introduction of the UFR. The vertical lines are three days before and after the announcement (and implementation) of the UFR on July 2, 2012. Yield spreads are in percentage points.



asset. The demand of investor i for government bonds with maturity h is a function of bond yields and characteristics (Koijen et al., 2020):

$$\begin{aligned} \ln B_{it}(h) &= \ln \delta_{it}(h) + \ln O_{it} \\ &= \hat{\alpha}_i + \beta_{0i} y_t(h) + \beta_{1i}' x_t(h) \\ &\quad + \hat{\beta}_{2i} y_t^{DE} + \beta_{3i} \ln(B_{2009q1,i}(h)) + \epsilon_{it}(h), \end{aligned} \tag{3}$$

in which $\hat{\alpha}_i = \alpha_i + \ln O_i$, $\hat{\beta}_{2i} = \beta_{2i} + \psi_i$, $y_t(h)$ is the average yield for maturity bucket h, $x_t(h)$ represents bond characteristics, and y_t^{DE} is the 10-year German yield and captures alternative investment opportunities outside of the Netherlands.[1] Moreover, the inclusion of the initial holdings, $\ln(B_{2009q1,i}(h))$, captures time-invariant omitted characteristics. Moving to the bond characteristics, I assume that yields are primarily driven by duration and convexity that is measured as the duration squared. I also add the average coupons and the total amount outstanding (TAO) as characteristics that drive demand for bonds.

In order to obtain consistent estimates of the parameters in (3) using OLS, one has to assume that characteristics are exogenous to latent demand. However, a positive latent demand for Dutch government bonds of a particular maturity may result in lower yields. The demand curves are therefore estimated using an instrumental variable approach. I use the weights assigned to the UFR as an instrument for changes in demand. Even though investors may have anticipated the UFR, they did not know the determinants of the shape of the UFR such as its level and the slope.[2] As a result, the demand shift by the P&I sector is exogenous and can be used to estimate the demand curves of the other investors, because the demand shift only affects holdings of other investor types through its effect on prices. In turn, I can estimate price elasticities of demand by taking the derivative of quantities with respect to prices (Koijen and Yogo, 2019; Koijen et al., 2020):

$$\frac{\partial q_{it}(h)}{\partial p_{it}(h)} = 1 + 100 \frac{\beta_{0i}}{T_t(h)} (1 - w_{it}(h)), \tag{4}$$

where lowercases are the logs of variables, and $T_t(h)$ is the average maturity for maturity bucket h. To compute $w_{it}(h)$, I use the investments in all bonds.

The demand elasticities for each investor type are summarized in Table 2. Banks have the highest demand elasticity, followed by foreign investors. The market clearing condition means that the weighted average elasticity matters for deriving yield effects and equals 4.11. In order to derive asset pricing effects from the demand system, I can perform a simple back-of-the-envelope calculation. Pension funds and insurers sold 21% of the amount outstanding of 30-year Dutch government bonds. This percentage means a price effect equal to $21\%/4.11 = 5.11\%$. For a bond with a maturity of 30-years, this percentage means an increase in long-term yields of 17 basis points.

Table 2: **Price elasticity of demand**: This table shows the price elasticity of demand, computed as in Equation (4) for each investor type, maturity bucket h, and quarter t. The total elasticity is the weighted median elasticity, using the weights of each sector defined in the last column.

	obs	median	std.dev.	min	max	weights
Banks euro	245	10.70	15.24	5.66	57.55	16
Foreign investors	245	3.56	2.04	1.79	9.80	55
Mutual funds euro	245	1.65	1.02	1.31	4.79	11
P&I euro (except NL)	245	0.84	0.25	0.08	0.92	7
Other euro	245	1.99	1.56	1.48	6.80	10
Total		**4.11**				100

Conclusion

My results show that regulation plays a nontrivial role in the demand for long-term bonds which in turn, affects the yields of these bonds. This finding has direct implications for the role of regulation in the government's cost of borrowing. Moreover, this finding shows the relevance of incorporating the regulatory framework of investors to analyze the effects of conventional and unconventional monetary policies on yields. ●

[1] The assumption that holdings of the outside asset only move due to changes in the German yield result in $O_{it} = O_i \exp(\psi_i y_t^{DE})$ and hence the logarithm results in the terms $\ln O_i$ and $\psi_i y_t^{DE}$.

[2] In fact, in discussions between the regulator and the P&I sector about the UFR before its implementation, the regulator prohibited P&Is to trade on this information. One specific insurer, Delta Llyod, did not comply and as a result, received a €22.7 million fine: https://www.rechtspraak.nl/Organisatie-en-contact/Organisatie/Rechtbanken/Rechtbank-Rotterdam/Nieuws/Paginas/Publicatie-uitspraken-over-boete-en-heenzending-bestuurder-Delta-Lloyd.aspx.

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Kristy Jansen

Kristy Jansen is a research associate at Tilburg University and affiliated with the Dutch Central Bank. Her primary research interest is the impact of regulation and institutional investors on asset prices. Kristy earned a Bachelor's degree in Econometrics, a Master's degree in Quantitative Finance and Actuarial Science, a Research Master's degree in Finance, and a PhD in Finance from Tilburg University. Kristy will join USC Marshall as an Assistant Professor in Finance in July 2022.

Interrail through Europe!

This year we have the honor to organize the very first rail trip of Asset | Econometrics. Although we have not yet been on the trip, we are already looking forward to it! Of course, there are a lot of complications while organizing already, but hopefully it will all be worth it in October 2022!

The rail trip committee will, as the name may already suggest, plan a trip by train. In the beginning we all pitched our ideal trip. Immediately there were many different ideas. For example, we could go north to make a trip through Norway and Sweden or we could choose for a completely different kind of journey by going east. We also paid attention to the price difference. It will probably not surprise you that Norway is way more expensive than the Czech Republic. In the end we were able to make a nice selection of possible destinations, but we will keep that a surprise for now! Partly also because this choice still depends on our budget and opportunities that may arise in the coming weeks.

The brainstorming about the destination was difficult because there were many factors we had to keep in mind. Before we could get concrete, we had to assign roles within the committee. We were with five people and there were three roles that had to be assigned. Selina and I were both enthusiastic to become treasurer. We fought it out with a game of rock-paper-scissors, as you do. She won, unfortunately for me. Because we now had two committee members without title, we also introduced a vice-chairman and a vice-treasurer. Now we all feel like worthy members of the committee!

After brainstorming, we looked closer at the options we had. We came up with the idea that a night train would be preferable as it would save the costs of an overnight stay in a hotel or hostel. A win-win situation you would think. However, we also realized that a ten-hour train journey would be far too long and that many of us would not be happy. As a result of this realization, many cities were no longer an option.

That is when we started considering a one-way journey by train and returning by plane. However, this would deviate too much from the vision of the rail trip and so we threw this option overboard again. Another thing we ran into is the price of the train tickets. Traveling by train is way more expensive than by plane. Because we did not want this trip to be too expensive, we tried to get a subsidy. After all, we are planning a climate neutral trip. We have sent a letter to various organizations. Hopefully it will help! To limit costs, we also try to choose the cheapest possible route, but finding this out takes a lot of effort. The train system within Europe is not what we hoped for, due to the absence of an overarching organization. Each website contains different information about the departure times, prices and even about the trains that travel there. In addition, train tickets cannot be bought far in advance and the departure and arrival times can still change until the moment of departure. That makes the journey by train a lot more uncertain than a journey by plane. Next to these complications, there are also positive notes. Nothing is more fun than planning a vacation and finding out what activities there are to do in the city or surrounding area.

For me personally, this is my first committee within Asset | Econometrics. I have met a lot of new people during the activities that I have been to. The reason I chose for the Railtrip committee is that I like to plan vacations or activities. Therefore, I was also interested in the Freshman Night committee, but I had to choose one of them and I am happy with my decision. For me, the committee does not take too much of my time, so it is no problem to combine it with studying. And most things that we do are luckily a lot of fun!

Cas Eegerdingk

Bachelor EOR

Age: 22

Footprintless Flying

written by **Flora Poon** and **Tamara Dert**

You are almost there! A well-deserved summer vacation after a busy semester of lectures, tutorials, and assignments, topped off with exams. Do you already have a destination in mind? Maybe an adventurous safari in Africa? Or do you prefer a more relaxed vacation on the tropical beaches of Bali?

Since gas prices are sky high, you might consider a trip by plane (at least if you are not scared of flying). It makes it even better if you could score a last minute plane ticket for an attractive price. However, when you are about to pay for your ticket, you are reminded of your carbon footprint as a result of your trip. Luckily, the flight company gives you the option to get rid of your guilt and compensate your emissions by paying an extra amount for financing eco-friendly projects. It sounds like a perfect match, being able to visit breathtaking destinations without worrying about pollution. However, does this amount really compensate for your full trip? Is this the solution for the climate problems?

How it (should) work

The idea behind CO2-compensation or climate-compensations is rather simple. You make sure that the extra CO2-emission you cause is compensated somewhere else on the planet. This can be done by planting extra vegetation to absorb the added CO2 or by investing in climate projects aiming to lessen CO2-emission in low income countries [8]. The concept is beautiful as it clears money invested in protection for rainforest or giving a poor family a more efficient wood-oven whilst you can enjoy your holiday. Sadly there are a few snags.

