nekst>>

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Seoul

ASSET Econometrics

What's Nekst?

This was the main question on my mind when I became the new Editor-in-Chief this summer. Or, how I would rather put it: when I became the new 'Emma'. Last year, the Nekst committee was a large group of lovely people. Hence, I was concerned that I could not find new editors who could live up to these high standards. Luckily, the new committee gradually grew into a wonderful group of people who are extremely motivated to produce this year's first edition of Nekst. You can read more about the editorial staff in the 'Meet the Crew' section.

The Nekst question on my list was which articles to publish in our beloved magazine. Again, luck was on my side! Ridho Hidayat had already written an interesting and catching special about Bitcoin. Additionally, Henk Norde, Anne Balter, and Kuno Huisman agreed to become our new columnists. Also, make sure to check the Familiar Faces section in which Linda Dekkers tells a story about her student life. Unfortunately, we are still in the middle of the corona pandemic, which means our lives are significantly different from what we are used to. Nevertheless, Asset | Econometrics did not stop organizing fun activities that we could report in Nekst. You can think of the Active Members Weekend or the online Hackathon by Ab Ovo, for example.

For now, the Nekst possible step for you is to start reading this magazine whether you are studying, traveling, or even in quarantine. I hope that all the articles will bring you joy and that you remember to always look at the bright side of things even in these weird times.

Yours sincerely,

Mylan Tran
Editor-In-Chief

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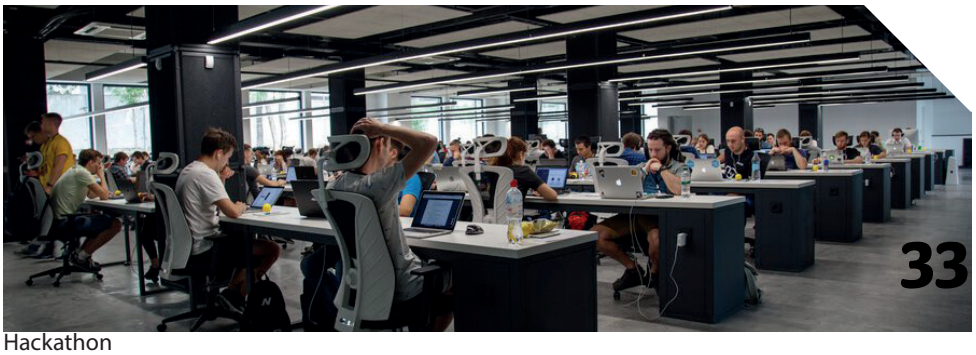

Hackathon

COLOPHON

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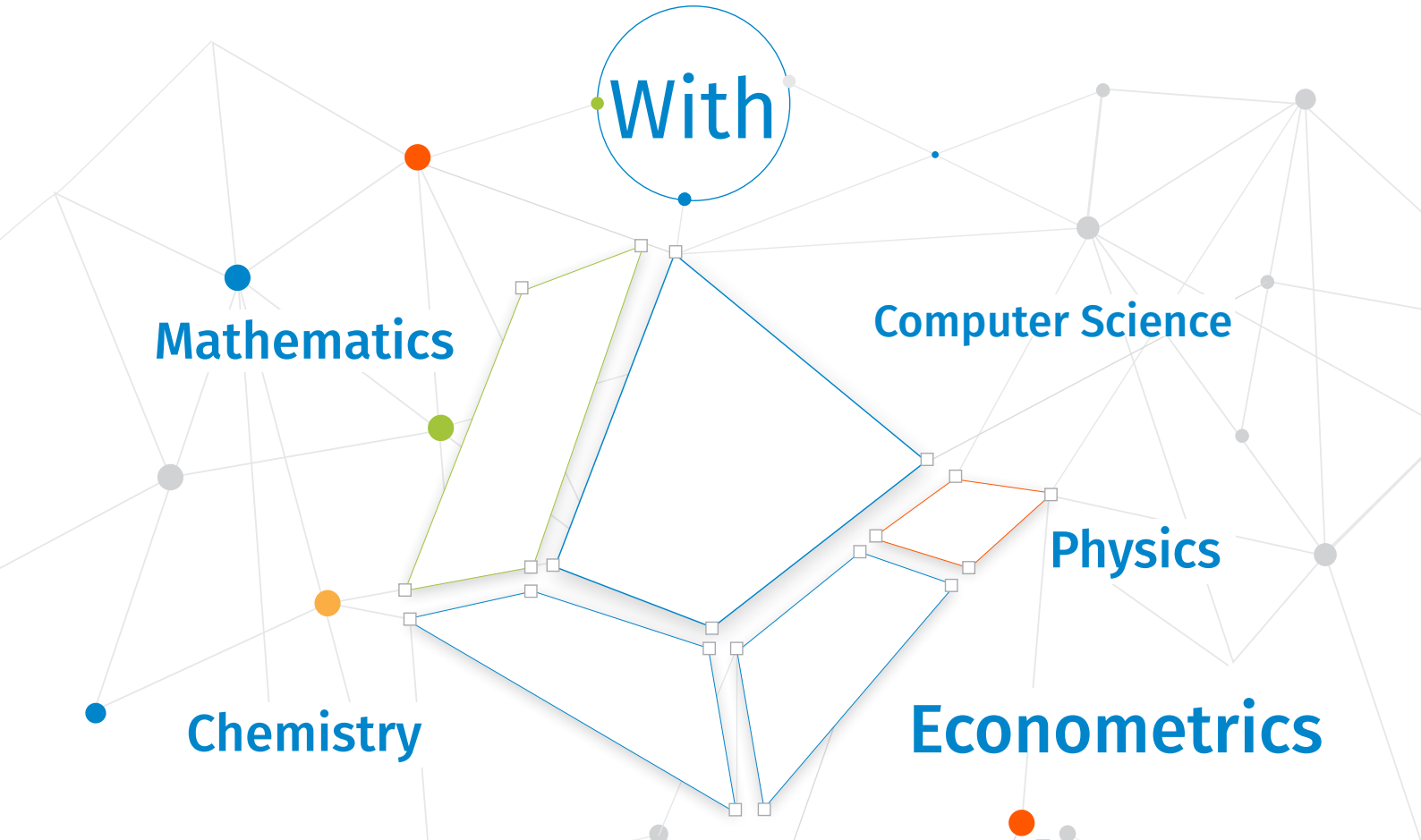

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Dear Members,

Normally, I would start by saying something about the challenges we face at the start of a new academic year, or by looking back at all of our events in the first weeks. However, doing that now feels a little strange. First of all, I hope that all who are reading this are healthy and doing well. As for everyone, the coronavirus also has great consequences for our association. Activities have to be adapted, canceled, or held online. Furthermore, our cozy rooms in the Esplanade building are closed for now. Even though these things are not as I hoped they would be, I still have absolutely no regrets about my decision to do a board year.

Before I talk more about the strange situation we are currently facing, let me start by introducing myself. My name is Juul Schuurmans and I am 21 years old. Last summer, I finished my Bachelor's degree in Econometrics and Operations Research, and this year I have the honor to call myself the Chairman of Asset | Econometrics. Of course, I am not the only board member this year, since I am very happy that Michelle Luijten, Stephan Sparreboom, Juliëtte van der Velden, and Tjum van Dijck also decided to do a board year. Together, we are the 42nd board of Asset | Econometrics. In the last few months we have gotten acquainted with each other and we got used to our life as board members. For more information about me or the rest of my amazing board, I would like to refer to pages 25-26, where we introduce ourselves.

Back to reality. In the last few weeks, I often got the question whether there was enough work to do, since a lot of activities have been canceled due to corona. The short answer to that question is yes. I hear you thinking, what is it that you are doing then? To tell you everything, I would need more than just this page. To give you an idea, I will give a few examples of the things we are currently doing as a board. Firstly, we are most of all focusing on the things we can do, because we believe there are always possibilities! A lot of things can still happen, but just not the way they used to. Hence, we are brainstorming a lot, often together with our committees, to come up with creative solutions. This also means that we have to adapt to the ever-changing measures from the government, which entails a lot of crisis meetings and last minute adaptations to events. For you, this results in some very nice online events coming up! Besides that, we are increasing our educational and professional support. For example, we are meeting more with the university to talk about the needs of the student. For professional support, we started with offering CV and LinkedIn checks for our members, and we are currently working on tools to help you prepare for your job application process.

On a final note, I would like to thank all our members who decided to become active this year by joining a committee, every member who attended one of our (online) events, and every one of you who supported our association in some way. I am looking forward to the upcoming year and I hope you are too! Together, we will make sure this will become an amazing year, regardless of the circumstances. I hope you will enjoy reading this autumn edition of Nekst and I would love to see you soon at one of our events!

On behalf of the board,

Juul Schuurmans
Chairman Asset | Econometrics 2020-2021

Meet the Crew!

Nekst committee 2020-2021

written by **Casper Heemskerk**

Mylan Tran

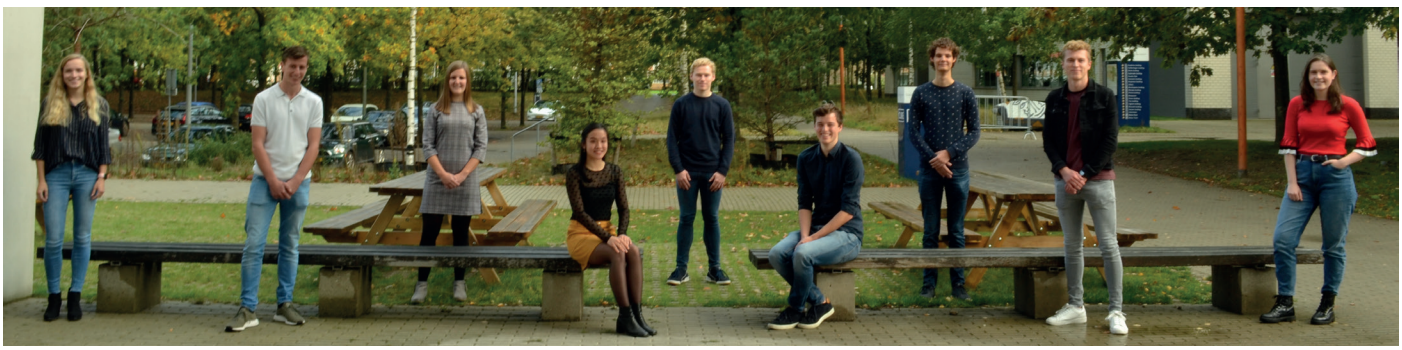
We would like to begin by introducing our new editor-in-chief: Mylan! Mylan is 20 years old and is from Den Bosch. She just finished her Bachelor's and has begun with her Master's in September. Before joining the Nekst-committee, she has been in several committees: Active Members Weekend, Econometrics in Practice Day, Europe Trip, and Actuary Day Tilburg. Within five years, she wants to have bought a grand piano. She also wants to travel to Vietnam because her parents are from there and she speaks the language. One of the most humiliating moments of her life was in high school when she fell down the stairs in the middle of the school while the whole school was watching her.

Dahli Koskamp

The design officer of this year is Dahli! Dahli is 20 years old and is currently in his first year of his Bachelor's. Last year, he organized the wonderful Europe trip to Ljubljana. Dahli's perfect day looks as follows: First, he wakes up at 11.00 hours and starts with a nice breakfast with some soft boiled eggs and toast. After his breakfast, he heads to his local football club Haspseboys to play a game in the fifth team and afterwards he will be joining the team in the bar to have a great time. Finally, late in the evening, he will go home completely satisfied. Furthermore, if he had unlimited money, his first purchase would be an indoor swimming pool just for himself.

Luuk Sommers

Luuk is co-responsible for Nekst-Online this year. Luuk is 22 years old and is originally from Elsendorp, a small town in Brabant. Luuk is in the fourth year of his Bachelor's. In his first year with Asset | Econometrics, he was in the Sports committee and last year, he joined the D&A committee. In five years, he hopes that he has finished his Bachelor's and Master's degree and is settled in a nice working place. His main activity during the lockdown was working and joining pub quizzes and he misses the spontaneous "kleine stapjes" the most. A monkey best suits his character because they are almost always happy and have a lot of fun.



Patrick Floor

Patrick is 21 years old and is currently in the fourth year of his Bachelor's. Together with Luuk, he is responsible for Nekst-Online this year. Patrick was born in Veenendaal and the Nekst committee is his fourth committee. He previously joined the Introduction Activity committee, the Education committee, and the International Business Tour committee. He likes to play volleyball, tennis, and squash. Seeing others on a daily basis is what he misses most at the moment. When he was in second grade in high school, he almost fell off his bike while overtaking slow cyclists. He never understood why he fell until someone told him that he fell because of the curb of the sidewalk. Unfortunately, it took him four falls to realize his mistake. It was a very humiliating moment..

Aimee Smarius

The only freshman of the Nekst committee this year is Aimee, who is 20 years old and comes from Berkel-Enschot. Aimee really loves to dance. She cannot think of a life without it and dances classical ballet and improvisation nowadays. She used to dance modern, jazz, contemporary, fusion, and a lot of random workshops in different styles. The skill where she is most proud of is being able to write and think of something different at the same time. She can mostly relate to a red panda if we are talking about animals: "It is quiet and it sleeps a lot, sounds like me!".

Casper Heemskerk

One of the (maybe) familiar faces of this committee is Casper. Casper is joining the Nekst committee for the second year in a row! Casper is 19 years old and was born and raised in Oudewater, a place near Utrecht. He is in the second year of his Bachelor's and loves to play football and go out for a run twice a week. Besides that, he likes to explore other sports like squash, tennis, or cycling. In five years, he wants to have made a trip across South-America or Australia and wants to have seen a lot of other cultures. Besides that, he wants to have finished half a triathlon or maybe even the whole iron man.

	Mylan Tran	Dahli Koskamp	Nienke Keuning	Nienke Kempers
Favorite song?	Rondo Alla Turca (Mozart)	Comptine d'un autre été, l'après-midi (Yann Tiersen)	Het Regent Zonnestralen (Acda en de Munnik)	I like me better - Lauv
Favorite tea flavor?	Rooibos	Dutch tea blend	Lemon green tea	I do not like tea
Favorite series?	How I met your mother	Suits	Gilmore girls	Brooklyn 99
Favorite drink?	Non-alcoholic: Lipton ice tea, Alcoholic: Coebergh	Beginning of the evening: Beer, ending with Malibu Cola	Liefmans	Alcoholic: Mojito, Non-alcoholic: Ranja
First reaction when joining the Nekst?	I hope I will find the perfect crew members for this committee!	Oh no it is going to be a busy year	Very excited and instantly checking which other awesome members are in this committee	I was very excited, because I like everyone in this committee

Jarno Ringhs

Another familiar face in this committee is Jarno. He joined the Nekst committee, like Casper, already in February. Jarno is the youngest of the committee, 18 years old and he is from Maastricht. During the lockdown, he played many online games to keep in touch with his friends and besides that, he went for a run three times in the week to stay fit. Now, he misses the visits to the football matches the most. If Jarno would have unlimited money, his first purchase would be his local football club. The penguin is the animal that suits Jarno best because penguins like to live with others around them and can be clumsy occasionally.

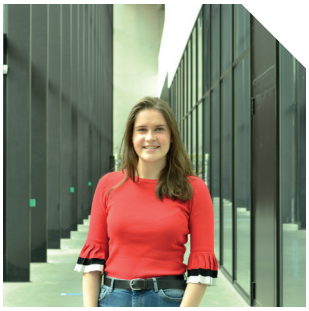
Marijn Wolferink

Marijn is 26 years old and comes from Rotterdam. He has only his thesis left of his Master's and will then be finished with his studies. Within five years, he really wants to buy a house with room to start his own vegetable garden and with enough space for his future savannah cat. He likes to play korfball and hockey. At the moment, he misses traveling to tropical areas the most. The animal that suits him best is a cat because he likes to spend time on his own, loves to eat and sleep, but also likes to be with humans from time to time.

Nienke Kempers

Nienke is 20 years old and is from Ruurlo (or "Ruuurlooo" as she pronounces it). Before joining the Nekst committee this year, she has been in the Active Members Weekend committee and the Promotion committee. Her perfect day looks like this: In the morning she would like to sleep in, following up with a fun activity surrounded by friends and finally going out at night. During the lockdown, her main activities were sleeping and studying. She is very proud of her grade for the Linear Algebra midterm, as she had a grade of 9.3/10, which was the highest of all two hundred students!

Nienke Keuning



We would now like to introduce the second Nienke of the committee. Nienke is 19 years old and is currently in the second year of her Bachelor's. Like our editor-in-chief, she is born and raised in Den Bosch. Last year, she was in the Promotion committee and the Freshmen Weekend committee. She loves to go on wintersport and also likes to play tennis. She is very proud of her "Just Dance" skills. Her role model was definitely her father as a child. She thinks that her character is best described by a dog because the more the merrier and when someone goes out, she is always the first one to join.

