NEKST

VOL. 26
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THE FUTURE OF FINANCE

THE IMPACT OF BLOCKCHAIN

ALSO FEATURING

- DATATHON: FOOD LOSS & WASTE
- TRIANGLE: ROBUST OPTIMIZATION
- SPECIAL: CRYPTOCURRENCY FOR DUMMIES

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Preface

The Final Stretch

Now that this year's lectures again belong to the past, it is only natural start to look forward to the summer. The freedom of the summer holiday shines like a bright light on the horizon, but if you look past that there is even more Asset | Econometrics greatness in store for you. Coming academic year will be the 8th lustrum of our study association, which translates to lots of events on the agenda. In addition many of you have another great edition of the International Business Tour to Seoul to look forward to!

During the period of downtime and anticipation for upcoming events we are proud to offer you some distraction and literal sustenance with already the last edition of this volume of Nekst. This Nekst revolves around the future of cryptocurrency and its influence on the financial and non-financial business. If cryptocurrencies and blockchain are still foreign concepts to you, do not fear the more in-depth articles, but get up to speed first with these topics in the *Blockchain for Dummies* article. To provide you with a look into the future and application of blockchain technology and cryptocurrency in academics we have interviewed prof. Ron Berndsen. If you are more interested in the business side of things, the interview with Teunis Brosens and Marc van der Chijs is definitely a recommendation.

I would like to thank the entire committee behind this volume of Nekst. Thanks to your endless efforts Nekst 2018-2019 is a volume of which we can be proud of. So, Dominique, Anouk, Zoë, Floor, Ridho, Loes, Aurel, Thomas, Bernard, Charlotte, Ennia, and Linda, thank you all!

Last of all, I would also like to wish all the best to the next Editor-in-Chief and Lay-out editor, Dominique Bavelaar and Bart Rutten, good luck!
For the last time I have the honor and pleasure to express my thanks to you as reader, and wish you a pleasant and entertaining read!

Guus Vlaskamp
Editor-in-Chief

COLOPHON

Nekst is the quarterly magazine of Asset | Econometrics ©2018 Insertion of an article does not mean that the opinion of the board of Asset | Econometrics or the editorial staff is verbalized.

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The impact of cryptocurrency on business is undeniable, yet how great and lasting is this impact really? We ask two business insiders for their insights from different perspectives.

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The Active Members Weekend is possibly one of the most anticipated activities hosted by Asset | Econometrics. An entire weekend revolving around thanking the active members making this association possible. Read all about the themes, teams and adventures!

Become Active!

Special thanks to the Drinks & Activities committee for all the fun events and unforgettable nights throughout the year!

Have you become enthusiastic after the last drinks or one of the activities? Asset | Econometrics has many possibilities to develop your 'soft skills' and to organize different activities. For more information, you can always send an email to info@Asset-Econometrics.nl or visit us in room E1.10 (Esplanade building) to discuss the possibilities!

Find the complete overview of our committees on our website: www.Asset-Econometrics.nl.

Dear Members,

The academic year has almost reached its end, which means that for many of you a well-deserved break is just around the corner. Perhaps you are reading this somewhere on a beach far away from Tilburg, perhaps from the cold halls of the University's library. Wherever it may be you are right now, I am thankful that this message reached you well, so that I get to talk to you about the academic year we shared together - and of course so that you do not forget about Asset | Econometrics during the summer.

People often say all good things have to come to an end. In our case, I would respectfully disagree as even though our year as board of this wonderful association is slowly approaching its conclusion, Asset | Econometrics will always remain the incredible addition to the student life of econometricians it currently is. Our determination to help the association achieve that goal is still as high as it has ever been and your presence at our events and at our rooms still always brightens our mood. It will therefore not necessarily be with joy that we step down from our functions, but the overall feeling of accomplishment we have gathered throughout the year does mean we will be able to do so in an overwhelmingly positive way.

Resigning as the board of this association is made that much easier knowing that we leave it in incredibly safe hands. As you are reading this, you have the luxury of not having to wait any longer for the names of our new candidates. For the academic year of 2018-2019, the candidate board will consist of Quirien Raat (Chairman), Wenxin Lin (Secretary), Jelle Sieben (Treasurer), Joris Piree (External Affairs) and Nina Cuypers (Internal Affairs). Further along in this edition of Nekst, you will find an article written by them of which I am certain that as you read it, you too will share in my confidence that this candidate board will bring an amazing year to the association.