The first issue is timing. When flying, you instantly add CO2 to the air. Whilst if you plant a young tree at the same time it will take ages before it can absorb the same amount of CO2 [9]. The difference in time would not be a problem if it was a single case, but the pressure already built in combination with the fact that there are millions of people travelling by airplane makes that we simply do not have this time to wait. With this in mind it is logical to focus our efforts on immediately lessening CO2 emission in countries where investments are the most efficient.

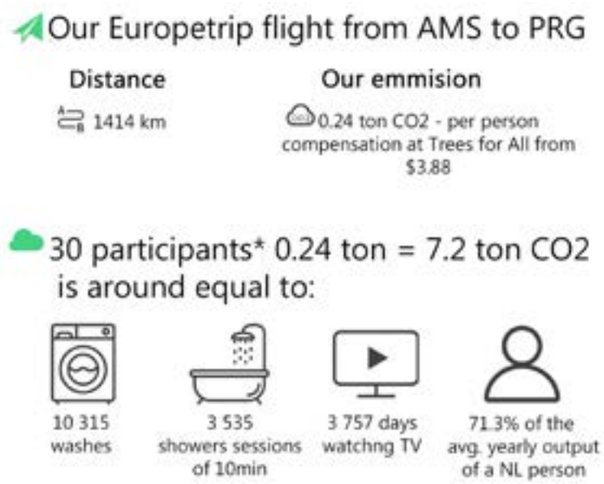
This brings us to the second big issue, namely finding out how efficient a measure actually is [9]. Giving out better equipment is useful. However, when you are going to estimate how much CO2-emission would be compensated with this, a lot of unknowns would come up. Moreover, it has to be proven that if you would not have intervened, the effort would not have been made. It should only count if you surpass the initial reduction objectives from for instance the Paris agreement.

The third thing that should actually be your first thought is determining how much CO2 should be compensated. This is not necessarily an issue as this can be estimated quite precisely. Nonetheless, this often goes wrong because not everything is taken into account. Transavia, for instance, offers for €1,85 compensation for a return flight to Barcelona whilst Trees for All asks roughly €6,- for the same flight [10]. Transavia here does not take into account that when a plane flies higher it emits more CO2.

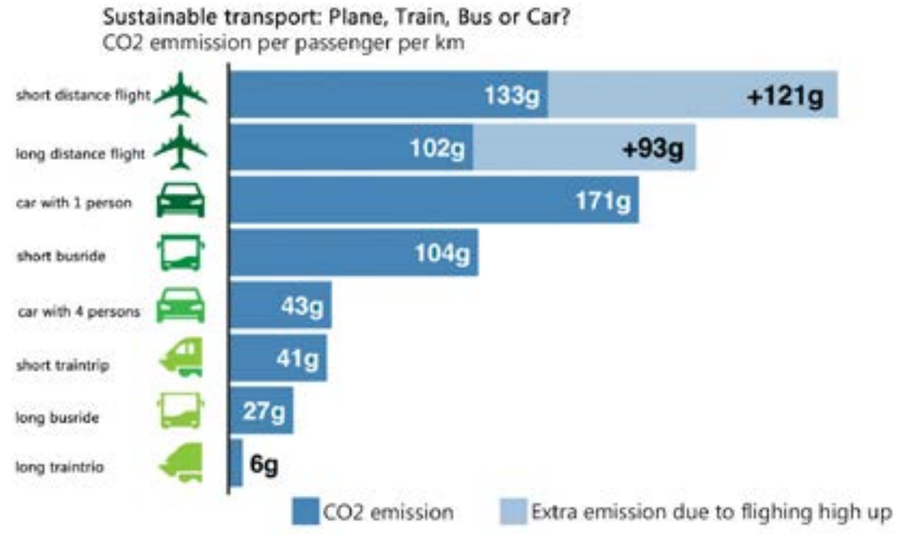
The Politics

Currently, there is no tax on kerosine or CO2-emissions in the aviation industry [1]. The reason for this is that European airlines are engaged in extensive lobbying to challenge EU policies. In addition, it is difficult to set rules for a company which operates in multiple countries. As a result, the aviation sector is not included in the climate agreement of Paris from 2015 [2].

Nevertheless, the first steps to reducing gas pollution have already been taken in Montreal 2016 [3]. The so-called Carbon Offset and Reduction Scheme for International Aviation (CORSIA) is a volunteer project in which participants will compensate for the increase of CO2-emissions. If the benchmark of emissions in 2020 is exceeded, airlines have to fund carbon-reducing and eco-friendly projects to offset the surplus.



Source: [11] and [12]



Source: [13]

Recently the Dutch government set an air passenger tax €7,85 per person per flight [4]. This does not hold for transfer flights or passengers under the age of two. By imposing this policy, they hope to lower the price differences between flight tickets and alternative travel options such as buses or trains. As a consequence, flights become less favourable among the travellers. Some news sites speculate about a potential increase of this tax to €24,- in 2023 [5]. Yet, this amount is nothing compared to the passenger taxes in other European countries [6].

Additionally, the European Commission is considering levying tax on kerosene from 2023 [7]. Currently, fuel used in the aviation and shipping industry is free of tax, which is defined in the international aviation agreement of 1944. The vice-president, who is in charge of the Green Pact for Europe, has confirmed a proposal to introduce new tax policies. Their decisions will be published 14 July.

In conclusion, the fight against CO2-emission in the aviation industry is a battle on two fronts. Firstly, politicians are making small steps forward in driving up the prices to encourage travellers to switch to less harmful transport alternatives and they will reinvest this tax money in certified climate projects. Secondly, consumers are having the opportunity to compensate for their own travels. Both fronts are not as well optimised as us, critical econometricians, like to see it, but progress is being made. Well informed consumers (like you now) can critically look at compensating projects to predict their efficiency and with an upcoming Europe wide new tax policy we can defeat the world wide environmental pollution problems.

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EuBT Day-to-Day Report

written by **Juliëtte Tillie** and **Patrick Floor**

Disclaimer: this is the EuBT in the view of Patrick and Juliëtte. Others might have other experiences.

Day 1 – Monday 2 May

The adventure began during the night of Sunday to Monday, the night of Mylène's birthday. At around 03.00 hours we gathered to drive to Schiphol by coach. There had been many problems there due to strikes during the weekend, causing long waiting times, but this luckily did not affect us. Our chairman Wout had injured his ankle on Sunday, which was very inconvenient. Nonetheless, we soon set foot on English grounds. On the train ride to London, Nynke fell and dropped her suitcase on the rails. This caused a lot of commotion, but luckily the suitcase was saved before being ripped open entirely. We dropped our stuff at the too-hot room of the Hostel (it was definitely not anyone's favorite place to stay, but we made it work). To let everything run smoothly, Patrick took on the role of Piccolo. After his work had finished, we started the city tour, with as tour guide Jarno! We walked past red phone booths, through the with-squirrels-filled Kensington Gardens, under the Wellington Arch, past Buckingham palace, over Westminster Abbey, and visited the Tower Bridge. That evening we had dinner together with the whole group in the Mayflower Pub, where Patrick and Juliëtte had the most amazing fish and chips.

Day 2 – Tuesday 3 May

We started this day with a visit to the office of Dassault systèmes (3DS) where we learned a lot about their company and we all got familiar with the term 'digital twin'. They had a beautiful, modern office in a skyscraper, and hosted several guest talks by employees of different departments. In the afternoon, we went to Bearing Point, a global business consulting firm where we again got presentations from the employees about their work and company. The presentation ended with an interesting case study about the Titanic. During this, we could already hear the champagne pop in the hallway inviting us to an informal drink to end the day! Here we had the opportunity to speak with the employees of Bearing Point and ask our questions.After the company visits, we all went our own ways to eat something in the city and gather at the hostel for the evening programme, which was a pub crawl! We visited four different pubs and had an amazing time!

Day 3 – Wednesday 4 May

This morning we all gathered to walk to the Imperial College London, or ICL. We were greeted by some students and taken upstairs to a big room to get a formal introduction. Chloe Mcclean told us all about studying at ICL and applications. Two student informers then answered all our questions about the London student life. Afterwards, we got a campus tour. By coincidence it was graduation day, and the school was filled with families and nicely dressed graduates.
After the visit to ICL, we were free for the rest of the day. Some groups decided to go shopping, or looked for a place to High Tea. However, Patrick and Juliëtte took a different route and visited the Natural History Museum of London (which was only minutes away from ICL). Here they learned all about volcanoes, which would come in handy during their visit to Iceland. In the evening, however, they both went their own ways. After eating at a cute Italian restaurant, Juliëtte, together with Nienke, Ikie, Selina, Mylène, Floris and Eva. visited the musical 'Phantom of the Opera', which was amazing (as expected)! Patrick, on the other hand, went on a citytrip exploring the yet unexplored parts of London together with Ferdy and Monique. And ended off the day at the pub to watch the nervewrecking match between Real Madrid vs Manchester City, which eventually resulted in a win for Real Madrid in the extra time.

Day 4 - Thursday 5 May

The day started early, with our alarms set to 4.30 am. We had to walk to the nearest train station where all trains to the airport apparently were canceled. But next to some stress and grumpiness, we made it to the plane quite easily. At 07.45 hours we took off, bound for Iceland! After landing, we made our way to the hostel in Reykjavik. After our experiences in the previous hostel, Kex hostel in Reykjavik was a ten out of ten. It was clean, pretty and comfortable. For example, there were small bathrooms, where you could take a shower, go to the toilet and use the sink all on your own. When you are constantly traveling by group, it might be nice to take such a moment for yourself. After a quick stop at the hostel, we started the city tour, hosted by Jules! We walked past some of the most important tourist attractions Reykjavik had to offer. It was cool to see the city, however, it was cold. During the trip nobody was allowed to say this out loud, or points would be extracted from your buddy group… We could not let that happen! Even when wet snow began falling down on us, we kept it to ourselves. That night we had a pubquiz hosted by the committee. Besides some inconvenience, like Joris who tripped over the cables of Pierre's laptop, we had a good time!