	Luuk Sommers	Patrick Floor	Aimee Smarius	Casper Heemskerk
Favorite song?	Demons - Imagine dragons	Zombie - Maître Gims	Brabant - Guus Meeuwis	Cold little heart - Michael Kiwanuka
Favorite tea flavor?	Rooibos	Lemon	Anything fruity	Just something fruity
Favorite series?	How I met your mother	3% and The 100	Friends	Breaking bad
Favorite drink?	Beer	Bacardi Lemon with Ice Tea	Cocktails	Affligem blond
First reaction when joining the Nekst?	Hopefully I do not have to write too many articles	Yes, I am excited!!	Yees, excited!	Very excited about the new committee!!

Tamara Dert

Tamara is 20 years old and is from Amstelveen. She is in the third year of her Bachelor's. Before joining the Nekst committee, she has been in the Introduction committee, Econometricians for Society committee, and the EOR Business Dinner committee. Her perfect day is when she is outside with good company while enjoying a constant stream of appetizers and corresponding drinks. She is quite good at finding shitty presents for every occasion and then speech her way out of it. Her most humiliating moment was when she was playing sports and was a little bit too competitive: she tore out of her pants during a tournament in high school.

Troy de Juncker

Troy is 21 years old, born and raised in Tilburg, and he is in the second year of his Bachelor's. Last year, he organized the Active Members Weekend. He likes to play football at Student Sports Association Merlijn and likes to run. His proudest moments thus far are achieving 7th place at the National Championships and qualifying for the European Championships with running. At the moment, he misses traveling the most. In five years, he hopes to either have completed his Master's degree or be in his final year. During the lockdown, he spent most of the time studying and working as a private driver.

Michelle Luijten

Finally, we would like to introduce Michelle. Michelle is currently our coordinator and is the Secretary of the board of Asset | Econometrics. She has just finished her Bachelor's and is planning to start with her Master's next year. She is 22 years old and is from Schinveld, a small village in the south of Limburg. Michelle loves running and she even gets up early on the weekends to go for a morning run. In five years, she wants to learn to drink coffee like a real adult. Her role models in her childhood, like many other girls, were the ladies of K3. She knew every song by heart back then. If money was not an issue, she would buy a car as she would be really glad to drive her own car instead of traveling by public transportation.

Tamara Dert	Jarno Ringhs	Troy de Juncker	Marijn Wolferink	Michelle Luijten
Firework	Goodnight Saigon	Anything of Ed Sheeran or Jon Bellion	Gasolina - Daddy Yankee, since it reminds me of my first parties.	Can you feel the love tonight (Lion King)
Fresh ginger	Earl Grey	The standard English one	Green tea with lemon	Rooibos tea with honey or mint tea with honey
Orphan black	Peaky Blinders	Suits	Game of Thrones until the 6th season	La Casa de Papel, Suits
glass of Riesling(2014)	Brugse Zot	Fuzetea	Long island ice tea	Cocktails
"Top"	Damn, now I have to actually do something for the committee I am in.	Very excited because of the people, but a little scared for all we have to do.	Nice! But I already planned something this coming Monday.	Waaaaah finally able to be part of Tilburg University's most beautiful magazine!

From Barter to Bitcoin

Ridho Hidayat

Graduated Master EME (2018)

Age: 26

In recent years, Bitcoin has gotten a lot of media attention, mainly for its large price fluctuations. Especially in 2017, as the price of the digital currency was rising to new record heights, more and more people were jumping on the bandwagon, hoping to quickly get rich from this hype. This may have left the impression that Bitcoin is merely about price bubbles. However, in this article, I want to dive a little deeper into the economic value behind this digital currency by looking at a much broader concept: money.

Direct and indirect exchange

What is money? At first glance, money seems to be a strange concept. Throughout the world people work 40 hours a week, primarily to see a number on their personal bank account go up. Intrinsically, you could say that this number is meaningless. Even in its physical form of currency, such as banknotes and coins, you could say that money is intrinsically quite useless. You cannot eat it, it does a poor job at keeping you warm, and you will have a hard time protecting yourself from wild animals with a €10 bill. So, what is money exactly, and why is it so important that we are willing to dedicate a large portion of our lives to obtaining it? To answer these questions, we need to look at the function and history of money.

Since the beginning of human history, exchanging value with one another has been a key aspect of any society. For example, one person makes bread, which provides food, while another person makes clothing, which provides warmth and protection. Both are needed for survival, and therefore it makes sense that these people may want to exchange these valuable goods in order to increase their likelihood to survive. The simplest way to do that is by direct exchange, also called barter. In the previous example, the bread is exchanged for the clothes. While barter has always existed throughout human history, it is highly impractical, especially in larger societies. The problem is that there is often a lack of coincidence of wants: what you want to acquire is produced by someone who does not want what you have for sale [1]. A person may not want to exchange his clothes for your bread.

The most logical way to overcome this problem is through indirect exchange. Indirect exchange means that you use a medium of exchange to get the goods that you want. Say you want to exchange your bread for clothes, but the person who has the clothes wants potatoes instead of bread. If you find someone else who wants to buy your bread for his potatoes, you can use the potatoes as a medium of exchange, so that you can buy the other person's clothes. While any good can serve as a medium of exchange, as societies become larger, it quickly becomes impossible to keep track of everyone's wishes. Therefore, it is much more efficient to use a single medium of exchange that everyone uses to trade their goods for. This is the primary function that defines money. It is not consumed, nor used in the production of other goods, but mainly used to exchange it for other goods. Thus, money can be defined as a good that is widely accepted as a medium of exchange.

Salability

In theory, any good could be used as money. So how does one specific good emerge on the market as money that is widely used by society? According to Carl Menger, there is one key property that leads to this: salability [4]. Salability is the ease with which a good can be sold on the market whenever its holder desires, with the least loss in its price. To measure the salability of a good, we can look at three different dimensions: salability across scale, space, and time.

Scale: Can the good be easily divided into smaller units or grouped into larger units?
Space: Can the good be easily transported or carried along?
Time: Can the good hold its value into the future?

This last aspect, salability across time, is the most interesting, because it can be considered to be the second function of money: being a store of value. If money maintains its value over time, it means that it retains its purchasing power and therefore people can preserve their wealth.

If people would store their wealth in apples, they would quickly lose this wealth as the apples rot over time, and rotten apples are hardly worth anything. On the other hand, gold hardly deteriorates, as it does not naturally corrode over time. Therefore, physical integrity, being immune to deterioration, is a necessary condition for salability across time. However, it is not a sufficient condition. A good can still lose its value, even if it does not physically deteriorate.

A good can also devalue if its supply increases drastically, as it becomes relatively less scarce. Money whose supply can be largely increased is called easy money, as opposed to hard money, whose supply is hard to increase. For that reason, hard

money is more likely to hold its value into the future. There are two quantities related to the supply of a good that determine money's hardness:
Stock: the existing supply of the good, consisting of everything that has been produced, minus everything that has been consumed or destroyed.
Flow: the extra production that will be made in the next time period.
The ratio between these two quantities, the stock-to-flow ratio, can be seen as a reliable indicator of the goods' hardness. If a good has a low stock-to-flow ratio, it means that its supply can have a relatively large increase. If it has a high stock-to-flow ratio, its supply is more stable, and therefore the good is more likely to hold its value into the future and be more salable over time. Note that money's hardness can change over time, and with it its salability.

The problem with easy money, money with a low stock-to-flow ratio, is that it falls into what Saifedean Ammous calls the easy money trap: anything that is used as a store of value, will have its supply increased, and anything whose supply can be easily increased, will transfer the wealth from those who hold it as a store of value to those who can produce it at a low cost [1].
Let us take a look at a historical example. For centuries, aggry beads were used as money in western Africa [6], [7]. They were small in size, making them salable across space, they could be combined into chains, making them salable across scale, and most importantly, they were hard to produce in Africa as glassmaking was uncommon there, making them salable across time. When European explorers came to Africa, they quickly learned how valuable these beads were for the Africans. Since they were cheap to produce in Europe, they were made and shipped in large quantities, and traded for valuable resources including gold, slaves, ivory and palm oil. Gradually, the beads lost their hardness, and with it, their purchasing power. However, during that process, the wealth of the Africans who held the beads as a store of value was being transferred to the Europeans who could produce them at a low cost.

The Gold Standard

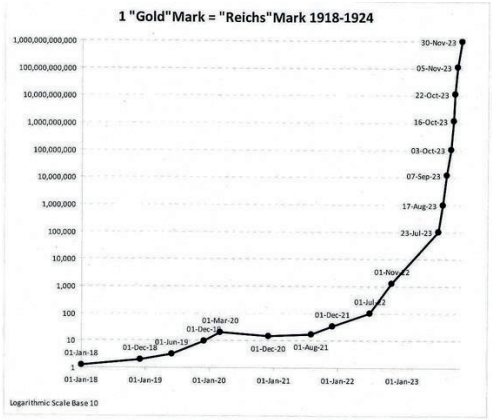
For around 2500 years, gold, silver, and copper were the prime form of money in many civilizations around the globe. Among these metals, gold has always been the most salable across time due to its rarity and its resistance to decay, and therefore the most useful as a store of value. Even today, central banks still hold thousands of tons of gold in their reserves [9]. The reason for that is that gold's hardness has a flawless track record; it beats the easy money trap. Even though people constantly increase the supply of gold for its function as a store of value, it cannot be increased significantly enough to bring the price down. Since the flow of gold is relatively low, due to its rarity, and its stock is relatively high, due to its indestructibility and the accumulation of thousands of years of mining, the stock-to-flow ratio is still very low.

From Ancient Greece to the early twentieth century, gold was mainly used to preserve wealth into the future. However, trading physical gold can be cumbersome. Transferring it can be troublesome, and more importantly, its high value makes gold less suitable for smaller transactions. While silver was used for smaller transactions, due to its lower value, the fluctuating exchange rate between gold and silver created additional trade and calculation problems.

More efficient trading became possible with the invention of new technologies, such as the electrical telegraph in 1837. This made communication easier, which resulted in the switch from a physical gold standard, to a monetary standard of paper. Bank papers were created, which were fully backed by gold or silver which was held in vaults. This was the modern gold standard. Everyone could use these bank papers at any time to redeem their gold or silver. People could simply store their gold in bank vaults and they could make payments of any size with these bank papers and checks, without having to physically transfer the gold. As long as the banks would not increase the supply of papers, gold could serve as the best monetary medium, being salable across scale, space, and time. However, this era, in which gold was chosen by the free market as the prime form of money, ended with the beginning of World War I.

Government money

At the start of the twentieth century, with the invention of modern central banks, governments brought their citizen's gold under their control. The central banks held large gold reserves, while governments issued their own printed money, called fiat money, to the people. This government money became the standard medium of exchange, and citizens were often obliged



Note: 1 "Gold"Mark value in grammes of fine gold (1913) = 0.35842g;
"Reichs"Mark = Currency not tied to the goldstandard in 1918 to 1924.

Source: Law about the Revaluation of Mortgages and other Claims (Revaluation Act 1925), issued the 16th of July, 1925 (Aufwertungsgesetz, Reichsgesetzblatt, Teil I, 1925, p.133-135) and Author's calculations.

Figure 1

to use this money, for instance to pay taxes. It got its salability because it was under av gold standard, meaning that the paper money was fully backed by the gold reserves that were held by the central banks.

However, within a few weeks after the start of World War I, countries that were involved in the war suspended the gold standard. They started printing more money than they could back by their gold. The reason was simple: under the gold standard, governments could only spend what they owned, but by suspending the gold redeemability, they could also spend the wealth of their citizens. For as long as newly printed money was accepted by the population, governments would not run out of money to finance the war. Through inflation, and thus the devaluation of their money, citizens indirectly paid for the war. This allowed governments to wage war for longer than they otherwise could. By the end of the war, the supply of the German mark was six times larger than at the start [2]. This caused the German mark to devalue significantly, making their defeat inevitable. After the war, the value of the Reichsmark devalued a lot further as the German government printed more money to pay for the damages done to other countries. This eventually led to the hyperinflation of the Reichsmark (Figure 1).

While this may seem to be a unique historic event, hyperinflations have occurred more frequently and severely than one may think. It has occurred 56 times since the end of World War I according to Steve Hanke and

Charles Bushnell, who define hyperinflation as an inflation rate of at least 50% over a period of a month [3]. The German hyperinflation only ranks 5th in the world hyperinflation rankings, with a peak of 29500% in October 1923. Zimbabwe takes the second place with a peak inflation of 79.6 billion percent in November 2008, and Hungary ranks first with a peak inflation rate of 41.9 quadrillion percent in July 1946. These are economic disasters that destroy all money savings of a society in a manner of months or even weeks, something which has not happened once in economies that used the gold or silver standard.

While hyperinflation only happens in extreme situations, money devaluation happens continuously now that economies no longer operate under the gold standard. This does not only apply to currencies of third world countries, but for instance to the dollar as well (albeit to a lesser extent), as can be seen in the Figure below [8].

There has been an average annual supply rate of about 6.0% since 1980, and an annual inflation rate averaging at about 3.5% since 1950. This means that the purchasing power of 1 dollar in 1950 is equivalent to the purchasing power of more than 11 dollars today. The reason is simple: the hardness of government money is only dependent on those in charge to not inflate its supply, in other words political constraints. However, there are no natural, physical, or economic constraints to the supply rate. Thus, government money falls into the easy money trap: its supply is continuously increased, and the wealth of the holders is transferred to those who print the money or receive it first. We also see it happening right now, as governments are implementing multi-trillion dollar stimulus packages to face the current economic crisis. While it may help out some businesses, it significantly devalues the currencies in the process.

Since easy money does not hold its value into the future, this incentivizes people to spend it instead of saving it, thereby giving more value to the present than the future. This is called a high time preference, as opposed to a low time preference, in which people give more value to the future. The downside of a high time preference is that it focuses on immediate gratification. In the long run, it would be more beneficial to save resources, accumulate capital, and invest it to raise productivity. This would result in more income and higher living standards.

Bitcoin fixes this

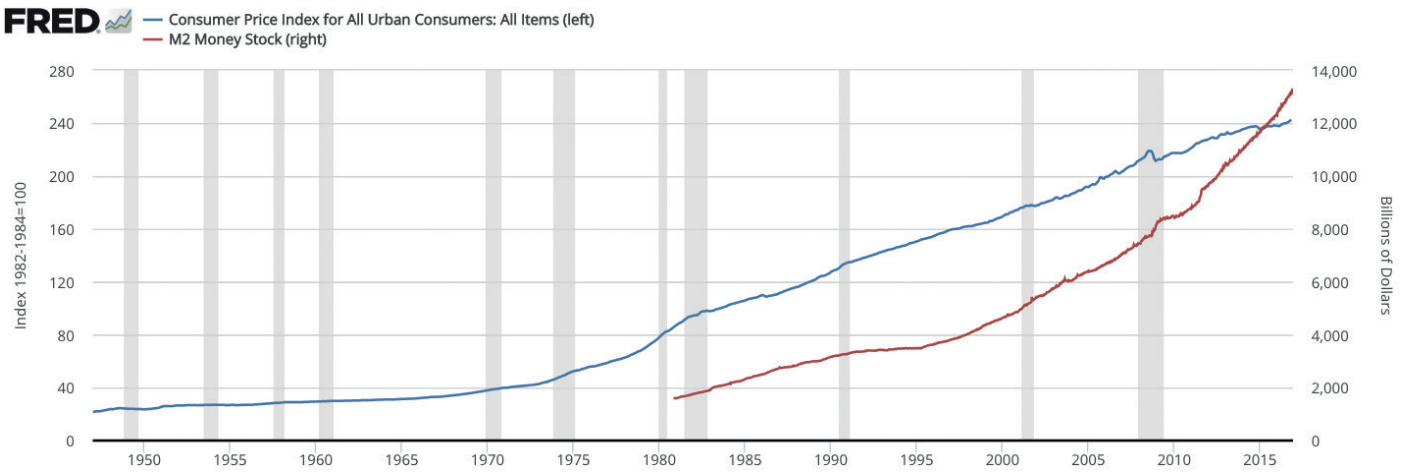
Now, how does Bitcoin fit into all of this? How does this digital money work, and what can we say about its salability and hardness? To quote Yan Pritzker, Bitcoin can roughly be summarized by three different points [5]:

1. A digital asset (typically bitcoin with a lowercase b) whose supply is limited, known in advance, and unchangeable.
2. A bunch of interconnected computers (the Bitcoin network), which anyone can join by running a piece of software. This network serves to issue bitcoins, track their ownership, and transfer them between participants without relying on any middlemen such as banks, payment companies, and government entities
3. The Bitcoin client software, a piece of code that anyone can run on their computer to become a participant in the network. This software is open source, which means that anyone can see how it works, as well as contribute new features and bugs to it.