For the upcoming year, it is of even more importance than normally to appoint a strong, competent board as on March 15, 2019, Asset | Econometrics will celebrate its 40th birthday. I would like to already invite all of you to mark the week of April 29 until May 5 in your calendar as this week will be filled to the brim with exciting activities to commemorate our 8th Lustrum. Of course, there will be many more things to look forward to, such as the Actuary Day Tilburg, the new Econometrics Business Dinner and the International Business Tour which will take 24 students to the fascinating city of Seoul. I am sure the new board will tell you about all these amazing events and more!

Finally, I want to take this opportunity to express a heartfelt sense of gratitude to you. Being in the board of this association has made me think a lot about what Asset | Econometrics is. It is not just an organisation that churns out events. It is an accumulation of wonderful people and their contributions, it is a commitment made by every member to make the student life of every fellow econometrician as enjoyable as it can be and it has been an amazing experience for me, Loes, Anne and Rachel personally. If you have at any point during this year been involved with the association, then you have contributed to that and we will forever be thankful to you for it.

It has been an absolute pleasure to spend this year with you.

On behalf of the board,

Jochem Bruijninckx
Vice-Chairman
Asset | Econometrics
2017-2018

Time to Say Goodbye

This will be my last column for Nekst. Not only because I was asked last year to write a column only for this academic year, which has almost ended, but also because I am retiring.

Supervising students

What I enjoyed the most during my academic life was supervising students, and then in particular PhD students. During the supervision you see students growing and becoming more mature, they listen, learn, and come up with ideas. Some are good and other are maybe less good, from which they may even learn more. That also holds for doing scientific research, ninety percent of the ideas do not work or are later improved, but the ten percent of ideas that survive form the basis of publications. Many students are somewhat annoyed in the beginning, because what they propose and discuss is not good enough or has been done by others. You then have to tell them what is good about it and how they could proceed. For Modelling In Practice, or Improving Society Lab as it is called now, the bachelor thesis, and the master thesis, the contact with a student is never more than half a year. Often even much shorter, not more than three months. However, with PhD students the contact is much longer and more intense.

PhD students at TiSEM typically first follow a research master program in either economics or business of two years at CentER after their bachelor or master degree. It aims to teach the fundamentals for research in economics and business, in which you learn the basic tools and theories. During the first semester of the second year you choose from a long list of courses the ones you are interested in. At the end of that semester you choose a supervisor to write a research master thesis. This thesis is often the starting point of your PhD research, and if you are admitted to become a PhD student you have three or sometimes four years to write a dissertation. In this way I have had contact with students during four or more years.

Keeping in touch

Over the years I have supervised PhD students from all over the world, mainly from China and the Netherlands. Most of them stayed in academia and some later on became professor. Two of them, a Chinese and a Dutchman, even at the same university, in York, although within different schools.

With all my former PhD students I still have contact and most of them will visit Tilburg when I leave. Although I formally retire on July 3, when I reach my official retirement age, which happens to be my 66th birthday, I will leave Tilburg University on September 21. That day I will give my valedictory address, at 16.00 hours in the auditorium, and there will be a mini-symposium in the afternoon before my speech. At this symposium three of my former PhD students, one Chinese and two Dutchmen, will speak. The two Dutchmen studied Econometrics at Tilburg University and are therefore alumni of the university. Although I am not an alumnus of Tilburg University, I have been administrator of the alumni association for econometricians (VAET) for the last 27 years. Once a year the VAET organizes a meeting around some EOR-theme. I hope that after you have finished your studies you also become a member and come back to university once a year.

Over the years I enjoyed teaching and supervising a lot and I received many rewards, including the funniest and best-dressed teacher award, but now it is time to retire and make place for younger people. I hope to see you on September 21.

Valedictory address

- **Date: September 21, 2018**
- **Time: 16.00 hours**
- **Location: Auditorium**

Dolf Talman

Dolf Talman is professor of Game Theory and Equilibrium Programming at Tilburg University (TiSEM) and CentER. His expertise is the development, to prove existence and the computation of equilibria in economic and game theoretic models.

Blockchain FOR DUMMIES

Text by: Thomas van Manen

These days there is no escaping cryptocurrency & blockchain. While writing this, cryptocurrencies are undergoing one of the worst pull backs in a year, but for all I know, when this Nekst drops on your doorstep their prices might be going through the roof again. This volatility is one the aspects that lures people to invest in them. With prices rising at lightning speed, no one wants to miss out on making (lots of) money. The underlying technology, blockchain, is one of the hottest buzzwords out there. However, only very few know the inner workings of these phenomena. For all other people, this new edition of "for dummies" will shed some light on the matter.