Day 5 – Friday 6 May

In the morning we visited the Dutch consulate in Reykjavik. Here Ásthildur Sölvadóttir gave us a warm welcome to Iceland. It was cool that she spoke Dutch, since she is Icelandic. She took us with her to the city hall, where her colleague took over. She gave us a (super funny) tour and explained everything about living in Iceland, answering all our questions. We all enjoyed it a lot. After that we had free time for the rest of the day again. We found out that there was a thermal footbath just one hour walking from the city centre. With Wout in the wheelchair we started our journey to the very end of the peninsula on which Reykjavik is situated. We tried to spot whales (without success), saw the cutest dog and almost lost Patrick's powerbank between big rocks. Eventually we made it to the footbath (which was deeper than expected, ask Ikie) and we all enjoyed a well-deserved break with a view. That evening we gathered to have dinner together, which was super tasty. Iceland is really expensive. Wine in a restaurant is easily €13! During dinner we could all order one drink for free, so you can imagine how happy we were. After the dinner, we explored the Icelandic nightlife.

Day 6 – Saturday 7 May

This was the first day of the two-day road trip. The committee had rented five cars to drive around the island. Divided in our buddy groups, we got in the (self-driving!) cars and drove past some of the highlights of the Golden Circle. What a day! We started the day at the Brúin milli heimsálfa bridge, where you can literally cross from the Eurasian to the North-American tectonic plate. We then drove to the Kerid crater, which was an impressive and colorful old volcano. The third stop was the ancient city Skáholt, where we discovered a semi-hidden pathway to a small museum. The fourth stop may have been everyone's favorite: the impressive Gullfoss waterfall. See our pictures for the amazing views! After that we visited Strokkur, a very active geyser that blows a whopping 25 to 30 meters high. Last but not least, we went to Thingvellir National Park to get some pretty views to end the day tour. The evening was spent in the hostel, playing games and having fun together with the group. It was an amazing day with beautiful memories and a lot of fun.

Day 7 – Sunday 8 May

We woke up excited to start our second road trip day! This time we visited the South Coast, starting with the impressive waterfall called Seljalandsfoss. Here you can walk around the whole waterfall, as shown in the pictures. That made it a unique waterfall. The second stop was another waterfall, called Skógafoss, being the third waterfall of the trip. However, it was yet another unique experience, as you could walk up to the very top of the waterfall and look down on it. While driving to the third stop, the weather suddenly got really bad. This made the experience on the viewing point Dyrhólaey eerie. The wind blew so strongly that we

felt like we would blow right off the cliff. We quickly moved on to Reynisfjara Beach and took a dry moment to take some cool pictures. Except for Patrick and his buddy group, they decided to run to the beach trying to get the first glance with success. The beaches on Iceland are black, and this particular beach featured large basalt columns, known as reynisdrangar sea stacks. Pierre told us all about the ancient folklore that goes with this phenomenon. We ended the road trip with the canyon Fjaðrárgljúfur, which could easily be an inspiration for fairy tales. Satisfied, we returned to the small town Vík to have dinner with the whole group. It was a cozy place with very good soup!

Day 8 – Monday 9 May

The last full day in Reykjavik… it still hurts to write this. But it was certainly not the least. This day was filled with a guided bus tour, starting out at the boiling mud in Seltun. This place, though it smelled strongly of rotten eggs due to hydrogen sulfide, made for absolutely beautiful pictures. You could also walk up a steep hill to get a better view, however, clay stuck very easily on the sole of your shoe which eventually felt like walking on high heels. After that we hiked up a mountain a bit to view the crater of Fagradalsfjall. This is a volcano that erupted last year, in 2021, releasing enormous amounts of lava in the area. The top layers had already dried, allowing us to walk over it. However, below us the lava was still hot and cooling down, which we could literally see by the steam that came through cracks in the basalt. What an amazing experience! The bus then drove to a small fisherman's village to have lunch in a local restaurant. After that, we visited a colorful geothermal field of various mud pools and fumaroles called Gunnuhver, which again smelled a lot but still was impressive. Lastly, we went to Brimketill, a viewing point where we could see the waves from the ocean hit the rocks. Our tour guide warned us that there was a possibility of getting wet, and he did not lie. At first the waves just left some of us with drops on our jackets, but suddenly a big wave hit. Almost everyone was covered in sea water and dripping wet. Everyone started running back to the shore but the sea could not let that happen easily, and sent one last wave to hit a few of the already-wet runners, Patrick was one of them. What a day! (For funny videos of this whole phenomenon, ask any of the travelers!)

Day 9 – Tuesday 10 May

Early in the morning we had to pack our bags and start our journey back to our home country… We had a long day of traveling ahead, with a six hour stop at London Heathrow. Tired, satisfied, and filled with amazing new memories, we could finally get into the airplane. The rest of the trip ran smoothly and just after midnight, the group arrived back in the most beautiful city of them all: Tilburg!

Patrick and Juliëtte loved every second of the European Business Tour. We are sad that it is over and will cherish our memories forever. We both have a basalt rock from Fagradalsfjall in our rooms to remind us of the good times. Thanks to the committee for making it all happen!

EuBT 2022

ASSET Econometrics

Meet Alexandros Theloudis, the New Assistant Professor Who Teaches Econometrics and Spots Airplanes

written by **Tijn Scholten** and **Stijn Craenen**

He just started working at the Econometrics and Operations Research department of Tilburg University in September 2021. This made it interesting to get to know dr. Alexandros Theloudis better, whom we are interviewing this time in 'The Teacher'. The new Greek assistant professor could be recognised from the subjects he teaches, which are Microeconomics for the Master's 'Econometrics and Mathematical Economics' and the newest course in the Bachelor's programme: Econometrics for Policy Analysis. We were wondering why he chose to continue his career in Tilburg after some adventures abroad and what he thinks about the Dutch teaching system.

Greek roots

We asked Theloudis where his roots can be found. As his name may already suggest, he is originally from Greece. To be precise, he was born in the capital city, Athens. However, his family's roots are from all over Greece. A part of his family is living in the Northern part of Greece, some can be found in Istanbul, and others come from the Greek island Chios. This is an island at the Eastern side of the Aegean Sea, which is closer to Turkey than mainland Greece. This island is well known for accepting many refugees from Turkey.

Road to Tilburg

Theloudis started his studies at the Athens University of Economics and Business, where he studied International & European Economic Studies. During his Bachelor's, he found this education to be quite poor: the people are extremely smart, but the incentives by the faculty and institutions are not there. Students that can motivate themselves enough will eventually move abroad while others only get a very shallow education that does not really build intuition or reflect the skills and responsibilities needed. This was one of the reasons why Alex (Theloudis goes by the short version of his first name) decided to go abroad.

He graduated with a Master's in Economics from the University of Essex, while he did his PhD at University College London. However, Alex ended up in the Econometrics department in Tilburg just last September, after getting some work experience in Luxembourg. He wanted an academic job, for which the applications work totally different from the regular job market. The academic market is highly regulated, especially during the time Alex was trying to get a job, due to the COVID restrictions. He sent his CV, his research history and his teacher's assessments to specific universities in the United States and Europe. After doing an interview in Tilburg, he was ready to start working here. The department of Econometrics & Operations Research of Tilburg University appealed to him the most as he felt like the environment in the university gives him an opportunity to keep his thoughts moving. Next to that, the department is quite strong in structural econometrics, which Alex is doing his research on.

Living situation

Alex does not live in Tilburg but he lives in Amsterdam. This is quite unusual but Alex has a very clear explanation for this. When he moved to the Netherlands, we were in the middle of the COVID-19 crisis. Everything was online, so he did not have the chance to meet his colleagues or visit the campus. He was thinking about where to live specifically if we went into lockdown again and he chose Amsterdam, at least for his first year. Today he has grown to love Amsterdam and he does not see himself moving to Tilburg. Amsterdam is a city that suits his mentality, and he loves the fact that people in Amsterdam are on the frontier of what they do, no matter what that is. According to Alex, Tilburg also has a hint of that but for him, bigger cities are preferable.

Teaching

We also asked him what his first impression of EOR-students is. Luckily for us, he was positively impressed! He is now teaching Econometrics for Policy Analysis for Bachelor's students and in the past semester he taught Microeconometrics, which is a course in the Master's 'Econometrics and Mathematical Economics'. This means that Alex has a broad picture of us. He finds the students in the EOR department quite intelligent; of course, there is a selection effect going on as people who choose to study econometrics are usually good at mathematics and statistics. Next to that Alex likes the fact that the main language on the campus is English. He says that this is extremely important for the students. However, as everyone speaks English quite well, he was quite surprised by the fact that students write quite poorly in English here, especially the Dutch. This is something that, according to him, the university should look into as it is important to communicate your ideas correctly to others. He thinks that there should be more courses designed to tackle this problem, but first the problem should be measured and acknowledged.