Let us further break down this summary. First of all, bitcoin is a digital asset, it is a currency that fully operates on the Internet. As such, it is a good that can be easily transferred across the globe, making it highly salable across space. Bitcoin's supply is limited to 21 million coins, each of which is divisible into 100 million units that are now called satoshis (the smallest divisible units), for a total of 2.1 quadrillion satoshis. This makes the currency highly salable across scale, as you do not have to transfer entire bitcoins, but you can also transfer these much smaller satoshis. The big question that remains is: is Bitcoin salable across time? If it is, then Bitcoin is arguably a better form of money than both gold and fiat money, as gold is not very salable across scale (and less salable across space than bitcoin), and fiat money is not very salable across time.

However, answering that question is much more difficult. And even though I will use the remainder of this article to argue that bitcoin is indeed salable across time, and thus a good store of value, it is advisable to read more about Bitcoin to be able to fully answer this question for yourself. That being said, why do many people believe that Bitcoin is salable across time?

The nature of digital objects is that they are not scarce. They can be reproduced endlessly, making it impossible to use them as a



CPI-Urban (blue) vs M2 money supply (red); recessions in gray

Figure 2

currency, because sending a digital object will duplicate it. That is why there is usually a third party involved, such as PayPal, which controls the digital currency, its supply, and the ownership of its coins. The problem is that a third party always adds a security risk, because you not only have to trust them that they do not increase the supply, but you also have an extra risk of theft or technical failure. However, Bitcoin is a game changer, because it does not require trust in third parties, nor can its supply be altered by any other party. The reason for that, is that Bitcoin is built on a foundation of proof and verification, which removes the need for trust completely.

As stated before, Bitcoin is built on a network, and every transaction on the network has to be recorded by every member of the network so that one common ledger of balances and transactions is shared by the entire network. Whenever a sum is transferred from one member to another, all network members can verify that the sender has a sufficient balance, and nodes in the network compete to be the first to update the shared ledger with a new block of transactions roughly every ten minutes. Importantly, the node that commits a valid block of transactions receives a block reward consisting of newly created bitcoins added to the supply, along with the transaction fees paid by the people who are transacting. This process is called mining. In order to commit such a block to the ledger, a node must solve complicated mathematical problems that are hard to solve, but whose correct solution is easy to verify. Only with a correct solution can a block be committed and verified by all network members, which is called the proof-of-work (PoW) system. The larger the network, the more difficult it becomes to make invalid transactions, because a majority of the network needs to come to a consensus on what the state of reality is. Thus, with a larger network, you need to convince more nodes that a transaction is valid.

The quantity of bitcoins that are newly created is preprogrammed, even if more effort and energy is put into its proof-of-work system. This is done through a process called difficulty adjustment, which is the primary reason why bitcoin is hard money, and why the stock-to-flow ratio is low today and remains low in the future. As Bitcoin's value rises, and people use it as a store of value, more effort is put into its production. However, this does not actually lead to an increase in the supply rate. Instead, the difficulty to commit valid transactions in the proof-of-work system increases, and therefore this extra effort only increases the security of the network, not the supply rate of Bitcoin. This makes Bitcoin resistant to the easy money trap, and actually the hardest money ever created: growth in its value does not lead to an increase in its supply, but instead it only makes the network more secure and immune to attack. Therefore, Bitcoin remains to have a lower stock-to-flow ratio than the dollar or the euro, which is why it is likely that Bitcoin's value (measured in fiat money) will increase over time, thus attracting more people to the network who use Bitcoin as a store of value.

The security in the network comes from the fact that there is an asymmetry between the cost of solving the proof-of-work that is required to commit a transaction to the ledger and the cost of verifying the validity of a transaction. Recording new transactions requires an increasing amount of electricity and processing power as the network grows larger, while the cost of verifying the validity of a transaction remains close to zero, regardless of the size of the network.

Bitcoin's consensus rules

Lastly, the question arises: can a person or a group change Bitcoin? Can for instance its maximum supply be altered, the difficulty adjustment be removed, or the proof-of-work system be tampered with? What ensures that Bitcoin remains the hard money that it is right now?

In theory, this is possible, as the software is open source. However, in practice it is highly unlikely. This stems from the fact that Bitcoin is both fully decentralized, and that everyone has a strong incentive to abide by consensus rules. Since it is fully decentralized, there is not a single entity that can change its rules. Furthermore, all participants have an incentive to abide by consensus rules:

1. Programmers will only have their code adopted if other programmers accept their code, which is unlikely if it tampers with Bitcoin's integrity;
2. Miners have to abide by consensus rules to receive the block reward for the resources they spend on the proof-of-work system;
3. Node operators are incentivized to abide by consensus rules because it ensures that they can make transactions on the network.

Every individual is dispensable to the network. Straying away from the status quo is likely to result in a waste of resources. As long as participants benefit from the Bitcoin network, and the benefit from the hard money that Bitcoin provides, it is likely that new participants will come up to replace individuals that strayed away. The consensus rules and specifications of Bitcoin can therefore be seen as sovereign. Bitcoin will only exist according to these rules and specifications for as long as it exists, and altering the rules and specifications becomes increasingly difficult as the network grows. For that reason, Bitcoin can be considered to be hard money, salable over time, and a good store of value.

Conclusion

Altogether, this article has hopefully given you some more insights into the history of money and the potential of Bitcoin. I have merely scratched the surface of Bitcoin, and I advise you to continue reading about the subject, for instance with Inventing Bitcoin from Yan Pritzker to understand the technical basics, or The Bitcoin Standard from Saifedean Ammous for the economic background, which I also used for this article. At last, if you would only remember one thing from this article, I hope it is the following: Bitcoin is not built to quickly make you rich. If anything, it is built to prevent you from slowly becoming poor.

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How a Summer Vacation Resulted in a PhD Position

written by **Nienke Keuning** and **Jarno Ringhs**

With 'The Teacher' we always try to give our readers the opportunity to learn more about the person who stands in front of them a couple of times a week. For this edition of Nekst, we decided that it would be nice to have an interview with Cristian Dobre. Some of you may know him from the Advanced Linear Algebra lectures or from one of the Master courses he teaches this semester. He has been teaching at Tilburg University for two years now, but how did he end up in Tilburg? What did his youth look like? What does he do besides his work at the university? Those are all questions where he gave us an extensive and open-hearted answer to.

About Cristian Dobre

Cristian Dobre is one of the many lecturers at Tilburg University. He teaches several courses, including Advanced Linear Algebra and some Master courses. Next to teaching, he is also an assistant-referee for the Royal Dutch Football Federation. Dobre is originally from the beautiful country Romania where he studied pure and applied mathematics. After his studies, he immigrated to the Netherlands in 2007 for his PhD at Tilburg University. He left Tilburg in 2010 for post-doctorates in Aachen and later in Wageningen. He ended up being offered a lectureship in the latter. Even though he enjoyed his work there, he started teaching at Tilburg University in 2019 after being headhunted.

Study period

Let us go back a few years: Dobre studied in his home country Romania. The Eastern European community differs a lot from the Dutch mentality when it comes to studying. "If you take a gap year before studying, it is financially very painful", Dobre explained. "It does not pay off. There is no way you can sustain yourself." Hence, he went straight into studying after high school. In Romania, he did three years of pure mathematics and then one year of applied mathematics.

However, studying mathematics was not his initial plan. In high school, his desk mate and one of his best friends convinced him to apply for law school together. He bought the books and started studying for the admissions test. However, after two months of studying, he realized something: "I cannot do this. I cannot keep cramming facts. I cannot do something I do not like." So, he decided to try something else. By coincidence, he got into a conversation about applied mathematics and realized the opportunities that this field could give him. Since it is very important in Eastern-Europe to positively distinguish yourself from others, he decided to go the hard way and start with pure mathematics.

During his student years, he worked at a local radio station 'Impulse radio'. He worked mostly during the night, because the work at the station was less intensive in the late hours. This made it possible to spend some extra hours on his study during his work. He stopped in the fourth year, because he could not balance school, refereeing, and work anymore.

Since it is very difficult to imagine how algebra is used in real life, he was very happy to start his Master of Science, where he could see some applications. However, his knowledge of algebraic applications was obtained during his time at different universities rather than during his lessons. In Aachen, while working for a process system engineering department, he learned to apply theoretical mathematics to dynamic processes.

From Romania to Tilburg

In the summer of 2006, Dobre decided to leave Romania. He was preparing to go to business school. However, that summer he went on vacation in Delft to visit one of his colleagues who was doing a PhD there. They met in his office and he was introduced to Etienne de Klerk. Later, he met with him over coffee and De Klerk mentioned a project which seemed like a good

fit for Dobre. So, as Dobre said: "I went on vacation and I left with a PhD position."

Expectations of the Netherlands

We asked Dobre what his expectations were of the Netherlands, to which he answered: "The fewer expectations you create, the less disappointed you are going to be. That is something that always guided me in life." The moment he left Romania for the Netherlands, all he wanted was to get a PhD. In Romania, it is very hard to find resources. There was no money for high-quality research. Also, a PhD from Tilburg University was much more credible in the world of science. However, he had no expectations about the country or the people.

Motivation for teaching

First of all, when he was younger he already knew he wanted to work with people when he grew up. Second, while doing research he would have to focus on one subject for a long time. He told us: "I do not have the patience to stay there, to go to the tiniest detail, and find the results. So, then I chose to do something that I like, to try to inspire people by teaching."

A normal day at the university during a pandemic

Before the pandemic, Dobre would drive to campus only for his teaching obligations. Administration and research can easily be done from home. Now, he still drives to campus to record his classes, but next to that not much has changed. But what does a normal workday look like? "It is waking up, having a coffee, answering emails, and then I check the Canvas pages to make sure all the material is placed for the three courses I teach this block." Then, he has an agenda with a lot of meetings and administration. He also told us: "I look at the clock. If I have started working at 8.30 hours, at 16.30 hours I will close the laptop and put it away. There is always something to do and you drive yourself crazy if you do not stop."

A passion outside of Mathematics

Next to his career at the university, he fills most of his spare time with being an assistant-referee in football. He played football at a high level for a long time during his youth, but when he was 16 years old this came to an end. A severe knee injury made it impossible for him to continue playing his favorite sport. He said: "I was playing football at a high level, but then I got a knee injury. I could run without pain in my knees, but I could not hit the ball. The ball is quite hard. So, I decided to stay on the pitch by starting a career in refereeing when I was 16." Nowadays, he has been a linesman in Dutch professional football for nearly ten years. The first game where he ran the line was AGOVV Apeldoorn against Telstar IJmuiden. The game he remembers the most is a friendly game between AFC Ajax and Steaua Bucharest. Steaua Bucharest is his favorite team and being able to referee them one time was "really nice".
"The most impactful game mindwise" as he describes it, was Excelsior against Feyenoord in 2017. Feyenoord was on the verge of winning the Eredivisie title for the first time after 17 years but lost 3-0. During this game, the referees of course had to deal with an enormous amount of pressure.

Of course, the pandemic also influences his hobby. Due to the regulations imposed by the government, all professional football matches have to be played behind closed doors. When we asked for his experience with it, he said: "My first game in an empty stadium was ten days ago. It was Utrecht-Heerenveen. It was so strange to be in this big stadium of Utrecht with 22,000 empty seats. I get my energy from the stands. When people are shouting and chaos is created, it influences your behavior on the pitch in a very good way. It gives you energy. But hey, we all have to go through this, right?" ●

Cristian Dobre

Bert & Ernie Questions

Student or Scientist?
"Student"
Calculator or Mental Arithmetic?
"Absolutely mental arithmetic"
Stress or Boredom?
"Boredom"
Beach or Mountains?
"Mountains"
Listening or Speaking?
"You have two ears and one mouth. You should listen twice as much as you talk."

Jeu de Boules: a Sport for the Elderly?

On Wednesday September 9, all freshmen were invited to join the Introduction Activity, which was organized by the Freshmen Committee of Asset | Econometrics. During this activity, all first year Econometrics students had the chance to get to know each other in an informal and amusing way. We were namely going to play the amazing game of Jeu de Boules.

When I told my friends from high school that I was going to play the game of Jeu de Boules with the study association, they all reacted a bit surprised: "Jeu de boules is a sport for the elderly, right? Why are students going to play this game?". I did have the same question in the beginning, but I still registered, as the Introduction Activity is of course also meant to get to know more people that study econometrics. Especially now in times of COVID-19, when it is less likely to meet new people outside your TOP group after the introduction week.

At the introduction activity, there were around 45 students who wanted to play Jeu de Boules. Due to corona, we had already been divided into two groups by the Freshmen Committee. One group had to be present at 18.00 hours and the other group at 19.00 hours. When I arrived at the Boules Bites Bar, where the "senior sport" took place, we were told that we had to split up into smaller groups to play Jeu de Boules. I joined a group with all kinds of people that I did not know yet. After we introduced ourselves, we could start playing Jeu de Boules. I was lucky to be on the team with a camping Jeu de Boules champion, so obviously we won. For people who do not know the game of Jeu de Boules, I will give a short explanation. In the game of Jeu de Boules, the goal is to throw or roll the metal balls as close as possible to a small wooden ball (the jack). Sometimes there were discussions about whose metal balls were closest to the "jack", which could be really funny, because some people could get really competitive.

There were also some second year students of the Introduction committee, who we could talk to. I even ran into one of the girls who showed me around during Student for a Day (in Dutch: "de meeloopdag"), which had been a year earlier. It was really nice to catch up and to get some tips about how to survive the Linear Algebra midterm.

During Jeu de Boules we could choose what we wanted for dinner. So after the game of Jeu de Boules we got a tasty burger with a drink. During dinner, we could chat more with our fellow students, which was really nice.

I had never played the game Jeu de Boules before, but it was a nice way to get to know more people. Afterwards, I must say that Jeu de Boules is not only a sport for the elderly, but also for first year students! Overall, I am glad that I attended this Introduction Activity. It was a nice way of spending the evening and the food was good. ●

Elise Hage

Bachelor EOR

Age: 19

The Reproduction Number R

Henk Norde
is a full professor in Mathematics and Game Theory at Tilburg University. His research interests are cooperative and non-cooperative game theory. He has won our own award for Lecturer of the year seven times!

Despite the misery the COVID-19 crisis is causing, it is also a source for new academic activities. Many research projects related to COVID-19 have popped up. For lecturers, in particular mathematics lecturers like me, it brings new practical examples to our classes, illustrating once again the reason why the theory, in particular the mathematics, we are teaching you is indispensable. Nowadays, even our prime minister Mark Rutte and our minister of public health Hugo de Jonge try to teach us some mathematical lessons. I quote from the last press conference "… although the hospitals seem to have enough room today, next week they can be overcrowded. Yes, dear people, that is the problem with exponential growth. …" and "… we must have R = 0.9 for a long time …".

Having mentioned the most famous number today, the reproduction number R, I have to make a confession: I really became a fan of this number. I cannot stop thinking about R. After every potential superspreader event, like the TOP week, the party of Willem II supporters, or the wedding of minister Grapperhaus, I think: Oops, R will go up. Every Tuesday I am looking forward to the RIVM-announcement of its newest value (albeit with a delay of two weeks, a pity of course). Every country has its own R: there is a German R, a French R, and a Belgian R, wow. Donald Trump seemed to have claimed that the United States R is already negative. Some say this could be fake news. By the way, I wonder why we have national R's and no local ones. In my opinion, the Schiermonnikoog R is always 0, whereas the Tilburg R during carnival must have been at least 10.

Obviously, it is clear that R must become smaller than 1. Only then, the number of contagious people is going down to zero in the end. Nevertheless, I think we should try to do more: keep the total number of infections limited. Infected people run the risk to become seriously ill and, if they survive, can suffer from the consequences of this illness for a very long time. Does R = 0.9 reach this goal in the long term? Let us do some simple arithmetic: one contagious person causes R infections in the next period, who in turn infect R^2 people in the period afterwards, who infect R^3 people afterwards, etcetera. So, this one person causes

$$1 + R + R^2 + R^3 + \ldots.$$

infections in the long run. Ah, here we have the famous power series with which we have bothered you a lot in the first year of the program. Of course, you recall that its sum is equal to $1/(1 - R)$ if $0 \leq R < 1$ and infinity if $R \geq 1$ (see page 129 in the reader Mathematical Analysis 1, version 2019-2020). So, if R = 0.9, then this sum equals 10: every contagious person now causes 9 new infections in the long run. If R = 0.8 we will have 4 new infections in the long run and if R = 0.99 even 99! The current estimation of the number of contagious people is about 130000. So R = 0.9 would lead to 1.3 million infections in total, R = 0.8 to 650000 infections, and R = 0.99 results in nearly the complete population of the Netherlands being infected. What value of R do we strive for? Is the statement "we must have R = 0.9 for a long time" a deliberate one or is it simply the first number smaller than 1 that comes to the mind of our policymakers?