From Nakamoto to Dogecoin

Before we dive deeper into the workings of the subjects at hand, let us take a step back to look at the start of cryptocurrency. While there had been initiatives earlier, the real start of cryptocurrency as we know it today can be pinpointed to January 3, 2009. On this day the Bitcoin network came to life as the genesis block of Bitcoin, consisting of fifty bitcoins, was mined by its creator Satoshi Nakamoto. He based this network on a paper he had authored a few months earlier, called: Bitcoin: A Peer-to-peer electronic cash system.

Nakamoto (whose identity remains a mystery to this day) had spent the prior year writing the software, partly driven by anger over the financial crisis that occurred around the time. This brings us directly to the core of cryptocurrency. Nakamoto's goal was to create a currency that was immune to arbitrary monetary policies as well as to decisions of bankers and politicians. The problem with conventional currency, according to Nakamoto, was that it requires trust in a lot of authorities to work. Trust in the central banks to not debase the currency, trust in banks to hold the money and transfer it electronically, etcetera. Over the years, all these organizations have breached this trust repeatedly, making traditional currency unreliable.

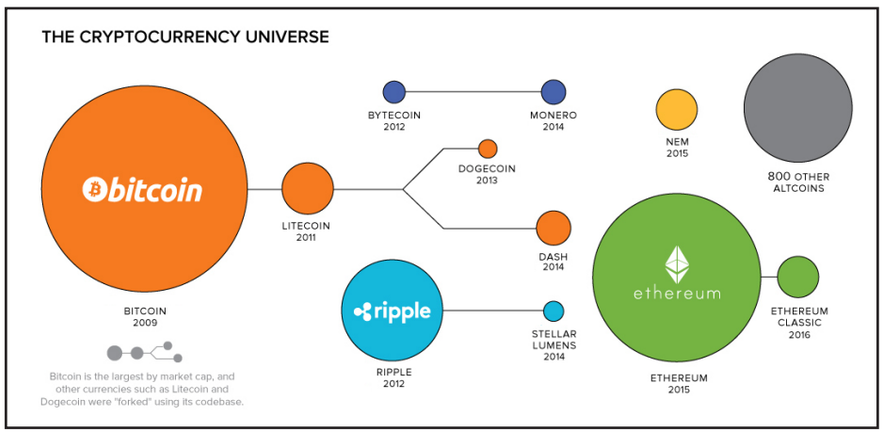
However, banks do more than only the aforementioned. For digital currency, they keep track of the fact that one euro, yen, or Zimbabwean dollar can only be spent once. For cash this is very easy to track, as you cannot spend one physical bill twice. However, without such instances, for digital currency there is a danger that someone can spend the same money multiple times.

This is where the genius of Nakamoto's Bitcoin lies. Nakamoto solved this problem by encrypting each transaction, while also obtaining a public record of every coin's movement that is published across the entire network. The buyer and seller are anonymous, but everyone can see see that a coin has moved from person A to B, and the code prevents person A from spending this coin again. This public record is what we nowadays know as the blockchain.

In the early years of Bitcoin, the transactions were only negotiated by individuals on the bitcoin forum. A notable transaction from 2010 consisted of 10.000 bitcoins to purchase two pizzas from Papa John's. By today's value, these pizzas would be worth more than 25 million euros each. →

'Over the years, all these organizations have breached this trust repeatedly, making traditional currency unreliable'

Soon after this, alternative coins (Altcoins) started popping up. As of today, there are more than 1500 of these cryptocurrencies available on the market These coins are mostly based on the open-source code of Bitcoin and feature all kinds of adjustments to the original Bitcoin. Well known examples include Ethereum, Ripple, EOS, Litecoin, and perhaps the funniest one, Dogecoin.



But how does it work?

Now that we know where cryptocurrency originated, let us get more technical and have a closer look at the inner workings. We will be focusing on Bitcoin as it is the cradle of all current cryptocurrencies.

In essence, a bitcoin is defined by a digitally signed transaction, that can be lead back to the creation of the first bitcoin. The owner of a bitcoin transfers it by digitally signing it over using a Bitcoin transaction, which resembles a bank transaction. This transaction is done by publishing the intention of the transaction to a network of nodes (computers that run the bitcoin software). These nodes check that the sender has the bitcoin he or she wants to send and has not already sent it to someone else. Once the network has confirmed these two things the transaction is included in a block. This block gets attached to the previous block, hence the name blockchain.