Alex already told us something about what he likes about Tilburg University but we also wanted to know what he likes most about it, if he had to choose one thing. His answer was that Tilburg University is a well-run university. By this he means, when he looks at day-to-day workings, that the university allows people to do their job in the way that they perform best. This is because, according to him, there is an overall inclusive and free environment. However, Alex does note that a well-run university now says nothing about the university in the future if the right investments in people & institutions do not take place.

This is Alexander Theloudis in Iceland, at the Seljalandsfoss waterfall, which was also visited by some of our students. You can read about thieir experience in the EUBT report!

Lack of students

For his current course, Econometrics for Policy Analysis, there are not so many registrations. So we asked him how he wanted to change this. However, the lack of registrations does not surprise him due to the fact that it is a third year elective and a new course. The course is teaching the students not the regular econometrics to which the students are used to. It is trying to teach intuitive econometrics, so it is not about theorems and conditions, but about building intuition. During the course, you get to think about some policy questions. Another reason why the registration numbers are quite low is because many students did not really know about the course in advance. He is still working on improving and finishing the course, so he thinks next year it will be much improved. But still he does not think that the course is failing the current students.

Spare time

When we asked Alex what he likes to do in his spare time, he said he does three things in his life: he sleeps, he works, and he plays. There is not much interesting to say about sleeping and the topic of working we have now covered, so we were interested in 'playing'. What does he mean by this? He likes to work out, which is often in the form of running, but he also wants to go back to the gym again. His big goal is to run the London marathon one day. Furthermore, he likes plane watching. He even dares to call himself an aviation geek. When a plane flies over, he can say what type of plane it is. How cool is that!

Alexandros Theloudis

We can conclude that Alex Theloudis does not sit idle in his free time, he leads a busy and impressive life. We wish him a lot of luck in the future, and we hope his new course will become a success!

Bert & Ernie Questions

Cat or Dog?	*"Dog, I hate cats!"*
The Netherlands or Greece?	*"Really can not choose"*
Chalk or markers?	*"Markers every day of the year!"*
Kingsday or Sinterklaas?	*"Definitely Kingsday!"*
Gyros or Souvlaki?	*"Souvlaki"*

The Craziest 88

Hi, we are Stans and Britt, 18 years old Freshmen and we won the Freshmen Activity! We were asked to write this article for this amazing magazine and we immediately said yes, because who better than the winners.

The Freshmen Committee organized a Crazy 88, a game where you can get points for 88 crazy challenges, the day before Active Members Weekend (AMW). The planning was not great, because the first activity of AMW was also a Crazy 88, but it was a good practice. The theme of the Crazy 88 was countries. One day before the activity we were put in a group chat and heard which country we were (in our case Greece) and with whom we would play the game. In this chat some information was sent about the event to make sure we were totally prepared. You had the option to go to the venue together with the committee or to go by yourself. We met up at the bar 'Vrienden van Tilburg' (VVT) where we got the list of challenges after which we started right away.

We were impressed that they actually thought of 88 unique challenges. It was impossible to do them all in the time we got, but it was really fun to try. The challenges were divided by level of difficulty and for the more difficult ones you could get more points. There were also country specific challenges and there was a separate category for the more creative challenges with variable points. For some challenges you had to buy something, but we could declare this, so that was not a problem.

After analyzing the list we quickly went to the supermarket to buy some things, so we could get started on the challenges. In the supermarket we won a game of rock-paper-scissors from a random bystander and we did a beautiful forward roll. We bought one single grape. Our next move was to go to the house of one of our teammates to do some challenges there. On our way we found a stand with albums and we recreated one. For us the easiest challenge was to walk around with two different shoes because one of our teammates always does that. We had a little snack when we arrived at the house. Someone had a can of soup, someone else ate a banana with peel and a third ate a whole lemon. After this great snack we needed some exercise so we did pushups and pullups. We recreated a great scene from the Titanic and performed a magic trick. It was quite chilly so we put on 20 layers of clothing. Then it was time to move on to the next house where we could solve a Rubik's cube. On our way we yelled to a bystander "Happy Birthday" and we climbed a tree. At the next house everyone helped with the cube while someone was blowing up a balloon until it exploded. When we finally finished the Rubik's cube it was time to go back to VVT. But we did not really get far because we got taped to a lamppost. When we got released we went to the supermarket one more time to do a country specific challenge, we ate greek yogurt. We made a little compilation of some of the challenges with the song "Hard Times" playing in the background.

Britt van Daatselaar & Stans Sonderkamp

Bachelor EOR

Age: 18

When we finally arrived at VVT, there was a delicious barbecue waiting for us. We got to socialize with the rest of the Freshmen and talked about our day. After we had some food and drinks we went inside where the winners were announced. We had some doubts because other groups also did a lot of crazy things, like getting married, but eventually we still won. We won a coupon to get pizza which we really liked.

We would like to thank the Freshmen Committee for this great day and we hope they enjoyed the pictures and videos as much as we enjoyed the challenges.●

Inequalities

As for most of us I got my first math classes at secondary school, at the age of 12. There are a few lectures I can still remember. First of all, the one where we proved Pythagoras Theorem. I really liked the proof. It was fascinating to see that a simple argument proves that two expressions always have to be equal. Later I got confused, disappointed and sad when it turned out that we were also going to pay attention to inequalities. Why should you do that? Almost all pairs of expressions are unequal. For me only equality was something special. It turned out that inequalities was a misleading term. It was not about 5.4≠6, π≠3.14 or 1≠0 (not to be confused with 1=0!!!) but about bounds.

For me inequalities like Cauchy-Schwarz are okay, but I have problems with inequalities that are abused to restrict your freedom. As a child you grow up with all kinds of bounds. Roughly there are upper bounds for everything you like (candy, watching television, sleeping in the morning) and lower bounds for everything you do not like (eating sprouts, doing homework, sleeping in the evening). I have never liked bounds. For me bounds suck and freedom rules.

When I left home to study in Eindhoven the number of constraints dramatically decreased. I liked all the freedom I got although this did not lead to a serious change in my behavior. We did not have a BSA back then. I think we only had to finish the first year within two years, but I do not consider these as serious constraints. I am a simple man. For me a baker is someone who bakes bread, a fireman is someone who extinguishes fires and a student is someone who studies. You could argue that being a student is also a way of life, but so is being a farmer. Yet if you do not run a farm, you are not a farmer.

No matter what I will write down further on, I want to state here that my marriage was the best decision in my life although it led to new constraints. I realize that I only have a limited view on how good or bad it is in general. I am still in my first marriage so from a statistical point of view I only have a poor approximation of the average situation and no idea about the standard deviation. What happened to me was that Rian decided to do the shopping and as a consequence put me on some sort of diet. I did not get more than five chocolate bars, four and a half liters of cola, two liters of ice cream and three kilos of grapes… per week!!! Of course there were more constraints like these but you only feel and remember the ones that were binding.

Also our fiercest marriage quarrels are about bounds. The expiration date of food to be precise. The situation once escalated when I found out that Rian had thrown away a carton full of yogurt that was ten days overdue. In my opinion the yogurt was still suitable for consumption and in order to prove this I ate the complete content of the carton at once. Instead of being convinced or impressed, Rian just called me stupid. The dispense of food is a never ending struggle in our marriage. Also during the writing of this column we had a new chapter in this conflict when Rian disposed of some Kinder chocolate. This time I lost.

So, what have we learned? Lesson 1: If you are a student you are probably in a local minimum of inequalities that you have to satisfy, so be happy and enjoy. Lesson 2: Be hesitant with imposing constraints. Either they hurt, or they are superfluous.●

René Peeters

is dairy farmer and part time assistant professor in mathematics and operations research. He is specialized in disrete mathematics, in particular in algebraic graph theory and combinatorial optimization.

Distribution-Free Statistics

Whether one is comparing means with a t-test, estimating regression coefficients or conducting some other statistical method, the corresponding results will, most likely, be subject to some distributional assumptions. These assumptions can rarely be verified in practice, leaving one exposed to adverse effects of misspecification. In this practical report I will describe the notion of distribution-free statistics and how they can escape the curse of potential misspecification.

Introduction

In the 'practical report' column, you usually read about some practical application that is thoroughly analysed with a bunch of good old-fashioned mathematics. In many cases, it is a summary of the thesis of some happy new Master's graduate. It is arguably the most essential econometrics column in the Nekst and a personal favorite. However, as it is the fourth and final Nekst of this academic year, I intend to shake things up quite a bit. In this quarter's practical report I will raise a more theoretical, perhaps even philosophical, issue that one encounters when conducting statistical analyses. We will be shifting gears quite a bit and I sincerely hope that you hang on, for along the way we will pick up valuable insights that will serve you in all future statistical endeavours. Oke hold on to your hats, here we go!

Parametric, nonparametric and distribution-free statistics

Irrespective of the particular situation, the essence of statistics as a field of research demands there to be some data that is generated according to some data generating process (DGP), $P \in \mathcal{P}$. Where $\mathcal{P}$ is some class of DGPs. Parametric statistics refers to statistical methods where the data is assumed to be generated by a DGP that belongs to some class $\mathcal{P}$ that is describable with a finite number of parameters. When the data is assumed to be generated according to a DGP that belongs to a class that cannot be described with only a finite number of parameters, then the corresponding statistical methods are referred to as nonparametric. An example of a class that cannot be described by a finite number of parameters is $\mathcal{P}_c = \{P : ||\mu||_2 < c\}$, with $c > 0$, that is, all distributions such that the euclidean norm of the expectation is smaller than some constant c. The separation of the space of DGPs into parametric and nonparametric is collectively exhaustive, however there exists a nonparametric class that deserves special attention and that is the class of all DGPs. Each restriction placed on $\mathcal{P}$ can be seen as an assumption on the way the data is generated, since a restriction rules out a set of possibilities. The class of all DGPs is free from any distributional assumptions and the corresponding statistical methods will therefore be referred to as distribution-free statistics. Although, they are not emphasized, and probably not even labelled as distribution-free, there is a good chance that you already encountered a distribution-free statistical method during your studies, like the one-sample sign test or the Mann-Whitney U test [1].