My conclusion is that our Outbreak Management Team definitely needs somebody with a background in econometrics. ●

Active Members

The Committee's View

written by **Troy de Juncker**

Last year, I decided to become active at Asset | Econometrics and join a committee. I was placed in the Active Members Weekend committee, which I was very happy with because it was my number one choice. It was good that we had some members that had experience with this weekend, because I did not know how big it really was and what to plan. A few days after being placed in the committee, our first meeting took place.

After we all got to know each other a little bit, we looked at the Google Drive documents of other years. These documents showed us what we all had to do for the weekend and they all gave us the same hint: get the accommodation as soon as possible. So, that is what we did. In the next few weeks, we all went looking for different locations throughout the whole country. After coming to a top 3, we all got together to see which one was our favorite. There was one accommodation that stood out the most and we decided to take a look there. When arriving there and getting a little tour from the owners, it even exceeded our expectations. It was big, clean, had a large outdoor area, and a lot more good stuff. We immediately knew this was going to be our location for the weekend.

Now that we chose the location, it was time to plan what to do during the weekend. We split up the committee into two groups, one took care of Friday and the other of Saturday. Every two weeks we would then come together to show and discuss what we had till then. I was placed in the Saturday group and had to make a big timetable for this day, including all the games and an evening program. After a few weeks went by, we completed the planning for Friday and Saturday. Our plan was to make Friday one big event of getting to the location. Here participants had to travel through different cities in the country to get different hints of where to go next. For Saturday we had some games planned, a lot of them outside on the big fields next to our accommodation. Saturday night we wanted to go to a big party in the village nearby. In the village, there was a big party because of King's Day, which was the Monday after AMW.

Then, in March we got some bad news: because of the coronavirus, we were not allowed to get together with so many people. We decided to postpone the Active Members Weekend from April to September and hoped that by then, it would be allowed to gather with so many people again. Because our accommodation was already booked, our search for a new location began. It was more difficult this time, because most of the locations were already booked. When we were almost about to give up, we found a new location which would suit our weekend nicely. We quickly sent them an email and were able to book our weekend at their accommodation. We decided to keep most of the planning the same, only for Friday we needed to set up a different route for the participants.

Sadly, also this was not allowed anymore, as the regulations regarding the virus were extended. As a committee, we did not want to throw the whole weekend away, so we decided to organize a fun weekend in Tilburg. We also decided to turn the intensity of the weekend down a bit and let all the participants be a bit more free in their choices of what to do. After all, I am very glad we did not give up and made it an unforgettable weekend in Tilburg. I also believe all the participants had a very nice time as well! ●

Weekend

The Participant's View

From September 18 till 20, the Active Members Weekend took place. The main theme this weekend was farm animals, which meant that the committee dressed up as farmers and each group dressed up as their assigned animal. On Friday around 13.00 hours, the weekend started in the Warande forest next to the university. Here we got to see all the groups in their self-made outfits, which was a really cool sight.

During the weekend, the goal was to earn as many points for your group as possible. Points were achieved for all sorts of reasons: At the start, every group got a bucket, a carton box, and an egg. They had to defend these items from other groups to make sure it could be handed in at the end of the weekend. Also, all the groups made a flag, which was worth a lot of points as well.

After the committee explained everything, we started with a crazy 88. We got 88 tasks to do with our group and every task was worth a point. We had to make pictures or videos of every task to show the committee that the task was fulfilled. Every time when 8 tasks were finished, they sent us a hint for the dinner location. Some hints were a bit difficult, but the more hints we got, the more everything started to fall into place. Many tasks and hints later, we finally knew where we had to go: Bet Kolen. Here we had a nice dinner to finish off the day.

On the second day, we started with a cycling brunch. This consisted of two rounds, in one round you had to prepare brunch and in the other round, brunch was prepared for you. For the first round, we had to go to another group where brunch was prepared for us. They made a nice mix of eggs, mushroom, spring onion, and cherry tomato together with some bread. When we were done with our food and almost completely full already, we had to go home and prepare food for another group. We decided to go for pancakes and I believe everyone enjoyed them.

When the cycling brunch was finished, everyone went to Stappegoor for a nice swim. Luckily, the weather was really nice this day and we were able to lay down on the grass area outside. Here, we were free to do whatever we wanted. I decided to play some card games with other students and sometimes, I went inside to dive into the swimming pool. After some nice hours at the swimming pool, it was time to go home, take a shower, and get ready for the evening program.

Around 18.30 hours we were all expected at Vrienden van Tilburg. The committee arranged a barbecue here, which was delicious. When everyone finished their meal, we all went inside where the room was split into smaller game areas. In every area, there was a committee member and two different teams who had to participate in a game. Of course, winning a game earned you points for the group. When we were done with the games, everyone was free to do what they wanted. Like most of the others, I decided to stay and play some more games while being accompanied by some nice drinks and music.

On the last day, we finished off with some lunch in the Spoorpark. This is where the group rankings got announced and we knew which group won the competition. Sadly, it was not us. The winning group got some presents from the committee and the losing groups had to walk around the park while making their animal noise. After this was over, some people stayed to talk with each other and grab some more lunch. I decided to go home as I was tired due to the whole weekend. After all, I can look back at an amazing weekend with a lot of fun people. Thanks to the committee for organizing this weekend and I hope to be there again next year!

Pim van Keulen

Bachelor EOR

Age: 19

Infrastructural Insight After Natural Disasters

In April 2019, cyclone Kenneth hit Mozambique and over 384,800 people were affected [1]. When a UN's World Food Programme worker was asked by the BBC what the main point of concern was, he answered: "The most difficult thing is transportation(...)" [2]. This problem is widespread, as studies by the Red Cross show that an average of 73% of total expenditure in emergency operations is spent in the supply chain, of which "major components of the supply chain related costs were (...) transportation and storage of relief commodities."[3].

Zero Hunger Lab

Tilburg University's Zero Hunger Lab, led by professor Hein Fleuren and Perry Heinen, aims to use data science to contribute to realizing global food security. This offers econometrics students of the EOR department the unique opportunity to use their powers for good. One such application of econometric knowledge on a humanitarian problem is the subject of this practical report.
World hunger can be due to many different causes. Structural food shortages, human conflicts, and natural disasters to name a few. The impact of natural disasters on an infrastructural system is often grave. Population centers can be disconnected from the outside world, where these very cities and towns could be in need of rescue or aid. The immediate classification of the damage done to the road network, and its subsequent impact, can be of great value for first responders.

Figure 1: Natural disaster damage reconnaissance.

Currently, the reconnaissance of the road network has to be done by manual checking, i.e., it has to be carried out by aid workers in jeeps. Identification of an importance ranking of elements in an infrastructural network can give a clear guideline for this evaluation work.

GIS data

In order to efficiently determine the damage done to an infrastructural network by a natural disaster and its consequent impact on the network, we put forward a method to rank the elements that make up the network of interest.

Before this method can be applied to a given geographical location, some prerequisites are needed. First of all, a topological network needs to be modeled based on the real-world infrastructure. In this model, the network consists of nodes and links, nodes being intersections and links representing roads. These links have some basic attributes, being their length and the nodes to which a link is connected. Links can only be connected to another link through a node and all links are connected to two nodes. It is however not necessary for nodes to be connected to two links.
In other words; Let $G(N, M)$ be a network which consists of the set of nodes N with n nodes and the set of links M which consists of m links. No node is connected to itself, and no pair of two nodes can be connected with more than one link.

In an emergency situation, data on a local infrastructural system can be limited. Therefore, any proposed element importance ranking solution needs to be able to perform while using only limited data. The solution proposed in this work, the *Normalized Wide network Ranking (NWRank)* algorithm as proposed by Wang et al.[4], uses only a node-link representation of an infrastructural network to determine a comprehensive importance ranking of elements. This node-link representation of an infrastructural network can quickly and freely be created using open-source GIS data sources such as OpenStreetMaps [5, 6] for instance.

Normalized Wide network Ranking algorithm

A computationally efficient method is proposed by Wang et al.[4], which is based on the spectral analysis of networks for simultaneous node and link ranking. Two methods are proposed; Wide Rank (or WRank) and Normalized Wide network Ranking (NWRank). Both algorithms are based solely on basic topological information, as demanded by our ad-hoc application.

The aim of our method is to assign a ranking score x_i to each node $i \in N$ and a ranking score y_a to each link $a \in M$. The WRank algorithm proposed by Wang et al.[4] simultaneously ranks both nodes and links instead of solely focusing on node ranking. The main premise of the WRank algorithm is that an important node should be pointed at by many critical links (being the L operation in equation 1), and an important link should in turn be attached to critical nodes (being the Q operation in equation 1). This relationship between links and nodes is therefore mutually reinforcing, since one can not exist without the other. The relationship can be represented as follows:

$$x = L(y),\ y = Q(x), \tag{1}$$

where vectors $x = (x_1, x_2, ..., x_n)^T$ consist of the ranking score of each node and $y = (y_1, y_2, ..., y_m)^T$ consist of the ranking score of each subsequent link. The operations L and Q can be expressed in the following matrix representations:

$$x = Wy,\ y = Zx, \tag{2}$$

where W is a $n \times n$ matrix and Z is a $m \times m$ whose entries are given by:

$$w_{ia} = \begin{cases} 1 \text{ if link a points to node i} \\ 0 \text{ otherwise} \end{cases} \tag{3}$$

$$z_{bj} = \begin{cases} 1 \text{ if node j is one of the end nodes of link b} \\ 0 \text{ otherwise,} \end{cases} \tag{4}$$

where $i, j, k, ... \in N$ are nodes and $a, b, c, ... \in M$ are links. W is the transposed matrix of Z and the other way around. Therefore, simply obtaining one of the matrices suffices. The ranking scores of each node and link are obtained through an iterative process, in which every update is represented by t.

If both $x(t)$ and $y(t)$ are used to denote the ranking scores at iteration t, the process resulting in the final solution can be represented as such:

$$x(t+1) = Wy(t) = WZx(t) \tag{5}$$

$$y(t+1) = Zx(t+1) = ZWy(t). \tag{6}$$

Final solutions for x and y converge to the principal eigenvectors of WZ and ZW or to a linear combination of the principal eigenvectors if more than one exists. Although WZ is similar to the adjacency matrix, the diagonal entries are not equal. The diagonal entries of WZ matrix are the in-degrees of the corresponding nodes, which makes this algorithm useful for directed networks. To this end, WZ provides node-to-node connectivity in the diagonal, as ZW provides link-to-link connectivity and link multiplicity on the diagonal. For the diagonal entries of the adjacency matrix, it holds that they are zero, which does not hold for either WZ or ZW.

WRank works well for most types of networks, however, two problems can arise when a network either has nodes of utmost importance or when network flow is considered in the ranking of nodes and links.

The first problem arises when there is a node of high importance which is attached to a large number of links, then in WRank, all of these links also get a high ranking. This, however, is not always desirable since the large number of links makes them dispensable. Therefore, the score received by each link from a node with high importance should be diluted if it is shared with other outgoing links. In a similar way, PageRank[7], which is widely applied by Google in its search engine, dilutes the importance of each outgoing hyperlink from a high importance webpage with $1/k_i$ where k_i is the degree of this 'node'. This approach does not work for WRank however, as all links end up with the same ranking score since they have the same weight k_i. This is not feasible for our application as some links are more important than others.

The second challenge for WRank is that no closed-form solution takes the role of network flow into account, except approximately for Betweenness Centrality. This can be a problem when two subnetworks are connected only through a small number of links.

To address these two problems, Wang et al. [4] expanded the WRank algorithm to include a weight-normalized Betweenness Centrality factor, resulting in the Normalized Wide network Ranking (NWRank). Instead of evenly distributing the ranking score of the node amongst all connected links, it dilutes the score amongst these links proportional to its neighbouring nodes' degree and the Betweenness Centrality[8] (BC) of each link. In this NWRank algorithm, the Z matrix from the WRank algorithm is replaced by the following matrix representation H:

$$h_{bj} = \begin{cases} \alpha \frac{k_b}{\sum_q k_a} + (1-\alpha)\frac{BC_b}{\sum_q BC_a} \text{ if } * \\ 0 \text{ otherwise,} \end{cases} \quad (7)$$

where h_{bj} is the score distribution from node $j \in N$ to link $b \in M$, q is the number of links connected to this node, k_a and k_b represent the degree of end nodes opposite to j of links a and $b = 0, 1, ..., q$. The variable α is the weight coefficient (for instance $\alpha = 0.5$), which can be adjusted according to sensitivity studies.
In conclusion, the NWRank algorithm results in the following iterative process:

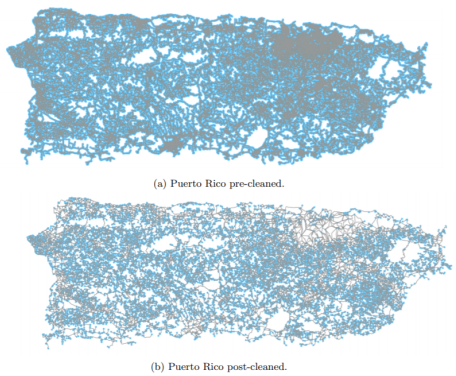
$$x(t+1) = Wy(t) = WHx(t) \quad (8a)$$

$$y(t+1) = Hx(t+1) = HWy(t). \quad (8b)$$

Testcases

To test the methods, as described above, and subsequent implementation on real world examples a number of test cases need to be defined. These cases varied in size and complexity, from a small Dutch town to the country of Jamaica. The first number of cases are of smaller size, and less complex, therefore better suited for intuitive comprehension.

Later test cases are relatively more complex and of much larger size, making interpretation of also more complex. These test cases however offer great value in determining the usefulness of the algorithm for large scale implementation.



(a) Puerto Rico pre-cleaned.

(b) Puerto Rico post-cleaned.

Figure 2: Testcase Puerto Rico, consisting of 14,055 nodes and 38,965 links.

All data is pre-processed and cleaned extensively and various speed-up techniques were explored. This cleaning of the data consists of deleting singular nodes, merging intersections, and double links. Another step in the cleaning process is the deletion of single-path nodes, which are nodes which are not intersections or dead-ends, or in mathematical terms:

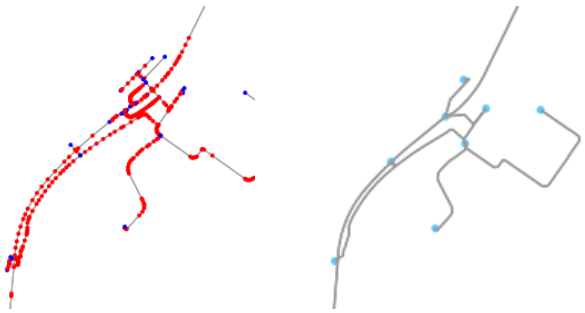
$$I_{ia} = \begin{cases} 1 \text{ if incoming link a points to node i} \\ 0 \text{ otherwise} \end{cases} \quad (9)$$

$$O_{ia} = \begin{cases} 1 \text{ if outgoing link a points to node i} \\ 0 \text{ otherwise.} \end{cases} \quad (10)$$

If for a given node i and link a:

$$O_{ia} = I_{ia} \wedge O_{ia} \neq 0 \Leftrightarrow \sum_{a \in M} O_{ia} = 1 \wedge \sum_{a \in M} I_{ia} = 1 \quad (11)$$

then node i is deleted.



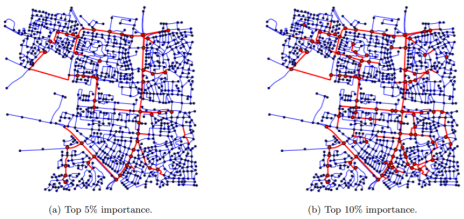
(a) Deleting single-path nodes (b) Post-cleaning network

Figure 3: Network during and after cleaning.

After all these cleaning steps, the test case of Puerto Rico, depicted above, goes from $1,746,464$ links to $38,965$, and from $876,723$ nodes to $14,055$.

Results

The application of the *NWRank* algorithm results in figures such as in Figure 4 below, where a part of Tilburg is evaluated. The elements in red are of increased importance, giving clear guidance to emergency relief workers on which roads and intersections to focus.



(a) Top 5% importance. (b) Top 10% importance.

Figure 4: The results for eastern Tilburg.

From the results, the conclusion can be drawn that the method proposed by Wang et al.[4] performs well on infrastructural networks. The importance rankings produced by the *NWRank* algorithm are of high interpretative value. No behavior of the algorithm and subsequent rankings is found that contradicts the intuitive correctness of the importance figures.
Using the algorithm, clearly interpretable importance rankings of elements can be determined for networks. Additionally, an emergency relief organization can quickly and reliably select the $p\%$ of most important nodes and links to assess damages, thus successfully reducing the number of roads to check.
The mutual dependence of nodes and links further reinforces the interpretability as important nodes are apt to, but not exclusively, connected to important links and vice versa.
This behavior can be explained by the fact that if an important link creates a bridge to an isolated sub-network and the rest of the network, the corresponding nodes are also of high importance. However, not all other links connected to these nodes have to be of high importance, especially if rerouting alternatives are available.

The runtime of the algorithm is relatively small, making the method especially suitable for emergency response situations. Nevertheless, the runtime of the algorithm does grow polynomially with the size and complexity of the network, making the algorithm less suitable for ad hoc use for very large networks. The various speed-up techniques, among which network subsetting, are shown to have potential, and thus give rise to further possible research.

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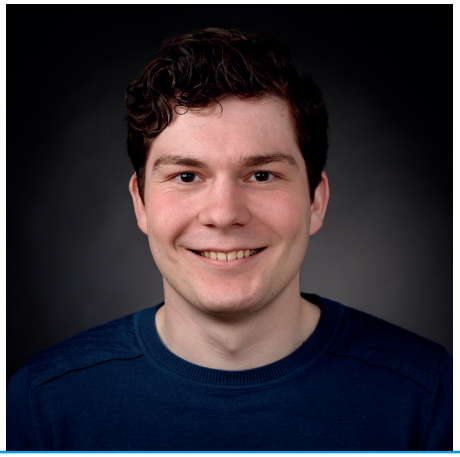


Guus Vlaskamp
Graduated Master BAOR (2020)

From Rookie to Boardie

My name is Linda and after four years of studying and being an active member of Asset | Econometrics, I was finally asked to write an article for the upcoming edition of Nekst. Let me first introduce myself and tell you more about the past years at Asset | Econometrics. I was born and raised near Oss and after the first year of my Bachelor's, I moved to Tilburg. In 2016, I started studying Econometrics, not having any idea about the principles of a study association, and not at all about the definition of being an 'active' member. During a lecture in one of the first weeks, someone who I had met during the TOP week was saying that he would go 'the rooms' afterwards, just to chill and chat with other Econometrics students, and he asked whether Linda van Geffen and I would like to join. Neither knowing where we could find these rooms, nor what we could expect there, we decided that it sounded like a nice idea. In case the people we were about to meet would not be nice at all, we would always have each other.

Of course, we however ended up in one of the usual entertaining afternoons at the rooms, and very soon we got the question whether we would like to have a chat with Anouk about becoming an active member. Not understanding why we had to chat specifically with Anouk about that (turned out she was the Internal Affairs of Asset | Econometrics of the academic year 2016-2017), nor what an active member was, we planned a conversation. Linda and I bargained to have a shared meeting as we thought a one on one meeting was way too intimidating. Three weeks later, I started as the chairman of the Freshmen Committee of 2016-2017, and my career as an active member as Asset | Econometrics was born.

The experiences this brought me were so great that I never decided to quit. After the Freshmen Committee, the Econometrics in Practice Day committee and Econometricians for Society committee followed soon. In September 2019, I started my Master's in Quantitative Finance and Actuarial Science and I decided that next to all those serious businesses, I wanted to do something fun, which brought me into organizing the Active Members Weekend of 2020. As soon as the year started, I discovered that my Master's carried a lot of assignments and study hours and so I started searching for some type of activity which would clear up my mind every now and then. I always loved sports, but the days were becoming colder and darker and my days at the university were even becoming longer. Then a friend told me about CrossFit, which was only one hour of training a day, one hour in which you would definitely give everything of yourself, so that you would be totally cleared-up after your workout. In November 2019, I opened the door of the Cross-

Linda Dekkers

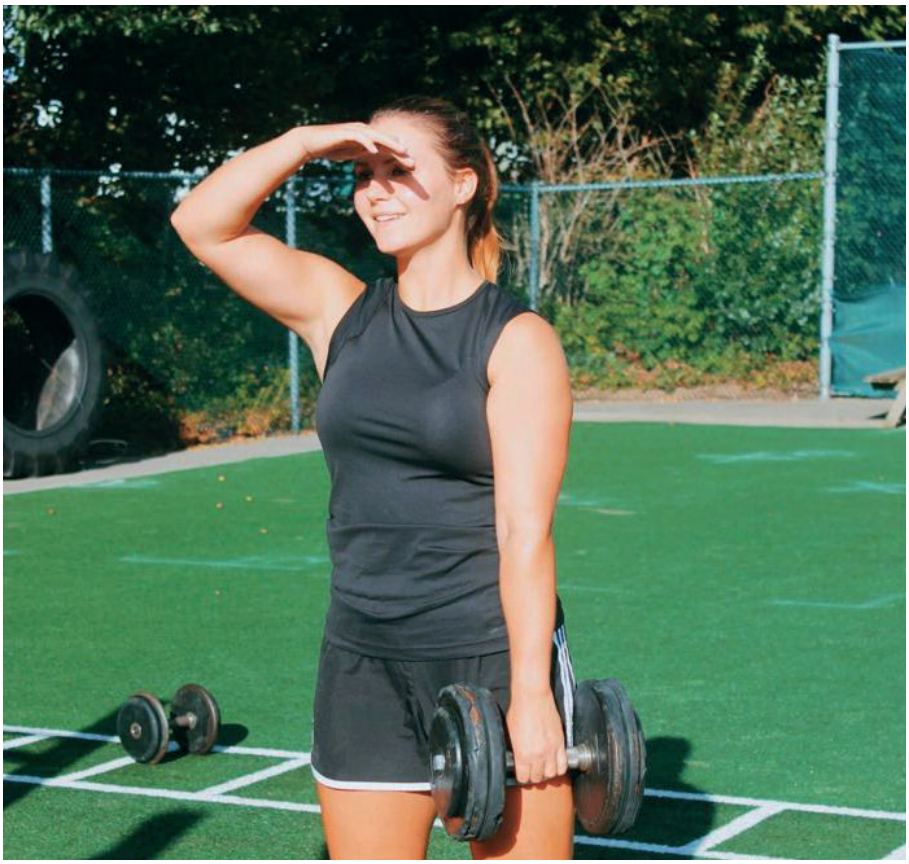
Master QFAS

Age: 22

Fit gym, not having any idea what types of muscular people I was about to meet. By now, you can find me behind that same door literally every evening.

In one of my earlier CrossFit classes, the trainer Bart asked me whether I was still studying. He told me they wanted to set up a Student CrossFit Association, but to get a go from the University Sports Center they had to be with at least 15 starting members. I did not even have to think twice about becoming a member and subscribed immediately for the not yet existing association, which would turn into S.C.A. Fortis soon. In a few weeks, we already had more than 20 members and the board planned the first trainings and social activities. By training and going out together, our group of members became closer and closer, and we were also growing really quickly. CrossFit is a sport that is accessible to all fitness levels, and training will never be boring. Due to the high quality of our trainings and the pleasurable community, a lot of students decided to join already.

The first board definitely succeeded to raise a strong foundation for S.C.A. Fortis, and then the moment had come to pass on the

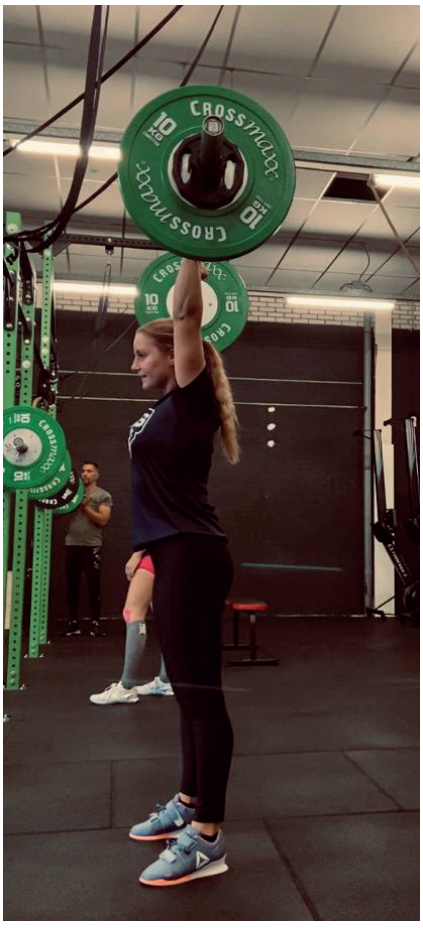


baton to the second board of S.C.A. Fortis. This year, I will fulfill the position of treasurer, and together with chairman Djess and secretary Maysa, we form the board of 2020-2021. The first weeks after we were officially installed started out to be already quite challenging, since corona measures are changing constantly. During this year, we are very excited to further extend our CrossFit community and provide our members with the best CrossFit experiences they ever had. Besides putting a lot of effort into obtaining more training moments a week, we definitely would like to expand the number of social activities of our association, because we want to facilitate that our members (70 by now!) can get as close with each other as we were a few months ago when we were only with around 20 people. Of course, this could become quite difficult in corona times, but me and my boardies are very excited to put in all the effort that is needed to reach our goals!

Certainly, the biggest motivation to broaden S.C.A. Fortis is based on the fact that you see people grow into better athletes throughout the trainings, which is something I also still experience myself. You are not only improving the techniques of your Olympic lifts, but also endurance is feeling easier and easier, you get to know your body and what you can or cannot handle at any point. The goal for every training, week after week, day after day, is that everyone will return home satisfied. Either because you lifted heavier weights than you ever did before, or because you felt your body recovering faster after a high-intensity workout, or because your body gave you the ability to perform a gymnastics exercise which you have never done before. There should always be that one small satisfying element, resulting in the fact that you want to train even harder as soon as you are able to.

One of the other likable aspects of doing a board year at a Student Sports Association (SSV) is that you get to know the boards of all other SSV's as well, which implies meeting a lot of new, inspirational people. During corona times, we all have to fulfill our functions under the same circumstances, and the nice thing about this is that it raises very close contacts with the boards of other SSV's about how to organize corona-proof activities and how to deal with the fact that only a limited number of people is allowed in the Sports Center. In the conversations with the other boards, a lot of new, creative ideas are born and we are certain that as a new association we will learn a lot from other SSV's during the upcoming year.

Despite all circumstances and all upcoming challenges that we will definitely face in the upcoming year, me and my board are looking forward to everything that will come. As most of the SSV's in Tilburg, our board year is only part-time, so next to it I am currently writing my MSc Thesis at Cardano Risk Management. We are in contact with the board of S.C.A. Fortis each day during trainings and socials, and once a week we have a formal board meeting to catch up on everything regarding the association. Besides this, I will also organize this year's Finance Expedition in November, implying that I am also still an active member of Asset | Econometrics. Keeping in mind that after this year I will presumably be graduated, this will be my last committee. After all these interesting activities, I will become a typical hard-working citizen, hopefully with the salary that they promised me at the Information Day of the Econometrics study, so that next to my own CrossFit goals (which I will have to realize with a lot of hard work and training), I will be able to realize all my other future dreams as well. ●



Meet the Board

42nd board of Asset | Econometrics

Chairman

My name is Juul Schuurmans and I am the Chairman of this years' board. I was born in Groenlo, a small cozy city in the Achterhoek, 21 years ago. In 2017, I came to Tilburg to study Econometrics and Operations Research, and I have just completed my Bachelor's degree. Before my board year, I have been an active member of Asset | Econometrics for two years. As Chairman of the association, I have a lot of different tasks. For example, I am responsible for keeping the overview and making sure that everything goes as planned. Furthermore, I am also on the general board of Asset, where my main task is to represent Asset | Econometrics. Besides that, I am also the Acquisition Coordinator, which means that I coordinate all the External Affairs officers of Asset, to ensure that we all collaborate smoothly with one another on the acquisition. In my free time, I like to run, play tennis, read, hang out with friends, and drink some beers from time to time. I really enjoy being a board member and I am looking forward to meeting you all at one of our (online) events!

Secretary

My name is Michelle Luijten and I have just finished my Bachelor Econometrics and Operations Research in Tilburg. Originally, I come from the south of the Netherlands, but I have moved to Tilburg ever since I started with my studies in 2017. After studying and being active at Asset | Econometrics for three years, I felt that a board year was the next step for me to take. As Secretary of Asset | Econometrics, I am responsible for many things, such as the minutes of the board meetings, the website and the social media channels. Furthermore, I also take care of the photos during our events and the administration system of our members. My main goal for this year will be to make sure that everyone knows about Astrics and that everyone feels at home at our association. When I am not busy working on my tasks for Astrics, I like to go for a run, play some board games, travel the world, hang out with friends, and go to all of our events!

Treasurer

My name is Stephan Sparreboom and this year I am the Treasurer of Asset | Econometrics. I will be responsible for all the financial matters of the association. I was born and raised in Koudekerk aan den Rijn, a small village close to Leiden. During my time at secondary school, I played Table Tennis at a national level. Fun fact: I have never won a tournament, all my prize cups are for 2nd place. Nowadays, I am mostly busy with fitness and being a board member of this lovely association. This year, I will coordinate multiple formal and informal committees, keep the bookkeeping up to date, and be responsible for the financial health of the association. Next to the regular tasks of the treasurer, I am also the IT-guy this year. If you have any questions regarding IT-matters, you can always ask me! In contrast to the other boardies, I do not drink due to a medical condition. However, I do enjoy our events a lot! I hope to see all of you during an event or drink soon.

External Affairs

My name is Juliëtte van der Velden and this year I am the External Affairs of Asset | Econometrics. I was originally raised in the lovely city of Geleen but happily moved to Tilburg to start studying econometrics two years ago. Since then, I have been a proud member of Asset | Econometrics and have been active in various committees. This year, it was time for a new challenge; a board year. As External Affairs, I am responsible for multiple things, among which the acquisition of Asset | Econometrics and coordinating and maintaining company contacts. I look forward to meeting all the companies that are interesting for us as econometricians and I hope to give you the chance to meet your dream company at one of our events! Besides spending a lot of time on Astrics, I am also a member of TSV Plato, my sorority Conserva and I play the violin in the Limburg Youth Symphony Orchestra. I really look forward to seeing you all this year, either online or at one of our events!

Internal Affairs

My name is Tjum van Dijck and this year I am the Internal Affairs of Asset | Econometrics! I was born in Spain twenty-one years ago and moved at the age of two to Beek, a village close to Nijmegen. In 2017, I moved to Tilburg and started studying Econometrics & Operation Research. Since then, I have joined multiple committees and visited almost all activities. After studying abroad in Hong Kong for the first semester of 2019-2020, I was ready for the next challenge. I am really grateful for the opportunity to be on the board of the association I love, where I have made friends for life, and have had the best times. As the Internal Affairs, I will be responsible for the Active Members Policy, the education-related matters, and part of the acquisition of Asset | Econometrics. I also represent Asset | Econometrics in the Public Relations meeting and the Acquisition Meeting. The diversity of this function, the contact with the members, the university, and companies, is what I enjoy the most. Besides Astrics, I like to hang out with friends, play football and tennis, and to go out and drink some beers. I am really looking forward to seeing you all this year at our rooms and the events!


ASSET
Econometrics

Who Is Your Boardbuddie?

At the time of writing, the first exams have already taken place, new students are not new anymore and the 41st board of Asset | Econometrics has been discharged. We, as the new board of Asset | Econometrics, do not want to forget the board of 2019-2020. Therefore, we want to commemorate them in this Board-to-Board interview. Get to know all ins and outs about the board year of Denise, Marieke, Bastiaan, Ricardo, and Britte!

written by **Michelle Luijten**

During a board year, you achieve lots of things for the association and yourself. What are you most proud of?

Denise: "I am incredibly proud of my fellow board members, who have been doing their very best to make the most out of it. Even during the COVID-19 outbreak, everyone kept on going and tried to raise the spirit."
Marieke: "I am very proud of the Active Members Weekend committee as they had to change their program so often, but still managed to make it an unforgettable weekend. It really felt like a nice goodbye for us as board of 2019-2020."
Bastiaan: "Personally, I am most proud of the bookkeeping and all the quick methods that I invented for preparing the meetings with the Finance Monitoring committee."
Ricardo: "What did I achieve this year? Hard question… I am most proud of the achievements of my committees. The Econometrics Consultancy Tour was a big success! Next to that, I am very proud of the AMD committee and the trip they organized to the city of Delft. Maybe this was the most fun day during my entire board year because it was substantive, but also a lot of fun!"
Britte: "I am most proud of the way I distributed our members over the committees. I am also very proud of the way we and the new board faced the challenges regarding the sixth board member."

	Typical eating habit at the rooms
Denise	Celery with peanut butter
Marieke	'Broodje knak'
Bastiaan	Noodles and fristi
Ricardo	Pistolets with filet american or roast beef
Britte	Did just not eat anything

What are the most important lessons that you learned during this year?