'You know what they say about assuming'

In theoretical statistics one aims to construct statistical methods and, under some assumptions, show that these methods exhibit some desirable properties. Focusing specifically on the distributional assumptions, from this viewpoint, it does not really matter whether the resulting method will be categorized one way or the other. Sure, in general, stronger assumptions correspond to stronger results. It is important to emphasize that the results depend on the validity of the considered assumptions. This is no issue for theorists, but a big issue for practitioners. Since, in practice you can rarely be sure that your assumptions are correct, hence the word assumption.

To mitigate the risk of making a false distributional assumption, one can conduct goodness-of-fit tests to verify that the obtained data sample corresponds to the proposed class of DGPs. This approach knows some disadvantages. Although, goodness-of-fit tests come in a wide variety, it might still be the case that for your particular problem/method, no goodness-of-fit test is available. A more serious shortcoming of goodness-of-fit tests is that they lack power in more than just a few dimensions [4]. This is problematic because the amounts and dimensionality of data out in the wild, has only increased.

Lacking a good alternative, here I would like to make a case in favour of distribution-free statistical methods. These methods are underrepresented in the theory. Which is probably due to the difficulty of obtaining them, which is arguably greater than for their distribution dependent (parametric and nonparametric) counterparts. Moreover, even if some distribution-free method is found, the corresponding results will naturally be less powerful than distribution dependent methods.

The remainder of this article will focus on a particular distribution-free result that I studied extensively during the writing of my Master thesis. I hope that this example clarifies the distinction between distribution-free and distribution dependent methods and that it shows that distribution-free methods are not only reserved for relatively simple problems, like testing a sample median, but that they can also be found for complex and interesting problems.

The classification problem

The example considered here is known as the binary classification problem. This problem considers a pair of random variables (X, Y), i.i.d. distributed according to some distribution P. Here $X \in \mathbb{R}^d$, d finite, is called a feature vector and $Y \in \{0, 1\}$ is known as the class label. The objective is to find a mapping $f : \mathbb{R}^d \to \{0, 1\}$ that best predicts, for each feature vector, the corresponding class label. Such a mapping will be referred to as a classifier. The classifier that has the smallest provability of error, i.e.

$$R(f) = P\{f(X) \neq Y\}, \tag{1}$$

will be considered best. The distribution P is considered to be unknown. The only available information regarding the structure of the distribution is given by a finite sample of feature/label pairs, $(X_1, Y_1), \dots, (X_n, Y_n)$.

Let $\eta(x) = P\{Y = 1 | X = x\}$ denote the conditional probability of class label '1', given realized feature vector x and let $\mathcal{F}_0$ denote the class of all possible classifiers.

Definition 1. *The Bayes classifier is given by,*

$$f^\star(x) = \begin{cases} 1 \text{ if } \eta(x) \geq 1/2, \\ 0 \text{ otherwise.} \end{cases} \tag{2}$$

Theorem 1. *The Bayes classifier is the optimal classifier, i.e. for all $f \in \mathcal{F}_0$, $R(f) \geq R(f^\star)$.*

The probability of error of the Bayes classifier, $R(f^\star)$, is called the Bayes error. Note that the Bayes classifier is infeasible, since it depends on the unknown distribution P. This implies that one cannot hope to achieve the minimal probability of error with a finite sample. The next best thing would be a classifier f_n such that $R(f_n) \to R(f^\star)$ as $n \to \infty$. Classifiers with this property are called consistent. Here, the subscript n simply emphasises that the considered classifier is constructed on the basis of a sample of size n.

There exist a class of classifiers $\mathcal{F}^{stone} \subset \mathcal{F}_0$ which can be shown to be consistent without making any distributional assumptions [5]. We will not go into the particularities of this class here, but for those who took the course 'Data Science Methods', the k-nearest-neighbor classifier is an element of $\mathcal{F}^{stone}$.

Now it appears that we have found a distribution-free solution to the classification problem and this is indeed the case. However, there exists a nuisance in the concept of convergence that significantly devalues the class $\mathcal{F}^{stone}$. This nuisance is the fact that convergence alone does not say anything about the rate at which the quantity of interest, here $R(f_n)$, converges towards its limiting value. The actual interest lies in, preferably small, convergence rate guarantees. Without such a guarantee, the convergence can take an arbitrary long time (number of observations) to converge. Recall from your statistics courses that estimators of parameters of some distributional class, generally converge with a rate of $\mathcal{O}(n^{-1/2})$.

Theorem 2. *There do not exist classifiers for which the corresponding probability of error converges with a specified rate to the Bayes error for all distributions.*

Theorem 2 throws a spanner in the works. It essentially says that the classification problem cannot be solved in a distribution-free manner. Most researchers take the impossibility of Theorem 2 up as a challenge to find (minimal) distributional assumptions, under which a specified rate of convergence can be achieved and with much success [6, 7]. However, there is another way around the impossibility, the road less traveled.

An alternative objective

The alternative is of course, to find a new objective. One that is still meaningful and that can be achieved without distributional assumptions. As mentioned before, finding an objective that meets these criteria is usually very difficult. In the following, we shall present such an objective and show that it satisfies these criteria.

Consider some arbitrary class of classifiers $\mathcal{F} \subset \mathcal{F}_0$ and let us denote by f^* (one of) the classifiers that achieves a minimal probability of error among all classifiers in the considered class, i.e.

$$f^* = \arg\min_{f \in \mathcal{F}} R(f). \tag{3}$$

Now the new objective becomes, to find a classifier f_n such that $R(f_n) \to R(f^*)$ as $n \to \infty$, with a specified rate of convergence for all distributions. The classifier that will be considered for this objective is called the empiricial risk minimization (ERM) classifier.

Definition 2. *Let $(X_1, Y_1), \dots, (X_n, Y_n)$ be a sample of size n the ERM classifier is then given by,*

$$f_n^{ERM} = \arg\min_{f \in \mathcal{F}} \frac{1}{n} \sum_{i=1}^{n} \mathbf{I}\{f(X_i) \neq Y_i\}. \tag{4}$$

Where $\mathbf{I}A$ is the indicator function of set A.

Figure 1 illustrates the discrepancy between the initial objective ant the alternative. When the class of all functions is

considered, then convergence towards the Bayes classifier is within scope, albeit without rate guarantees. When an appropriate subset $\mathcal{F} \subset \mathcal{F}_0$ is considered. Then, convergence towards the Bayes classifier might not be in scope. However, rate guarantees toward a minimizer of the subset $\mathcal{F}$, is feasible.

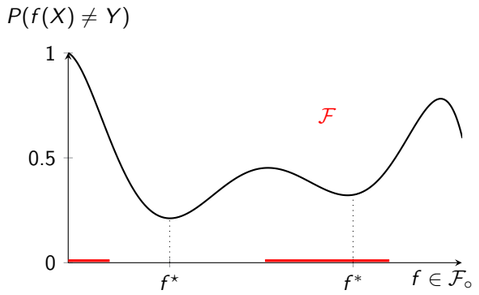

Figure 1: Abstract depiction of the probability of error for all binary functions. Red underlined, correspond to the binary functions that are an element of $\mathcal{F}$.

It is clear that $\mathcal{F}$ needs to be a strict subset of $\mathcal{F}_0$, because when $\mathcal{F} = \mathcal{F}_0$ from (3) we have $f^* = f^\star$ and by Theorem 2 for this class of functions, the objective is infeasible. Removing a single function from $\mathcal{F}_0$ would result in a strict subset, however, we would not expect the objective to be feasible when a single classifier is disregarded. This raises the question for which function classes the objective is feasible and for which classes it is infeasible?

VC-dimension

This question is answered by a single verifiable conditions of binary function classes. Before this condition can be stated we first have to introduce some additional concepts.

Definition 3. *Let $\mathcal{F}$ be a class of functions from $\mathbb{R}^d$ to $\{0,1\}$ and let $X_1, \dots, X_n$, $X_i \in \mathbb{R}^d$, be a sequence of feature vectors. The restriction of $\mathcal{F}$ to $X_1, \dots, X_n$ is given by,*

$$\mathcal{F}(X_1, \dots, X_n) = \{(f(X_1), \dots, f(X_n)) : f \in \mathcal{F}\}. \tag{5}$$

That is, the restriction of $\mathcal{F}$ to a sample of size n is a set of binary vectors, all with length n. When all possible binary vectors of length n are contained in the restriction, we say that $\mathcal{F}$ shatters the finite sample.

Definition 4. *A binary function class $\mathcal{F}$ shatters a finite sequence $X_1, \dots, X_n$ if the restriction of $\mathcal{F}$ to $X_1, \dots, X_n$ is the set of all functions from $X_1, \dots, X_n$ to $\{0,1\}$. That is,*

$$|\mathcal{F}(X_1, \dots, X_n)| = 2^n. \tag{6}$$

Here $|\cdot|$ denotes the cardinality of the set.