Denise: "The most important thing that I learned is that it is good to have some fun and to enjoy everything a bit more consciously. When you are always working hard, it is easy to miss out on the fun things."
Marieke: "Hmm… very difficult question. I think I learned most about what I stand for and what I think is important."
Bastiaan: "The most important thing is that you must always try your best. Sometimes, even people working at highly regarded companies also make mistakes. People are just people."
Ricardo: "For me, the most important lesson was that you cannot say "yes" to everything and everyone. It is impossible to do everything, and saying "no" is therefore also important sometimes."
Britte: "I learned that it is fine to take a step back sometimes."

What was the best moment in your year as a board member of Asset | Econometrics?

Denise: "For me, it was having tapas at La Cubanita with the Econometrics in Practice Day committee! The second best moment was the Asset Pre-Carnaval party."
Marieke: "The best moment was definitely the first day of the Active Members Weekend when the committee and I were waiting for the participants, and then suddenly everyone came and all groups were dressed up so nicely. Everybody tried their best, which was very nice to see and made me really proud of our association!"
Bastiaan: "For me, joining the International Business Tour to Mexico City was the best moment of my board year. The hike there was so awesome, it was really an unforgettable moment."
Ricardo: "The best moments in my year were definitely waking up after a night of clubbing, going to the rooms to listen to the beautiful stories of the night before. Next to that, I loved just spending time in the rooms together."
Britte: "For me, two things stood out most: The first moment was going to a super chique Chipsoft Christmas dinner. We were so enthusiastic that we handed out Astrics Christmas cards to random strangers on the train on our way back home. The second moment was the LEST-afterparty in Utrecht. Together with Juul, Luuk and Mylan, I went into a separate, empty room and had our own party there."

Who or what surprised you the most in your board year?

Denise: "I was surprised most by how much fun we had with the boards of the other Asset departments that had their rooms on the same floor in the Esplanade building as we had."
Marieke: "Denise really surprised me as she was never late in the entire year. She was often too early, but never came too late."
Bastiaan: "Ricardo surprised me most in the wonderful way he puts things into words, and how he can set up such polite, but persuasive mails. He really showed how hard he can work and that hard work pays off."
Ricardo: "I was most surprised by the fact that people in the working field also make mistakes sometimes. This shows that people are just people and that everyone can make mistakes."
Britte: "Bastiaan surprised me most as he took care of all of his stuff. He really knew what he was doing and worked hard. Next to that, he was always there when I needed him most, no matter what the issue was that I needed help with."

Board Buddies

	Favorite Astrics promo item
Denise	Astrics gloves
Marieke	Bike lights and the Astrics beach tennis set
Bastiaan	Astrics inflatable chair
Ricardo	I am no fan of goodies
Britte	Cotton bags and the LED folder from 2013 with built-in calculator

Board Buddies

In this part of the interview, we asked the board of 2019-2020 to answer questions about their fellow boardies.

What did you like most about ...

Denise? "We really like the way Denise tells her stories. She is so enthusiastic about telling them and is open about everything. When Denise is in the room, there is always some dancing and singing."

Marieke? "We think that Marieke developed herself very well. She has really opened up and always makes sure that there is a cozy atmosphere. We love her sense of justice and the way she works with all kinds of schemes and time tables.

Bastiaan? "We really like how Bastiaan knows how to fix all his stuff and how much humor he has."

Ricardo? "We like Ricardo for all his typical Ricardo stuff; Ricardo always stays true to himself. He was very self-critical and it was great to be present during his learning moments. We loved all the good conversations that he had with the recruiters."

Britte? "We really liked her passion for the association and her members. She has such a clear vision about the sixth board member and finds her way to work it through. We also admire her perseverance and the way Britte thinks a situation through."

What is the craziest thing about...

Denise? "She can keep talking about her cats and has a huge aversion against sports. The craziest thing that happened once was that Denise entered the room, said many random words, and then started typing."

Marieke? "Marieke once gave us a toothbrush, so that we could all brush our teeth together in the rooms. Marieke always arrived just on time at the rooms and then used the mirror in the ladies' room to get ready for the day. Marieke also once locked a committee in a room."

Bastiaan? "Bastiaan can finish his preparations for the Finance Monitoring committee within three minutes and has some crazy dance moves where he moves his hips very smoothly."

Ricardo? "Ricardo always put all his stuff on other desks, except his own. He also only wants tea if he does not have to activate the water cooker himself."

Britte? "Britte once cut herself on a jar of cottage cheese. She also never uses Google docs, but prefers to upload several Word versions of the same file."

	Favorite candy shop snack
Denise	Never ate anything from the candy shop
Marieke	Redbull and regular Pringles
Bastiaan	Fristi and hot & spicy Pringles
Ricardo	Biggetjes and apekoppen
Britte	Kinder Buenos

What will be the future of ...

Denise? "Denise will be living on a farm together with Daniël. She will be working for RTL and will have two cats and two kids."
Marieke? "Marieke will be working at Vrienden van Tilburg and will still be living the great student life for quite some time. Later, she will be having a part-time job while being a mother of twins. She will be driving in a Jaguar and will still be living in Eindhoven."
Bastiaan? "Bastiaan will be a programmer who will still be working on his Bachelor's. He will probably be living together with Nadia and will have a fridge full of specialty beers."
Ricardo? "Ricardo will be a partner of a big four company and will be living in a fancy penthouse in Amsterdam. He will be working lots of hours, but will make quite some money and will be the proud owner of a wine fridge."
Britte? "Britte will be working for a company in Brabant that is analyzing sports. She will be living in Brabant and will have a relationship but will not be living together yet."

What is your inner teletubbie?

Denise is **Dipsy** as her pointing aerial resembles a dipstick with which she can always eat her beloved snacks with dip. Dipsy loves dancing and being with Laa-Laa.
Marieke is **Laa-Laa** as her favorite thing is to dance and to party with her orange bouncy ball. She likes to hang out with Dipsy.
Bastiaan is like the **Sun Baby** as he was the youngest active member while he was doing a board year. He is also the rising sun with an everlasting smile.
Ricardo is **Po** as he is very clever but can sometimes be a little mischievous. He enjoys signing company contracts together with Tinky Winky.
Britte is **Tinky Winky,** as her favorite thing is wearing something red. She enjoys going for walks and being with Po.

Board Buddies

Fun facts:

Did you know that Denise has a mini heater that does not heat but only smells because it is melting?

Did you know that Marieke called Bastiaan on his phone, who was sitting in the room next door, to tell him what to do?

Did you know that Bastiaan gave a name to all the computers at the rooms? He called them 're ceptie' (reception with a space in between), 'biologisch theehuis' (biological tea house), 'kletshoek' (chat corner), 'cijfer paradijs' (digit paradise), and 'aannemersbedrijf Van Belzen' (contractor company Van Belzen). Can you guess which computer belonged to which board member?

Did you know that Ricardo sometimes bought three pistolets while he only ate two of them? And did you know that he also opens a window from time to time and then walks away?

Did you know that Britte also likes to design flyers?

Did you know that Denise likes to have karaoke sessions, while the other boardies do not enjoy these as much as Denise does?

Did you know that Marieke had to clean the toilets of the hostel after the LED because a member had a little accident?

Did you know that Bastiaan went dressed in panther clothes to the constitution drink of Magister JFT?

Did you know that Ricardo is famous in our association for his turtle imitation?

Did you know that Britte created all the board awards?

Control Alt Elite

written by **Luuk Sommers**

Other than other years, Tuesday September 22 the annual Hackathon took place as an online event. Members of Asset | Econometrics, Asset | SBIT, and D.S.A. Pattern could join this one-day competition and gain insight into some applications of programming. This year's host Ab Ovo prepared an optimization case of a daycare company in the Netherlands. Along with three other students, I participated in this Hackathon and I will lead you through our day.

The day started at 9.00 hours with an online introduction of the Hackathon committee and a presentation of Ab Ovo. They gave us an insight into their company, what they did themselves, and they also talked about several cases that they solved. After this, we received information about the Hackathon's case, which was based on a daycare company problem.

The fictional company From the Egg is planning to open new daycare centers, where they provide daycare to children from 0 to 3 years old. There is an unlimited source of suitable potential employees and parents have already subscribed their children on the waiting list. Unfortunately, not just all children can be accepted in the daycare centers. The children have to be placed in different groups with specific rules attached to the number of supervisors in each group depending on the age and the quantity of the group. From the Egg now wants to know how to divide children and employees across the groups such that profit is maximized. From the Egg does not have the budget to afford licensed software, so everything must be programmed in the cloud. For us, this meant that we could program stuff locally and upload it to the cloud where it was checked automatically by Ab Ovo. They also managed to provide an up-to-date scoreboard with the maximum profits of each group for the three datasets. All teams had until 16.15 hours to obtain the highest profit.

We, as team "Control Alt Elite", started by obtaining a view on the whole problem. We soon found out that the employee regulations were the trickiest parts of the case. Ab Ovo provided a complete scheme with all supervisor regulations for each single year group and mixed year groups. What looked like a structured scheme, was very challenging to implement in a programming language like Python. We had to apply this to three datasets in ascending order of size and difficulty. Even though the first dataset was solvable by hand, it took us already an hour to program this. We quickly proceeded to the second dataset where some simplifications were deleted. Getting a reasonably profitable solution in this dataset took us a few hours, more than we desired.

Because of the time limits, we had to work more efficiently. Something which can be very hard to do, while working together online. We decided to split the group into two tasks: finish the algorithm and make the pitch. Our pitch makers attended a presentation skills workshop called "Story Telling" offered by Ab Ovo. Here, we learned how to give an interesting pitch and convince the clients to choose for our "company". To finish the algorithm, we had to implement the third and most advanced dataset. We really had to rush to write the code for this dataset on time and I think we submitted our final algorithm perfectly on time at 16.14 hours. One minute later we started with the pitches, where every team received five minutes to present their solution to the From the Egg-jury. Together with the Hackathon committee, Ab Ovo ended the day by revealing the Hackathon winners, where we even won the prize for best algorithm.

For me, this was an interesting and unique way to experience a real-life application of a programming problem. Therefore, I want to thank the committee for organizing this amazing Hackathon and Ab Ovo for their enthusiasm and creating this challenging case!

Online Together

You can hardly open an email, internet page or newspaper, or switch on the television or radio without a reference to COVID-19. So does this column. The virus has changed both your daily life as a student and our lives as teachers and researchers considerably.

Just after the first measures against COVID-19 were put in place in the Netherlands, block 4 started. Suddenly we had to switch to online education. As coordinator of the first-year Bachelor course "Introduction to Finance and Actuarial Science", I recorded the lectures in short videos from my bedroom and we interacted online. Now, during the elective Master's course "Empirical Finance", we also have live Q&A sessions which increase the direct interaction. Interruptions from you during a teacher's monologue is what makes teaching most enjoyable, at least for many of us. When you raise questions, we perform at our best. Answering and clarifying a particular issue confirms your genuine interest to understand a specific topic.

On discussion forums or in the chat of live sessions via which you could raise questions about the homework or lectures, the answers are sometimes provided by your fellow students, even before we have had a chance to view it. Passive listening has proven to be a less effective way of learning and less efficient in terms of the percentage of material remembered. At the top of the learning pyramid, we can find the act of explaining something to someone else. Therefore, when you explain something in the chat or forum you are actually helping both your fellow students and at the same time learning the best you can yourself.

Some things, however, have not changed when comparing in-person and online education. When an on-campus class is over, some of you stay a bit longer and approach the lecturer to ask questions about the material or to ask the lecturer's opinion about related discussions such as financial investment decisions or the pension reform. It appears that this behavior also exists online. While lingering around until the online meeting is closed, some of you turn on their microphone when the crowd is getting smaller.

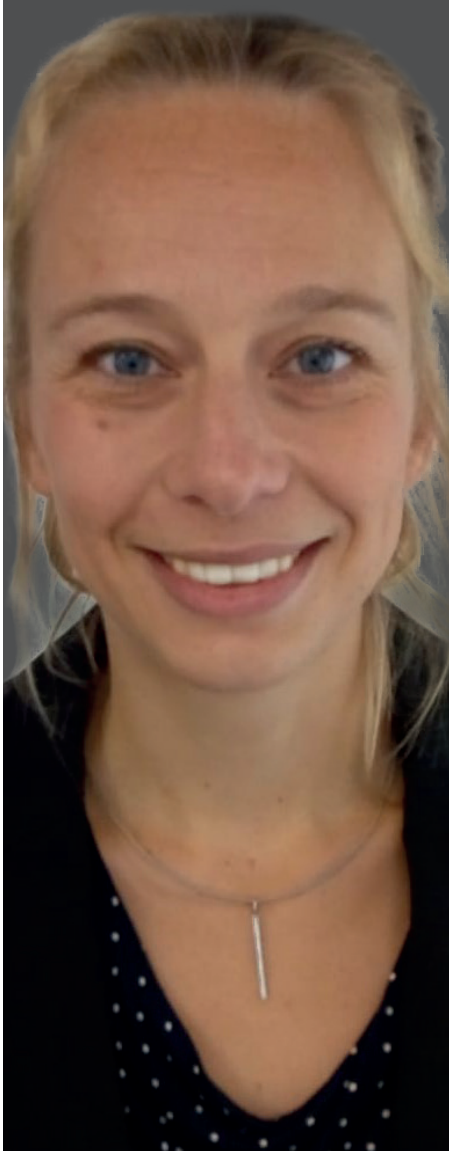
With respect to group size, the smaller the group, the greater the feeling of connectedness. From the five senses that Aristotle proposed, you can easily increase the connection by turning on your camera. Perhaps surprising to some of you is the value of simple body language like nodding when you understand or shaking your head when you do not. Furthermore, hearing a different voice and in particular raising your questions out loud creates a fresh sound. This makes us feel that we are not completely alone sitting next to our bed or in the kitchen, talking to a screen with a list of names.

To increase the quality of the online classes, both innovation and active participation are important. Since the beginning of the 21st century, information technology has been growing rapidly and it has brought us to where we are now. This advancement has created an apparent contradiction: it allows us to study and work in the current circumstances but at the same time life has become more individualistic.

Will this COVID-19 period with a relative lack of social interaction lead to higher rates of mental illness or do we learn from it and does it make us happier eventually? Even before COVID-19, society and in particular younger generations were increasingly relying on online rather than face-to-face interaction. COVID-19 might help us realize that our lives were becoming too digitalized and lonely, and we might crave for down-to-earth physical meetings.

A student life without parties, without making new friends, or exploring the world stagnates the process of developing independence and discovering oneself and others. Can you as an econometrician test whether we are at a structural break in the growth process of individualism? Or will you yourself make the regime shift significantly? ●

Anne Balter
is an assistant professor at the Department of Econometrics and OR and a senior research fellow at Netspar. Her research interests include mathematical finance, in particular robust portfolio problems, pension economics, and real options.



Ortec Finance Talks Real Estate

Coen Ravesloot

Business Specialist Real Estate Management

For this issue of Nekst, we had the pleasure to interview Coen Ravesloot from Ortec Finance. Ortec Finance is a leading provider of technology and solutions for risk and return management in different industries all over the world. As the name already reveals, it used to be part of Ortec. More than ten years ago, they split into an independent firm: "The only things we still have in common with Ortec are: our name and logo style", Coen said. Luckily for us, he has a lot of interesting things to tell us about Ortec Finance and his role in the company.

written by **Tamara Dert** and **Aimee Smarius**

Could you tell us a bit about yourself and how you ended up at Ortec Finance?

"I have been working for Ortec Finance in the real estate department for about three years. How I got there probably started with my choice of study. I was interested in both mathematics and economics, so econometrics was the perfect combination. That is why I started my Bachelor Econometrics at VU Amsterdam. I did not know anything about the ICT side of econometrics and was very surprised to get courses in programming. To be honest, I started studying econometrics without knowing what job I wanted to do later. I decided to do a Master's in the subjects of Operations Research and Econometrics, in the latter I also wrote my thesis. I actually came into contact with employees of Ortec Finance during the 'Landelijke Econometristen Dag' (National Econometricians Day), and we had an instant click. I decided that I wanted to join Ortec Finance and started at the real estate department. I did not know anything about real estate, but to be honest, there is no university study that focuses on this. I saw this opportunity as a fun challenge, but it required approximately 1.5 years to read up on the material. Throughout the process, you gain more and more responsibilities. Also, a lot of econometricians already worked at Ortec Finance and were willing to help me during the onboarding process."

Can you tell us what your function within the real estate department of Ortec Finance entails?

"There are two types of real estate, there is commercial real estate and social real estate (e.g., social rental housing or student housing). Ortec Finance provides different model solutions that support the composition of budgets, market values, simulations, and risk analyses. We focus on housing associations that have to buy a license for a solution in order to use these models. In general, we support approximately 90% of the market. The market is quite regulated by our government, so we also have to keep close contact with the Ministry of the Interior and Kingdom Relations. We also conduct independent research for them, we do for example calculations for the ministry to predict the outcome of proposed regulations in the real estate sector. Furthermore, Ortec Finance is of course active in the consultancy branch: we support companies that we work with to solve their problems. I am a real estate consultant and therefore I mostly focus on giving calculated advice about issues. Additionally, I am working in the research department of Ortec Finance. I think that this ongoing process of solving issues presents you with many challenges, and these challenges in return allow you to develop yourself continuously."

With what kind of people and structure do you work?

"We have a lot of very smart people, mostly econometricians and software developers, but we are also always on the lookout for mathematicians and others with degrees in beta studies, like technical physics and computer science for instance. In the end, Ortec Finance believes that these degrees indicate that you are capable of learning and making the right connections. Together with the structure and training that Ortec Finance provided, these people can really flourish.

Within Ortec Finance, we have less of a top-down hierarchy than other compa-

nies that I have come to know. Immediately at the beginning, I received a lot of responsibility and everyone was really helpful. We mostly work in teams of about eight people. Such a team is then responsible for one or two solution models from A to Z. Within the team, we have smaller project groups that tackle specific problems and tasks. The members of these small teams are interchanged often, making sure you learn rapidly, as you have to work with people from all kinds of backgrounds."

Can you give us an impression about a week in your life?

"Last week was very hectic since we are busy doing research for the ministry. I have been busy drawing up the solution model and making calculations for several regions. The main question that I worked on is, whether there is enough money to pay for the sustainability task that housing associations have. A little while ago, some of the national research that I did, was published and was shown in the news. Usually, the tasks during my week are more diverse: one day a week I work as a kind of helpdesk. Customers with questions about the model or about the extra applications can then call for direct advice or support.

Normally, we work 40 hours a week and we do not work overtime. So, every extra hour you put into your work after hours is voluntary. In my free time, I enjoy playing padel. After work, I often play a match against a colleague at the court next to the office. Besides that, I also play indoor football once every two weeks. When I was a student, I played indoor football on a really high level at a club in 't Groene Hart. Ortec Finance also has a staff association that organizes all kinds of activities. Here you can meet colleagues from the other departments and get to know them a little better. The activities focus on having fun. Ortec Finance even has an annual winter sports vacation that every employee can join."

Ortec Finance has offices all around the world and works internationally. Do you often collaborate with these offices or other firms?

"Ortec Finance is indeed located in Toronto, London, Hong Kong, Melbourne, and Zurich. Nonetheless, our department is situated in the Netherlands with offices Amsterdam and Rotterdam as we only serve Dutch housing associations. Ortec Finance of course also has clients like banks, insurances, pension funds, and gives advice on investment decisions. The departments dealing with these clients operate and collaborate with other countries. Due to the many departments that Ortec Finance has, there are many possibilities for switching functions without leaving the company.

The real estate department of Ortec Finance where I work does not collaborate a lot with other firms. However, we work closely with client firms and have partners that we can use as an extra set of hands. These partners are trained by us and are mostly consultancy firms that sell our solution models to smaller clients. This way we can keep our focus on innovation and creating the best solution models possible. At the moment, we do not have a lot of big partners, nor big competitors, but with this strategy we focus on our biggest assets: our smart people and our brand are known to be big, trustworthy, and experienced. Right now, this seems to pay off as we hold a big part of the market share in the Netherlands in the markets where we have solution models."

How has it been working for Ortec Finance during the COVID-19 pandemic and how do you see the future?

"Within my department, it is going very well; we are doing better than ever. However, as Ortec Finance we are feeling the effects of the pandemic. We see that Ortec Finance still gets steady incomes out of the licenses that last multiple years, but for now, we see that many client firms seem to roll back on their innovation. Often, we help these firms with consultancy, and therefore we now lose some of our work. For

some time last months, there was a stop of new hires and all other procurement projects, but now we are slowly starting to look at the possibilities to restart these things. My department, for example, has definitely proven itself very profitable, even during the COVID-19 crisis and therefore has been granted permission to start hiring again.

For the distant future, I think that we, as the real estate department of Ortec Finance, are safe. Even if everything will be automated and done by computers, consultants are still needed to give advice. Since we also have a lot of analysts who know about both the market and the technology, our department is a proven and useful addition to Ortec Finance."

Have you ever considered a different path for your career, like getting a PhD and becoming a researcher?

"I never really considered studying further by doing research at the university. I think this was a good decision as I would miss the contact with the client, and research seems to be a lot less dynamic than my current job. In fact, I am now switching a bit towards the Advice & Research department of Ortec Finance. I guess in a way, I became somewhat of a researcher after all but in a different setting. For the future, I think that for me, the most important thing is to have a challenging job. I really admire people that know everything about a certain sector, like Johan Conijn for example. He knows everything about the market and is a real expert in his field. The feeling of being so good at what you do, is something that I would love to have. For now, I am pleased to be in a role that is mostly about implementing the solution. Maybe someday, when I have seen more, I would like to have a more executive role to oversee the bigger picture."

How many econometricians are working for Ortec Finance and why is Ortec Finance so interesting for econometricians?

"Econometricians are everywhere in Ortec Finance. The department where the least econometricians work is the real estate department, where I work. Making budgets is not necessarily something for econometricians, but doing risk analyses definitely is. The other departments use more econometric models, that is why more econometricians and mathematicians work there.

Besides, Ortec Finance is a very versatile company and stimulates its employees to experience this themselves. You are welcomed to see and work alongside other departments and really use what you have learned during your studies. Some departments use econometrics to build models to predict the future, but there are also departments that make more use of quantitative finance to perform risk analyses. Switching departments is not an odd thing to do at Ortec Finance. A second great selling point is the people that already work here. Ortec was founded by university students and has always kept close ties with universities to keep the input of young minds and shape them with the experience that we have kept over time. Most people in my team are in their early 30s, I think."

Do you have a last piece of advice to give to econometrics students who are getting ready for the labor market?

"Make sure you know what you want to learn. Grasp the opportunities such as internships, traineeships, but also smaller things like the study association events to see, talk, and have a try in all kinds of different settings. This is, I think, the best way to find what suits you and maybe even more important: what does not. When you start to work, either as an intern or as a starter, it is crucial that you are fearless in asking questions that may feel stupid. I can tell you right now that making mistakes because of bad assumptions is far worse. By being honest to the people around you and giving yourself some time to learn, you will do great in no-time."

Yearbook Committee

The past year, I was a member of the Yearbook committee, which was supposed to end around July 2020. But, like everything this year, things did not go as planned. I will tell you what the committee does and how we approach these tasks.

It all started when we set a goal for ourselves, one that did not seem too hard to fulfill: actually make a yearbook. The Yearbook committee is, as is clear from the name, a committee that makes a book about the past year. Who were our active members, what committees did Asset | Econometrics have, what events took place and suitable for this year; which ones did not, etcetera. Last year, with that I mean the academic year 2018-2019, the Yearbook committee did not manage to produce a yearbook. That is why our goal was nothing more than to provide one for the year 2019-2020. Today, it is October 16 2020 and the committee still has an upcoming meeting to finish off the yearbook.

The reason for our delay is not that we were not motivated enough. March 2020 we started off strong with a meeting in the Esplanade building, working on a mind map and gathering ideas. That great motivation was soon blown away with something that affected us all this year; the coronavirus. We were not allowed to come to university anymore and continued our meetings online. In the beginning, we thought we could do our job via Zoom, but we soon realized that working that way was neither productive nor fun. This resulted in a small break until the situation would become clearer.

In June, we realized that summer was close. Britte made an attempt to book a room in the Esplanade building, but we were simply not allowed to meet there. Luckily, this time in the year corona seemed to cause fewer problems and we were allowed to meet at someone's home. These meetings went on during summer and little by little, the yearbook started to make progress. Nowadays, the yearbook is almost done but a few meetings still need to take place. The committee is finishing up right now and we hope to provide you with this half-a-yearbook!

The Yearbook committee is a fun and creative committee because of the freedom you get. We work together on a book that we get to design ourselves completely. You work on your Adobe InDesign and Photoshop skills, write entire columns, think about fun questionnaires to put in there, and much more. You do not just work together with your team, but now and then, you have to reach out to other students to ask them to write a small part. None of this is necessary, though. It was completely our own initiative to make a Google Form and send it to the active members of Asset | Econometrics. It was us that wanted to include some test results and it was us that decided to make this effort. The yearbook is a product that you can make as easy as possible but put in that little bit extra and it will become something way more satisfying.

Juliette Tillie

Bachelor EOR

Age: 22

We cannot wait until we can share what we have been working on with you. I can now only imagine the reactions we will get, the discussions that are triggered, the happy and maybe some less happy comments we will hear about. Hopefully, the next committee will experience it with the same amount of fun and freedom as we did. So let's give them something to write about!

Incomparable Exchange to Seoul

written by **Jasmijn Aartsen**

Going on exchange during a global pandemic… My exchange experience is somewhat different than others, but luckily I was still able to go on exchange during this pandemic. I have been to South Korea from the end of February until the end of July, where I studied at Sungkyunkwan University in the capital, Seoul.

In January when COVID-19 was spreading around China and the rest of Asia, and everybody in Europe didn't care too much, I was planning my exchange to South Korea. My flight was scheduled for the end of February and at that time South Korea was, next to China, the most infected country in the world. My host university and Tilburg University still allowed me to go, so with some worries from my family, I flew during the Carnival break to Seoul, my home for the coming semester.

On the plane, I already met four exchange students from my university and together we went to our dorms. In Korea, most students live with their parents or in the university dormitories. I lived in a girls flat because boys and girls are strictly separated and not allowed in each other's dorms. We were sharing the room with an assigned roommate. Mine was a girl from the Netherlands and we luckily became really good friends, otherwise sharing a room would have been a more difficult task. Almost everybody arrived on the same dates: the first days the dorms were open, and since the host university made a group chat with all exchange students, we could easily hang out. During the first weeks of my exchange, we met almost every day at a bar close to the university and at all the dorms to get to know all other students. In this bar, we made plans for the day and new friends were made very easily.

Since we came from "the safe Europe", we had to get used to the COVID-19 measures in Korea. There were no strict rules and almost everything was open as usual, but still, the city felt quite different. Due to the coronavirus, the streets in the normally busy city of Seoul were quite empty. Lots of Koreans were afraid of the virus and stayed inside. They also wore a facemask outside almost all the time, while this was not mandatory. We got checked on our temperature several times a day when going in the dorms, big shops, or governmental places. Nev-

ertheless, we quickly got used to how the Koreans were handling the situation and it felt really safe.

Only one time we experienced how the government controls the coronavirus. The clubs had been open and one person was tested positive after going clubbing in one of the main clubbing areas. We had also been there on the same day. You had to write down your phone number at every club you go in, so the government could call and text everybody who was in that area. Not all of us were called, probably because of the handwriting, but still, we all had to get tested because we had been in that clubbing area where one person had tested positive. If we did not get ourselves tested, we would risk a fine of a few thousand euros or we would be sent out of the country. Here, we could see that English is not Korea's best quality. All communication was in Korean and it was difficult for us to find a place where they had time to test us. Once we found it, we had to say where we had been in the area and got our test. The next morning, we all got the results and none of the exchange students tested positive, so this was a big relief since quarantine is mandatory in Korea and they will track your phone if you do not follow the rules.

In the meantime, the virus had also arrived in the rest of the world and a lot of exchange students were sent back to their home country. The Netherlands let us decide for ourselves whether we wanted to return or stay in Seoul. Because the virus was quite under control in Korea, and at home, they still had to figure out how to deal with the virus, I decided to stay in Seoul. Now, we were only left with less than half of the exchange students that would be there originally, but luckily my closer friends stayed too.

The university life was of course different since we had online lectures the whole semester. In Korea, being present during the lectures and participation count in your grades. This meant that we had to watch all lectures within a week to get the full participation grade. There was also a language barrier. My professors could speak English quite well, but the students really struggled with this. This made presentations and debates quite difficult. I followed a lot of data analytics courses and those were mostly focused on programming and processing data. Since the lectures were held online, we got a lot of extra homework assignments to make sure we understood what was going on. All this was mandatory to do and counted quite a lot for your final grade. The exams and midterms were conducted online without that much supervision. Sometimes, you had to put on the camera to make sure you were alone, but the internet was accessible. They trust the students to do the exam on their own. This is because there is a lot of competition between students, only the ones with high grades can get good jobs. The Korean culture is that you want to be better than your classmates, so you will not help them.

Most lectures were recorded, which gave us a lot of freedom to make plans

Jasmijn Aartsen
22 years old
Bachelor EOR

to discover the country. We mostly studied during the first few days of the week and did some fun things during the weekends and evenings. After two months, we had already seen a lot in Seoul, but we wanted to discover more. That is when we started to travel. When we were at home, we studied long days to make sure we had the time to travel during our trips. Also, we planned some free days during our trips to study, especially when it was raining.

Together with a large group of exchange students, we went to the second biggest city in Korea, Busan, to discover a new city, look at the sea and have fun. We flew to the island Jeju, the Hawaii of Korea, for the waterfalls, beaches, and hikes. As we loved the nature in Korea, we went to the most beautiful national park in the east and hiked there for a few days. After the semester, we went to Busan again to enjoy the holidays and the nice weather on the beach. To experience the life of a monk, we went to a temple to stay there for a night. One positive note about the online lectures is that we had all this 'free' time to travel inside the country.

The thing I liked the most was just the daily life in Korea. We went out for food once or twice a day, because the food was so cheap in restaurants. Every international was open and always welcoming you to activities. Moreover, you really stand out in this homogeneous culture, if you are not Asian. So, it is easy to spot other exchange students and English teachers, which made it really easy to contact other people and make new friends. We were able to do so many things. We were there during the cherry blossom season, Buddha's birthday, and we celebrated Kingsday with a large Dutch group. We wore the traditional Korean dresses to a palace, went to the highest tower in Korea, and hiked to the highest mountain. I even danced to K-pop songs and sang in karaoke rooms. There is just too much to tell.

It was not the usual exchange, but an unforgettable experience and I would totally do it again if I have the chance. Going to South Korea was a good choice, I loved the food, culture, and nature and if it was possible, I would love to visit the country again!

Ten Years in Tilburg

Kuno Huisman
is director of business control Twinscan Factory at ASML. Next to that, he is a part-time full professor of decision making under uncertainty at Tilburg University where he teaches courses on professional skills and investment under uncertainty.

I am very honored that I have been asked to write a column in the coming four issues of Nekst. Let me start by introducing myself. I am Kuno Huisman, 48 years old, and I live in Best (near Eindhoven) with my wife Inge, three teenage children, and two dogs. I am working at ASML as Director Business Control TWINSCAN Factory. Next to that, I am a professor of Decision Making under Uncertainty at Tilburg University at the Department of Econometrics and Operations Research.

After finishing secondary school in Hoensbroek (in the beautiful province of Limburg), I moved to Tilburg in the summer of 1990 to start studying Econometrics and Operations Research. Ten years later, I defended my PhD thesis and I started working at CQM in the summer of 2000. Again ten years later, I left CQM and started working at ASML in 2010. This means that I have worked for ASML for a decade now. After recognizing these periods of ten years, I decided that I will dedicate each column to a ten-year time period in my life. I will start the first column with my time at Tilburg University as a student and in the next column, I will discuss my time at CQM. In the third column, I will discuss the first ten years at ASML and in the fourth and last column, I will give my outlook for the next ten years.

In the summer of 1990, I moved to Tilburg. To be more precise, I rented a room in a large student house situated at the Willem II-straat 72. My neighbor played basketball, which was something that I also wanted to do. So after the introduction week, I joined Pendragon, the student basketball association, and started playing basketball. Later, I also became a more active member of the association and I joined the board and co-organized an International Basketball Tournament. Next to basketball, I kept on playing squash on a regular basis.

From an academic perspective, everything went rather smoothly. After one year, I finished my 'propedeuse' and I started with my 'doctoraal' thereafter. I liked Operations Research the most and therefore most of my elective courses were in that area. After four years, it was time to plan the last year of my study. It turned out that I had two options: (1) I could finish my studies in five years and do my one year of military service after that or (2) I could prolong my studies with another year. This meant that I did not have to do my military service because the government decided that the military service would be put on hold in 1996. After a visit to my parents (to arrange the financing), I decided to take the second option and prolonged my studies with a sixth year. In that last year, I did a Research Master in which one of the courses was taught by Peter Kort. For this course, which is called "Dynamic Real Investment" nowadays, we had to write a paper. Later this paper was extended to my Master thesis and eventually my thesis became one of the chapters of my PhD dissertation with the title: "Technology Investment: A Game Theoretic Real Options Approach".