Example 1. *Consider one dimensional feature vectors and consider the binary function class $\mathcal{F}^1 = \{f_a : a \in \mathbb{R}\}$ with $f_a(x) = \mathbf{I}\{x \geq a\}$. Then any realized sequence of one element $x_1 \in \mathbb{R}$ can be shattered by $\mathcal{F}^1$, since for $a = x_1 - \varepsilon$ with $\varepsilon > 0$, $f_a(x_1) = 0$ and for $a = x_1 + \varepsilon$, $f_a(x_1) = 1$. These are the only two one dimensional binary 'vectors'.*
Now, considering a realized sequence of two elements x_1, x_2 with $x_1 \leq x_2$. Then class $\mathcal{F}^1$ cannot shatter this sequence since there does not exist a parameter $a \in \mathbb{R}$ such that $f_a(x_1) = 1$ and $f_a(x_2) = 0$.

Definition 5. *The VC-dimension of binary function class $\mathcal{F}$, denoted by $VC(\mathcal{F})$, is the maximal size of a sequence of feature vectors that can be shattered by $\mathcal{F}$. If $\mathcal{F}$ can shatter sequences of any size, then the VC-dimension of $\mathcal{F}$ is said to be infinite, i.e. $VC(\mathcal{F}) = \infty$.*

This means that if one would like to show that the VC-dimension of a particular class is k. Then, one has to show that there exist at least one sequence of feature vectors of length k that can be shattered by $\mathcal{F}$ and one has to show that there exist no sequence of $k+1$ feature vectors that can be shattered by $\mathcal{F}$.

Example 2. *Let the feature vectors be d dimensional, i.e., $x_i \in \mathbb{R}^d$ for all i. Consider the binary function class of axis aligned rectangles. That is,*

$$\mathcal{F} = \{f_{(a,b)} : a \in \mathbb{R}^d, b \in \mathbb{R}^d \text{ s.t } a_j \leq b_j, \text{ for all } j \in \{1, \dots, d\}\},$$

where,

$$f_{(a,b)}(x_i) = \begin{cases} 1 & \text{if } a_j \leq x_{i,j} \leq b_j \text{ for all } j \in \{1, \dots, d\} \\ 0 & \text{otherwise.} \end{cases}$$

Then the VC-dimension of $\mathcal{F}$ equals the number of parameters, i.e., $VC(\mathcal{F}) = 2d$. To show this fact, one needs to find a sequence of length $2d$, that can be shattered by $\mathcal{F}$ and one needs to show that no sequence of $2d+1$ points can be shattered by $\mathcal{F}$. To this end consider $2d$ points in $\mathbb{R}^d$, such that all points lie on the boundary of the corresponding convex hull. Such an allocation is shattered by $\mathcal{F}$. A visualization, for $d = 2$, makes this obvious (see Figure 1).

Consider any set of $2d+1$ feature vectors. Now consider enumerating the dimensions and for each dimension selecting the feature vectors with the minimal coordinate value and the maximal coordinate value from the set, without replacement. When several points share a minimum or maximum coordinate value, pick one arbitrarily. After the enumeration one obtains two sets: one set of selected points with a size of at most $2d$

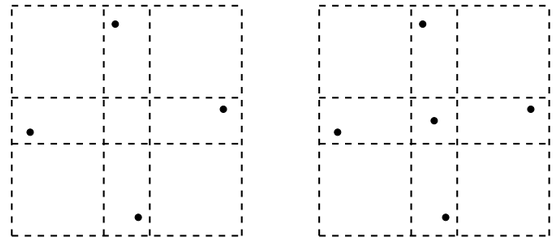

Figure 2: Left Panel: Depiction of the points with the maximum and minimum coordinate values in two dimensions. Each of the rectangles, generated by the dashed line, corresponds to one of the 2^4 binary vectors. Right Panel: Same depiction as in Panel Left. However, here there is an additional point, it is clear that there is no rectangle that classifies all but the additional point '1'. Therefore, in two dimensions, five points cannot be shattered by $\mathcal{F}$.

and a set of remaining points. Now the rectangle labelling all selected points 1, necessarily includes the remaining points. Therefore the labelling of all selected points 1 and all remaining points 0 cannot be achieved by $\mathcal{F}$. Therefore, $\mathcal{F}$ cannot shatter $2d+1$ points and we conclude that $VC(\mathcal{F}) = 2d$.

If you reached this far you are probably wondering what this all has to do with distribution-free statistics? This becomes clear by the statement of the following theorem.

Theorem 3. *Let $\mathcal{F}$ be an arbitrary binary function class. The ERM classification function (4) is consistent[1] for $\mathcal{F}$ with specified rate for any distribution, if and only if, the VC-dimension of $\mathcal{F}$ is finite, i.e., $VC(\mathcal{F}) < \infty$.*

Example 2 is a rather simplified example. However, the VC-dimension of many of the binary function classes used in practice can be calculated in a similar fashion.
Of course, the function class minimizer f^* can still perform much worse than the theoretical optimal $f^\star$. This objective is nevertheless useful because the particular function class is something we have control over. So in practice, if the the particular ERM classifier has a bad performance, one can simple retry with some other function class. Whether the performance of the function class minimizer f^* is adequate will depend on the particular practical application.

Conclusion

Throughout this read, we have separated statistical methods in three categories: parametric, nonparametric and distribution-fee. Next, the implications of making distributional assumptions were discussed. Here we found that there is a trade off between few assumptions and strong results. When one prefers making few assumptions, which in practice often is the case, then distribution-free statistical methods are a good option. Although distribution-free methods are rare, by analysing the classification problem we have found that distribution-free alternatives are available, even for complex and interesting problems.

[1] Here, with consistency, we mean that $R(f_N^{ERM}) \to \infty$ as $n \to \infty$.

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Vince Hasse
Master QFAS Graduate (2022)

Dress the Board

A Farewell

from the Nekst committee 2021-2022

You are currently reading Nekst 4 again and that means that this was our last Nekst edition as the Nekst committee 2021-2022! We would like to thank you as readers for reading all the pieces. I think I can say on behalf of everyone that we all enjoyed this year very much. During this year, we have all written many different articles and did some funny activities together. To conclude this year, I have conducted a questionnaire among the committee among others about what they liked this year, who will be missed the most and, of course, how they want to thank you.

What do you like the most about the Nekst Committee?

'Creative freedom'

'The Quatch app, I will miss it.'

'I like the weeks before the next deadline where the working load is real but fulfilling!'

'The size of the committee'

'Being at the rooms a lot!'

'I asked among the committee members what the favorite article of all Nekst editions is this year. I have to give the credits here to Sara en Matthijs because their special about Board Game Theory wins. Although I am not convinced that two votes are their own since they liked him very much themselves as well. Whether you voted for yourselves or not, you won, congratulations!'

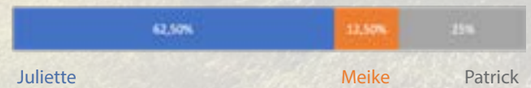
What makes the Nekst committee the best committee?

'The fact that we will win the committee ranking.'

'The people and that you have to do so much as a committee, which really creates a strong bond.'

'It is a big committee which means a lot of social fun.'

Our Editor-In-Chief, Juliëtte will be missed the most among the committee members.



A Thank You to Our Readers

'Thank you for reading this year's Nekst made by the amazing committee. Where each individual has provided wonderful articles written in their own style with a lot of creativity. Enjoy your summer holiday while reading, and see you next year!'

'By saying that we appreciate every compliment we get! We work way harder for it than most people expect which also makes us extra grateful when we know that it was not all for nothing! Thanks!'

'Thank you for appreciating the nice design of Nekst. I hope you enjoyed all of it!'

... Seoul!

Dear tristjes, I am writing to you today from the capital city of South Korea! I have been here since the beginning of February and I can say with 100% certainty that these have been the most enjoyable, heavily partied months of my life. But let's start at the beginning.

The beginning of this whole adventure was heavily influenced by our big friend COVID-19. After a long list of canceled fall exchanges (Mexico City, Puebla, a few others that did not offer the dreaded but necessary EME/BAOR/QFAS courses), I decided to postpone my exchange to the spring semester and re-apply to my first choice: South Korea. After a lot of trips to the Korean embassy in the Hague, 20 pages of printed forms and a lot of anticipation, the day finally came: I was going on exchange! Or well, I was going to sit inside my house for seven days.

I was one of the lucky ones: not only did the Korean government reduce the quarantine period from ten to seven days right before I left, but I was also allowed to quarantine in my own apartment instead of a hotel or the university dorms, which are notorious for bad food.

Once I was finally out of quarantine, the real fun began. I opted to live in an apartment with other students instead of a dormitory, since my university (Sungkyunkwan University) is located far from the fun neighborhoods. I ended up renting from this guy named Jason, who runs a community of international students in the Sinchon and Hongdae area. I can say without a doubt that this community has made my whole exchange even more enjoyable, especially back in February and March when restrictions were tighter and we were not allowed to attend classes or go clubbing after 22.00 hours. It was difficult to meet new people but through this community, I met a lot of great people and we got a lot of chances to do fun stuff with the whole group. For example, we went to a football game (South Korea vs Iran: SK won!) and we went on a big trip to Busan (yes, I took the train to Busan).