In the student house, I met my wife, who is also born and raised in Limburg. After living together in two rooms in the student house, we moved to an apartment at the Bodehof, which was only 200 meters away. In those years, I spent my holidays in the mountains most of the time, first in France and later on in Austria.

Looking back at those ten years in Tilburg and my life up to that moment, I wrote the first lines of my PhD thesis: "Life is a gathering of coincidences". Not only do these coincidences direct us through time, but they also, at least in my opinion, keep us fresh and make life interesting. In my next columns, I will come back to this as there is more in life than only uncertainty and that is decision making! ●

The Power of Online Engagement

On Tuesday October 6, the Actuary Day Tilburg was planned at the Willem II stadium. A few hours after our supposedly last committee meeting, new regulations regarding COVID-19 were announced, which led us to the decision to reschedule this event to next semester. What would the day have looked like? And what was it like to organize a formal event in times like these?

The Actuary Day Tilburg is an event that is held once every two to three years and aims at informing Bachelor and Master students about actuarial science and connecting them to possible future employers. Since this is such a unique event, the planning of the day, its location, and the acquisition were completely open for discussion. This gave us the opportunity to evaluate our past experiences in order to come up with a new concept of Actuary Day Tilburg. We decided that we wanted to welcome more companies and participants for this edition to be able to introduce more students to actuarial science and to the participating companies. Our efforts paid off and we were able to acquire the Dutch Actuarial Institute, the Dutch Actuarial Society, Deloitte, Milliman, Netspar, and Triple A. Moreover, the online promotion was a success since this year's Actuary Day Tilburg got more registrations than ever before.

This committee started in February 2020 with Abdel Zariouh, Bas Verkaik, Mylan Tran, Ricardo van Belzen, Tim Niemarkt, and me. Hence, the initial decisions about the planning and participants had been made in February and early March after which COVID-19 spread quickly. Consequently, our meetings were continued online (as well as our committee picture), and we started working on different scenarios that took the regulations into account. We updated these scenarios regularly and were in close contact with the participating companies and the location about the decisions that had to be made to ensure the safety of all company representatives and participants of Actuary Day Tilburg. One of these scenarios involved the fact that this is a unique event and being able to organize it in real life would be essential to achieve our goal. Therefore, the decision had been made to reschedule this event rather than switching to an online event.

The Actuary Day Tilburg would have started with morning cases from Milliman and Netspar. This would have been followed by a formal lunch, after which a general presentation would have been held by the Dutch Actuarial Institute and the Dutch Actuarial Society, which would emphasize that there is a variety of opportunities within actuarial science, ranging from pensions to non-life insurances and data science. Thereafter, afternoon cases would have been given by Deloitte and Triple A and the day would have been closed by a networking drink and a formal dinner with Triple A and the Dutch Actuarial Institute and the Dutch Actuarial Society.

Even though our event could not go on as planned, I can definitely recommend being part of a committee in times like these. First of all, joining a committee is fun from a social perspective. We organized several online game nights and after the switch of the board, we enjoyed having the new perspective and enthusiasm that Stephan Sparreboom gave to this committee. Besides that, we experienced that communication is key, especially in times like these. Even though no one knows what is going to happen next, working out scenarios and communicating this to all parties involved, helped us a lot during the preparations of the day. Hence, there was no such thing as a boring meeting. Moreover, this situation challenged us to be more creative and inspired us to come up with our online promotion ideas such as our Actuary Day Tilburg questions in the Instagram story. We loved to see how enthusiastic everyone was during this promotion period and we are looking forward to welcoming you to our rescheduled event on April 29, 2021! ●

Melissa van Wingerden

Master QFAS

Age: 22

ACTUARY DAY TILBURG

Need Study Support?

www.Asset-Econometrics.nl/Study

You can find old exams and more on our website!

Guidelines

- Introduction Analysis and Probability Theory
- Mathematical Analysis 1
- Mathematical Analysis 2
- Probability and Statistics
- Statistics for Econometrics
- Games and Economic Behavior
- Games and Cooperative Behavior

Write a Guideline!

We are always looking for students willing to write a new guideline. For every decent self-written guideline that is published you will be financially compensated up to €150,-. Do you want to publish a guideline? Contact us via Education@Asset-Econometrics.nl!

Give us your feedback!

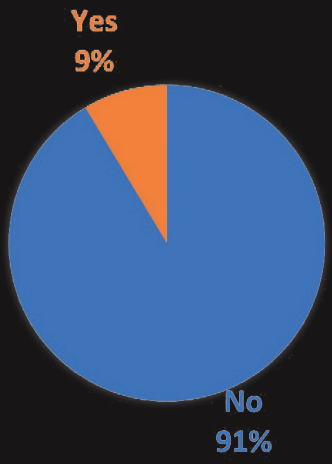
We try to contribute to the quality of the education within the Econometrics department in several ways. For example, we take part in soundboard meetings with the Academic Director(s) and the Program Coordinator. Do you have feedback on one of the Bachelor or Master courses? Contact one of the board members or fill in the Course Evaluation form on our website!

ASSET Econometrics

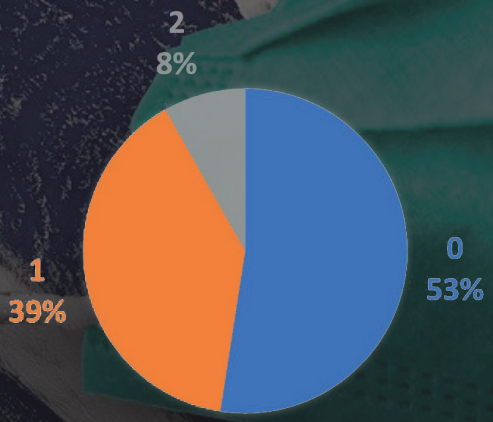
Let's Talk!

If you ever watch the news on tv, read some articles on your phone, or even read a real newspaper, you often see that journalists love to conduct surveys among the people to report how people respond to certain situations. Almost every day, you see graphs, tables, and all other kinds of pictures that display percentages based on the sentiments of the population. Now, during the COVID-19 pandemic, you probably will be no stranger to hearing some newsreaders tell you that a certain percentage of the Dutch population wants mandatory face masks. Hence, we decided to conduct our own research by sending a survey to our fellow students. This edition of Let's Talk will show you what econometrics students think about the current COVID-19 measurements and to what extent they follow these rules.

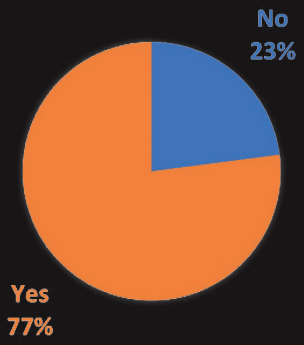
written by **Patrick Floor**



Have you ever been tested positive on COVID-19?



How many times did you test yourself for COVID-19?

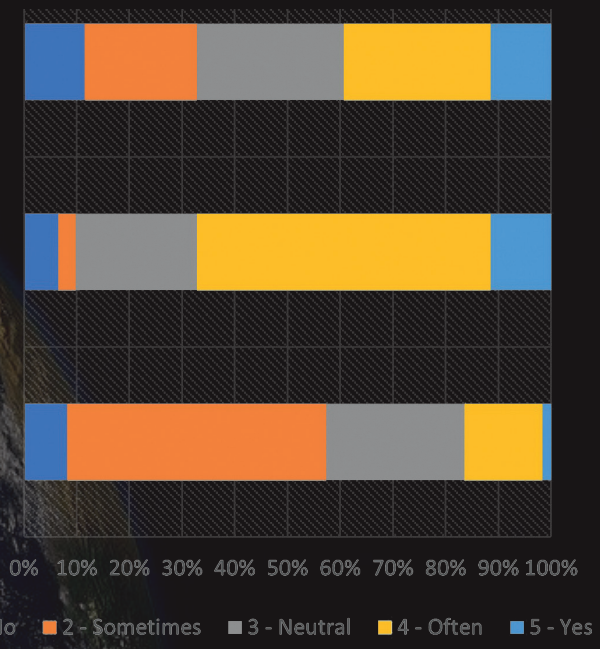


Do you think that face masks should be mandatory?

Do you find it difficult to keep following the advised measures for COVID-19?

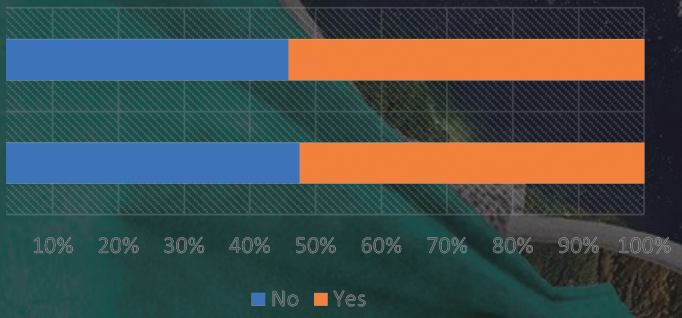
Do you stay home if you have a cold?

Do you always wash your hands for 20 seconds in the correct way?

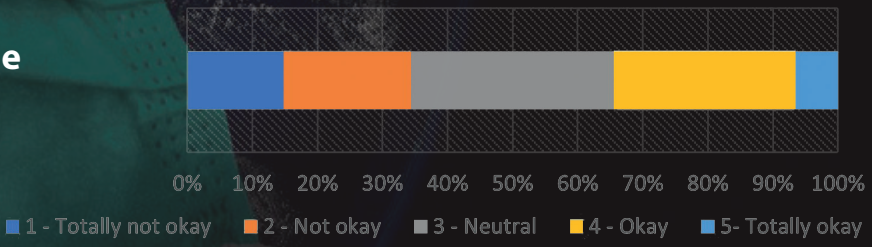


Have you ever been in quarantine?

Have you been abroad during COVID-19?



What do you think of the online lectures?



What is your opinion on online lectures?

"In terms of effectiveness it is very nice, but socially not so much."

"The quality of the lectures has not necessarily been decreased, but I miss the social contact during lectures."

"Not ideal and very individual, but there is not really another option"

"I feel it is fine, given the right contact hours. The lectures are fine and maybe even better online, while tutorials are way better offline and live"

"I like being able to watch the lectures at suitable times."

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

Britte Kragten
"Waarom heb jij een Asset Thirsty Thursday account?"

Ricardo van Belzen
"Om mezelf te liken"

Michelle Luijten
"Heb net uit zenuwen mijn Astrics tasje gestreken"

"Welk land werd in 1975 onafhankelijk?"
Juliëtte van der Velden
"België!"

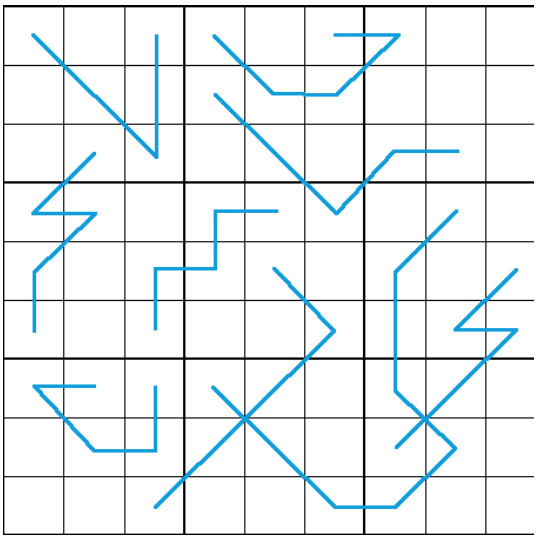
Pim van Keulen
"Krieltjes? is dat vis?"

Mirte de Ronde
"Ik werk nu fulltime bij de Leen Bakker"

Juul Schuurmans
"Zullen we brood halen bij Mirte?"

PuzzleTime

The classic Sudoku game involves a grid of 81 squares. The grid is divided into nine blocks, each containing nine squares. The rules of the game are simple: each of the nine blocks has to contain all the numbers 1-9 within its squares. Each number can only appear once in a row, column, or 3x3 box.



Sudoku 1

An extra rule for the sudoku below is that instead of filling in the numbers 1-9 you have to fill in 9 different letters, other rules remain the same. Fill in the following words on the blue lines: **ADDED**, **ADVENTIVE**, **AWARD**, **AVIAN**, **DRIVE**, **RENEW**, **TIRED**, **TRAIN**, and **WEIRD**. Which nine-letter word can you read in a straight line?

		W	P	Q	L	X	G	
A		O	S	V	B	Z		E
J	D		G	Z	C		P	T
T	N	F		I		K	B	R
W	H	M	L		U	N	Q	C
X	K	E		H		M	S	U
H	V		D	O	G		Z	K
M		T	Y	J	W	D		P
	X	J	F	N	S	Y	V	

Sudoku 2

For this sudoku, all letters and blanks have already been filled in the sudoku except for the diagonals. Multiple letters (and a blank) refer to the same number in a classical sudoku. And all groups have the same size, for example, the letters ABC = 1 are all 1 (DEF = 2, … and YZ and a blank = 9). Solve the sudoku after finding out which letters represent the same number. Also, all letters (and a blank) occur with the same frequency in the sudoku. Which mathematical journal can be found on the diagonals?

Can you figure out the puzzle?

Please enter your solutions at www.Nekst-Online.nl/Puzzle. A goodiebag will be waiting for whoever has sent the best (partial) solutions. Please note that, as before, every recipient of this magazine is eligible to send in their solutions, so members of the department are invited to participate as well. Good luck!

Boyd Werkman is the winner of the previous puzzle. The solution can be found at www.Nekst-Online.nl.

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Tilburg University

EBT Economic Business weeks Tilburg

Agenda

WED 11 NOV – FRI 13 NOV
Online Finance Expedition
On November 11 - 13, you have the opportunity to meet Deloitte, NN Group, and PGGM during our first Online Finance Expedition ever! Every pillar of finance is served: the first day is about Asset Management, the second about Corporate Finance, and the last day about Risk Management.

THU 12 NOV
Econometricians for Society
This event organized by the Econometricians for Society committee focuses on helping those in need who are feeling a little lonely because of COVID-19. The committee wants to help them by having online video conversations and by playing online games with them.

WED 18 NOV
e-House Day with Optiver
Interested in a career at a leading trading firm? Or want to see how a day in the life of a trader is? Join our online inhouse day and hear all about Optiver's job opportunities in Trading and Technology.

THU 19 NOV
Cycling Dinner
If the COVID-19 regulations allow, the D&A committee organizes our annual Cycling Dinner on November 19! During this event, you will be put in groups and have dinner with people you would normally not immediately hang out with. Hence, a perfect opportunity to get to know your fellow econometricians better!

THU 26 NOV
Online Econometrics in Practice Day
This years' Econometrics in Practice Day will look a little different than you are used to, as it will be completely online! During the day you can meet several employees from companies and explore your career opportunities. You can also gain insight into their work and practice your econometrics skills during a case.

FRI 27 NOV
Sports Activity
It is time to get fit just in time before the exams! The sports activity will be fun for everyone, no matter if you love a good night of couch surfing or if you are more enthusiastic about hitting the gym multiple times a week!

TUE 01 DEC
Activity Olden Goldies
Are you a third-year student or older and have you ever heard of the television show 'Ranking the Stars'? Then the Olden Goldies committee has organized the perfect activity for you!

WED 02 DEC
Freshmen Activity
Tired of always meeting the same people during the lectures that are held on campus? Do you want to meet your fellow students who are also econometricians? Come to the Freshmen Activity and get to know all of them!

TUE 08 DEC
St Nicholas Drink
Even though we are currently in a pandemic, St Nicholas will still visit the Netherlands this year. The D&A committee will organize a fun event, such that we will not skip the great holiday of St Nicholas!

TUE 15 DEC
Study Break
Tired of studying all day? Did you know that taking breaks helps you stay focused over a long period? There are only advantages to coming to the Study Break organized by the Promotion committee! You can clear your head for some time and go back to studying afterwards.

TUE 22 DEC
Christmas Dinner
As Christmas is a real family holiday, we would love to celebrate it with the whole Astrics Family. Therefore, all members are invited to join us on our Christmas Dinner to start off Christmas in a fun and chic way!

TUE 22 DEC
Announcement Drink
Curious about the successor of Tjum? And do you already have suspicions about the new External Affairs? You will find out if you are right on December 22, when the new board members are revealed in a very special way!

MON 25 JAN
Department Members Meeting
The new board members will be installed during our semi-annual Department Members Meeting. Tjum will also be discharged as board member, and you will get an overview of how the association is currently doing financially.

MON 25 JAN
Constitution Drink
After the Department Members Meeting, we will thank Tjum for his efforts in the past half year and will give a toast to the new board members!

Register and find more information about our events at
www.Asset-Econometrics.nl/events

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