I think an experience report about Seoul is not complete without mentioning the amazing, incredibly affordable food scene here. From amazingly juicy Korean barbeque, to sashimi that is so fresh, you saw it swimming in a tank 10 minutes ago, or surprisingly good pasta and pizza, the food in South Korea just does not seem to ever disappoint (except for the time we accidentally ordered cow intestines instead of sirloin steak – oops). And with every amazing meal, there comes a nice green bottle of traditional Korean alcohol: soju! This cheap 20% drink can be used as a shot, a mixer, or just be drunk straight from the bottle. There are many different flavors and no Korean night is complete without a bottle of soju in each hand.

For those of you who are more interested in outdoor activities than going on a food adventure: do not fret! Seoul has a lot to offer in that aspect as well. The city is surrounded by large mountains that are perfect for a little hiking trip or a few days of camping. I do have to warn you: don ot go hiking in the hot sun after a long night of drinking soju.

Although I have been here for three months already, I still feel like I have a lot to learn regarding the culture. It is quite jarring to see how important the small respectful gestures are here, such as handling everything with two hands or bowing when thanking someone. Especially compared to the quite casual culture in the Netherlands. Still, it is really interesting to see where our cultures differ and where they are similar: Koreans like drinking even more than the Dutch somehow!

Ishana Dajal

Bachelor EOR

Age: 23

I still have two months left here, but I feel like I will have to come back sometime soon. There is so much to do, so much to see and so much to taste! If you are considering an exchange, you might want to give Seoul some thought. I can vouch for the amazing experience this city will leave you with.

인사말 , Ishana

Dear Nekst committee

On these pages I want to thank the amazing crew that has delivered the four editions of Nekst this year. I will start with thanking the general crew, ordered by their first names. Fun fact: almost all names start with R, S or T!

Many of the interviews you have been reading last year were from this girl! Flora you are a surprising girl who delivered time and time again. I want to thank you for your work this year!

At first glance you might come across a bit chaotic, but in the end Matthijs, my god did you deliver. I think everyone agrees with me that you were one of our top writers. We were lucky to have you not just because of that, but also because you are a great person to have around. Always smiling and always lighting up the room!

Roel, I am very happy you were in the committee. You can always manage to make everybody laugh and are a joy to have around. At the same time, you are a hard worker who we could count on, and you really delivered every time. Thank you for being in our committee :)

Funny, Sara, how before this year we did not even know each other and a few months ago we slept in a room together on the Asset Ski Trip. I am happy that you were in the committee! You were the creative sparkle that we needed so hard at times. Not just that but the committee activities would not have been the same without you.

Stijn, 'you are me one'. We also bonded on the Asset Ski Trip and nowadays the party is not done until I have danced with you as well. Next to that you were a good crew member, working hard and even though you were sometimes late, I knew eventually you would deliver. Thank you!

Tamara, you joined us after your amazing exchange semester in Hong Kong. How lucky we were, because you are one of the most committed 'Neksters' out there! This was not your first time joining the committee, and I am glad you gave it another shot (pun intended).

Never forget the first moment we saw each other in real life, when we were so confused because we recognized each other. After a second of thinking we remembered we had been TOP-siblings! Tijn, I am happy that we ended up in the same committee, you were a very welcome addition :)

Let us all take a moment to appreciate Timo Klabbers, Omit, or how we like to call him: Rikki-Takki-Tavi. The Nekst-online guy, master brain behind all the puzzles, our very own photographer, and a nice guy in general. to have with you during activities. Timo, you really delivered this year! I am happy you were in the committee :).

Last but not least, Timo van Oorschot. Whenever there were articles left that nobody was really interested, you would take one for the team and go 'just give me it'. You were a flexible and nice addition to the crew, and I really want to thank you for all the work you put into Nekst.

Now I want to thank two people in special. Together, we formed the 'editors' of Nekst. I am talking about our Design Officer Meike and our Coordinator Patrick.

The girl that put most work into this committee by far is Meike. I know sometimes you wanted to give up, though, I hope that now that the work is over, you can look back at your year with pride. Because that is what you deserve. I think nobody will understand how hard it was at times and how much work goes into this magazine. I really cannot thank you enough that you decided last summer to do this together. It has given me a very good and reliable friend in return, for which I am very grateful. Thank you for being the best designer any of us could have wished for!

A very special thanks goes out to our coordinator Patrick, better known as Patty. We did not really know each other before this year but I think we have grown closer. It was a pleasure working with you (I am actually really going to miss it). You are a very special guy and I hope we will keep hanging out for a long time after Nekst. This has not been an easy year for you but probably also one of the best ones at the same time. I hope our work together (and of course all the informal hang-outs) is part of what you look back on in the future. Thank you for being our coordinator!

Finally, I want to thank the reader for their support past year. I have already stated this in my opening preface on page 1, but we got a lot of empowering comments that we are grateful for. Thank you in particular to our most loyal readers: Bob and Emma.

Next year a new (at this moment unknown) committee will take over. I want to wish them good luck! I cannot wait to see what you will do with our beloved magazine.

Yours truly, Tillie

Dear Tillie,

After a year of COVID-19, everyone was a bit in the dumps. Everything was canceled, lectures were online, and (not unimportant) Nekst had to be edited in the deep dens of student houses. When finally the restrictions were lifted, everything had to be a tad more grand. Obviously, Nekst needed to follow the same approach. The new Editor-in-Chief needed to have a significant amount of flair, be a bit chaotic, and absolutely had to possess some sort of appeal that would motivate Nekst-writers to create new journalistic masterpieces. Ultimately, the board ended their search with Juliëtte Tillie.

Some of you may describe Tillie in 2 words: 'pure chaos'. Although this is mainly true, this is not the only side of Tillie. With her unlimited enthusiasm, many writers have crossed into journalistic territories that they may have not entered without her. Some may even say that the Nekst committee was not a committee, but a cult under Tillies wing. She never failed to stand up for the rights of Nekst to the board (someone has to ensure that the Nekst committee gets committee clothes!). However, sometimes Tillie was a bit to sweet. Deadlines have to be met, and some Nekst-writers had a bit of trouble doing that. Every time, Tillie found a piece in her heart that forgave them, even when Stijn messed up again. But the most important thing for Tillie, is the coveted title of committee point queen. Beating Freshmen Night is for Tillie the most glorious purpose possible, and for the rest of the committee as well. All in all, we owe a big thanks to Tillie.

We will miss you as our Editor-in-Chief, the Nekst Committee

Let's Talk About...
... Holiday Plans and Footprints

written by Tamara Dert and Roel Delescen

In a few weeks, the school year will come to an end and most of the people will go on a vacation with their friends and family. As everyone knows, the attention to climate change becomes more and more important every year. This made us wonder whether people will take this into consideration when making their vacation plans. We did some research and came to the following findings.

Figure 1

We have asked 17 of our members where they will be going for the coming holidays. The map on figure 1 shows this, and is already turning quite blue. Especially Eastern Europe seems to be the new hype. Let us hope this is because of the untouched nature, and not because of the lower beer prices. As these closer-to-home destinations get popular one question comes up: what kind of transport will they use? Out of our questionnaire, 63% of our Europe explorers will travel by airplane. The other 37% travels solely (Flix)bus, train, boat or car. By now, we all know that the latter way of traveling is a lot better for the environment, but we also just want to enjoy our holidays. It is not just black and white. That is why we were also informed about how they made their plans. We learned that 59% actually did take their CO2-emission into consideration. Sadly, the fast majority had to conclude that it was still not a feasible option due to high cost or big logistical inconvenience. Another 29% stated that they simply had not thought about the option. We shall see whether these two groups will get smaller in the upcoming years. To give a bit of an idea: right now our students would on average be willing to pay 13% extra to make their vacation eco-friendly.

... Gossip and Dreams

As the exams are coming up, it is nice to sometimes dream away about cool ideas that will probably never happen. We can for example dream about the next destination for an Asset | Econometrics trip. When asked about their 'dream Astrics trip' (in case they would have unlimited time and funds), some students came up with some interesting ideas. One shot literally for the moon suggesting a trip to space. Other fun ideas were:

- **A trip to Japan and follow a premium sushi workshop from a chef**
- **Australia**
- **Backpacking through America or Africa**
- **Join the Europe trip, and fly to Prague, but then decide to take the car instead, because you are not allowed to board**
- **Rent out a water park including unlimited food and drinks**
- **An Astrics Yacht sailing the Caribbean**
- **Trip through South America visiting Iguazu Falls, Nazca Lines, El Salar de Uyuni, Machu Picchu, Christ Statue Rio, Lencois Maranhenses, Ushuaia, Pailón del Diablo, Huacachina, Ángel Falls, Pantanal, Bonito Brazilië**

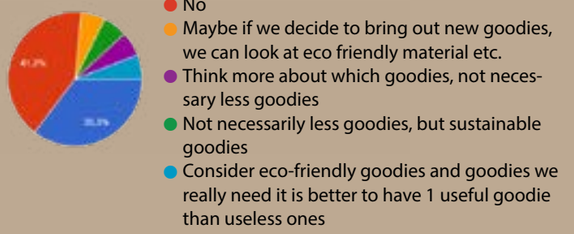
Which boardie would be the best travel companion, was not a very easy question. Some were very sharp and thought to bring Joris (with the Astrics debit card), but most votes out of love went to Floris. Some reasons for this phenomena were:
"Floris, because it is always fun and cozy with him and I think he is a good traveling partner. I think he somewhat would like the same vacation as me, which is mostly seeing many places and do lots of activities, but also at the end of the afternoon just lay at the poolside and enjoy the sun."
"Floris, together to the gaybar"
"Floris, he has the most spontaneous adventures"

Talking about our lovely boardies, soon we are gonna say goodbye to Floris, Joris, Patrick and Wout. Time to gossip on who will take their places. Our students are suspicious of: Juliëtte Tillie (our current Nekst Editor-in-Chief), Jeroen Conijn, Jarno Ringhs, Bente Stokebrand, Nick Verkaik, Luc Geurts, Manon de Groot and Nynke Koornstra. Keep an eye out for them and, of course, we will keep you up to date by introducing the lucky new boardies in next year's Nekst!

To end our Let's Talk and give the upcoming boardies some extra perspective on the priorities of their members, we introduce some last statistics. 59% of questioned members would like to see some thought put into eco-friendly measures, for instance changing the way we work with goodies.

What do you find most important?

Should Astrics take more eco-friendly measures? For instance decrease the goodie-output?



Quatsch!

¯_(ツ)_/¯

Quatsch?

Over the past few months, the editorial staff of Nekst received many quotes that relate to the study of Econometrics and to the activities organized by Asset | Econometrics.
Hereby, we present to you a selection of some striking and funny quotes!
Please send in your quotes at:
www.Asset-Econometrics.nl/more/nekst/Quatsch

Sara
"Ik vond ALA echt een leuk vak! Ik ben blij dat ik het volgend jaar nog een keer moet doen!"

Jasmijn
"Eigenlijk is het best voordeling om voor een master ingeschreven te staan en €2000,- te betalen, je kan lenen, je hebt een gratis ov, en je kan blijven wonen."

Ricardo
"Hahaha, Jessica zei iets doms. Onze gids vertelde net dat ze in Wenen werkte en Jessica zei "oh wat leuk, hoe vind je Italie?"

Floris
"Hahaha, wat grappig. Even voor mijn info, Wenen ligt in Spanje toch?"

Patrick (wil amw in the Engels zeggen)
"Ee-em-wie"

Ferdy (Reactie op zijn Quatsch in Nekst 3)
"Waarom is hertenbiefstuk dan wel van een rund?"

Meike
"Je moet eens naar jezelf kijken in plaats van anderen."

Luc
"Ik heb dat gedaan, maar daar werd ik niet vrolijk van. Daarom kijk ik liever rond."

Ricardo
"Doe mij ook maar zo'n paar krukken! Wout boft."

Jeroen
"Ik kwam hem 8 dagen in de week tegen."

Lotte
"Ga jij naar Wenen?"

Tamara
"Nee, Verona."

Lotte
"Is dat niet hetzelfde?"

Juliëtte (over the maïskolf in Nekst)
"Kan die wortel niet naar beneden?"

Elise
"Huh, ga jij naar Terschelling? Ben jij een Zeeuw dan?"

Luuk (in een dubbeldekker)
"Zit de busschaffeur onder of boven?"

Kroesen Cracks the Case

I, Sherlock Kroesen, have never not solved a case presented to me. Together with my companion Timo Watson, I make sure that no evildoer can escape the eye of justice. When I was traveling in Iceland, one cruel crime caught my attention. It was an unspeakable act, and the bereaved deserve to know the exact details of how the victim died. However, this crime is very tricky to solve. There are multiple suspects, each having a believable motive and a convincing alibi. That is why we need some help from you! I have laid out some traits of and facts about every suspect, their statements about the case, and their alibis. Can you find some contradictions in the statements, or are some clues too good to be true? Help me solve this case, and be quick about it! The killer can escape from Iceland any second now…

written by **Matthijs Kroesen**

Tillie's Crime Scene

The crime in question is a brutal homicide. On the foot of the volcanic Fagradalsfjall, a reporter named Juliëtte Tillie is found dead. Tillie participated in a tour of "the Golden Circle", the touristic hotspot of Iceland. Tillie was found dead on top of solidified lava (see picture 1). Only six persons were close to the murder at the time, and therefore there are only six suspects. By pure chance, these are the board members of Asset | Econometrics.

You can see multiple pieces of evidence on the picture of the crime scene:

1. A sharp bloody stick, which may or may not have been used to poke Tillie to death.
2. An empty Arizona bottle, which may or may not be poisoned
3. A lot of volcanic rocks are covered with a bloody substance, which may or may not have collided with Tillie with a deadly impact.

It seems that Tillie was dead in one hit, because no one heard a thing. Unfortunately, there are no forensic experts in Iceland, so you can not extract further information from the pieces of evidence. We can only rely on our sharp and observant minds to crack this case.

Wout

Statement:
It took me quite a while, descending the volcano… I am not as fast as usual now, since I am on crutches. When I arrived, she was already dead in Joris' arms... I should have seen everything from up there, but I did not. What I have seen is that Patrick was crawling through the stones, and Floris was calling someone. He seemed to have a heated conversation. Unfortunately I have not seen anything from the slopes of the volcano, since I was too busy not falling on my crutches. I have heard that Ikie was mad at Tillie, because she said that Ikie always has a stiff look.

Traits & facts:

- was injured by the ankle at the time
- proud as a peacock
- plays rugby

Patrick

Statement:
We had our differences, but Tillie did not deserve this. I was adding stones to my collection, only the beautiful ones, and all the while I have not seen anything. I did hear Floris though, he sounded quite angry. I could make out the word 'coffee'. I had been searching for stones, until I heard Joris' shout. I know that Nienke always said that Tillie talked a lot to her, and caused her a lot of work. I do not know whether she would kill her for it though… Also, Tillie always said to Ikie that she had a very serious look, which annoyed Ikie a lot.

Traits & facts:

- a living meme
- joyful
- has a low tolerance for substances

Joris

Statement:
When I found her… my world collapsed. Oh Romeo, oh Romeo, she used to say… I have not seen the killer. I was occupied thinking about a nice gift for Tillie. Now that I think about it, Wout was remarkably fast present at the crime scene. Could he have done it? And Ikie and Nienke came from the direction of where I found Tillie. How could I just have left her on her own…? I have not seen Floris and Patrick anywhere.

Traits & facts:

- In love with and hopelessly devoted to Tillie - now heartbroken
- impulsive
- obsessed with cash
- acts a bit too tough on a regular basis
- found Tillie at the crime scene

Nienke

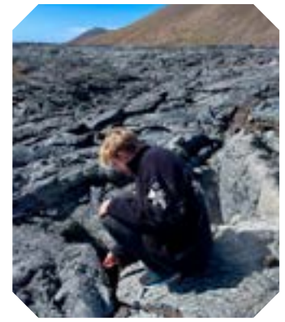
Statement:
Poor Tillie… Although she never could be silent, I feel for her. Poor Joris. I was talking to Ikie, and I saw Wout moving upon the mountain, he was almost down. Would he not have seen something? We had a great view up there. We did see Joris shortly before he found her; there was too little time between that moment and the scream for him to have committed a murder, I think. Anyways, as Internal I knew Tillie had some issues with Patrick, but I cannot tell you the details of that.

Traits & facts:

- always looks like she is angry
- twitches her left eyebrow when she is nervous
- empathic
- never reveals a secret

Floris

Statement:
I had Patrick in close sight while I was examining the solidified lava in close detail. He was looking for rocks and I saw him pick up and put down multiple specimens, which I thought was suspicious… he left very suddenly as well. Was he looking for the right one? I have not seen anyone else… I heard from Tillie that Wout was quite angry with her, because he had to write Dear Members every Nekst issue. Also, was Nienke not annoyed with Tillie because she did not want to join the Education committee again? And Joris was heartbroken that Tillie called him her ex by accident…



Traits & facts:

- extrovert
- likes to gossip
- moves with his hands when talking, like an Italian
- one of Tillie's best friends

Ikie

Statement:
I was completely caught off-guard by the murder. I was talking serious business about the board applications with Nienke, when we crossed Joris, searching for Tillie. He seemed kind of happy. Patrick and Floris were nowhere to be found, but I saw Wout climbing down from the vulcano, left behind by everyone. I know that Patrick and Tillie could not really see eye to eye when working on the Nekst. Unfortunately, I am completely in the dark. One more thing - I do know that Patrick and Tillie sometimes argued, when designing the Nekst.

Traits & facts:

- calm
- has a great sales pitch
- can be quite sassy
- observant

Conclusion

Holmes! I think I may have a hunch about who the killers may be. However, I do need a second opinion. Dear colleague/reader, can you submit at https://nekst-online.nl/puzzle who you suspect of this terrible crime (note, there CAN be multiple killers!), and why? Obviously, there is a handsome bounty for the detective that best approximates the homicide. Good luck searching! I hope to welcome you soon to 221B Baker Street in London, to discuss this case in full detail over a cup of tea.

Eva Schoenmakers is the winner of the previous puzzle. She can pick up her prize at the rooms of Asset | Econometrics.
The solution can be found at www.Nekst-Online.nl.

Extra challenge:
In the 'Dear members' Wout has hidden three words. Can you guess what words he tried to blend flawlessly into his writing?
Let us know and maybe your name will be mentioned in the next edition of Nekst!

Asset | Econometrics congratulates...

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Supervisors Dr. P. Cizek, Dr. J.R. de Bresser

Name **Daan van den Dool**
Title UniversityAssessing the impact of competitors' price variables on the forecast accuracy of the total sales volume
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