Validation of transactions

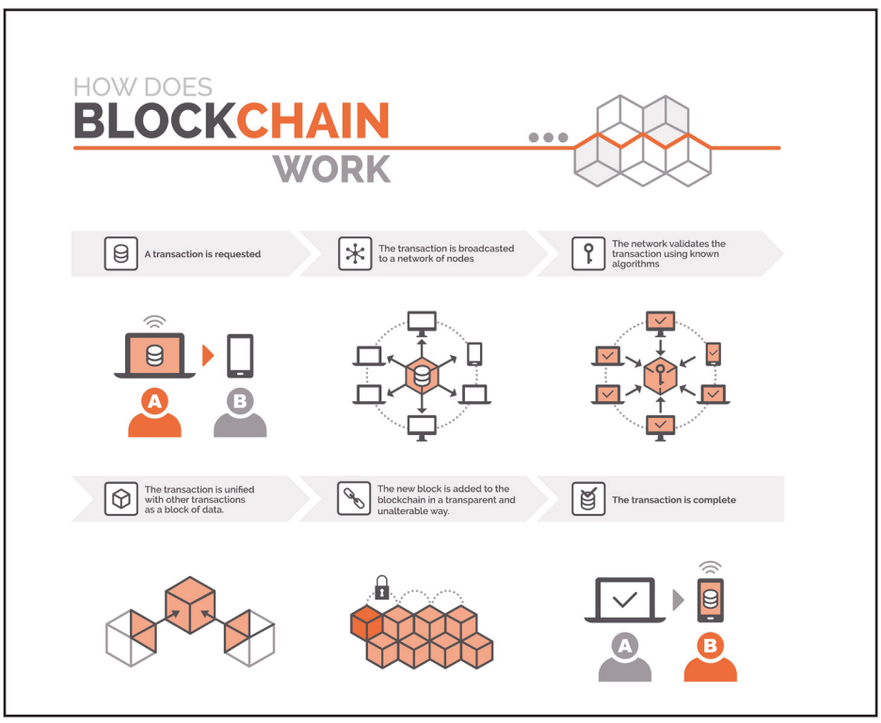
An important feature of the Bitcoin network is the way transactions are validated. You make a transaction using your Bitcoin wallet. However, your Bitcoin wallet does not actually hold your bitcoins. It holds your Bitcoin address, which keeps a record of all your transactions, and hence knows your balance. This address, which consists of a 34-character string, is more commonly known as your "public key". You do not mind that the entire network can see this key. However, each public key also has a corresponding private key, a 64-character string that is private, and therefore secret and safe. This public and private key are related, but there Is no way you can figure out the private key from the public key.

A transaction can then be issued by plugging in the transaction details with your corresponding private key. This results in a digital signature that is sent out to the entire network to check. The network can then check the validity of your transaction because it knows your public key and because all transactions are public on the blocks in the blockchain. Note that the network does not need your private key to do this, and hence your own wallet stays safe.

Blockchain

But what are these blocks we speak of? To answer this question, we first need to take a brief detour and look at a key cryptographic concept called hashing. A "hash" is an object consisting of a certain number of characters created by a hash function. This is a complex mathematical equation that can reduce any amount of data to a string of a fixed number of characters. This is done in such a way that if a particular set of data is put through a hash function multiple times, the same hash will be obtained each time. However, if you change even a comma, your hash will be completely different.

A block can then be defined as an object that contains a number of validated transactions, its own hash, and the hash of the previous block in the chain. The



‘As a reward for finding the correct hash, the victorious miner obtains some bitcoins, at this moment 12.5’

consequence of this is that if only the tiniest part of a previous block is altered, also all succeeding bocks would have to be changed, as their hashes would become invalid. This is very hard to do, since by the time you are halfway done changing all succeeding blocks, there are probably already new blocks added on top of the current one. This makes Bitcoin basically impossible to tamper with. It also makes Bitcoin very transparent, because any person can view this blockchain at any time.

Mining

An interesting question is how we can obtain a hash for each block. The answer to this lies in a term that most people have heard of: mining. Miners are specific nodes in the network that group transactions together into blocks and add them to the blockchain. This is done by solving a complex mathematical puzzle and including the answer in the block. The puzzle they need to solve is to find a number that, combined with the data in the block, when passed through the hash function returns a hash that falls in a certain range.

While this sounds not that hard, it is incredibly difficult. As a matter of fact, it is so difficult that the only way to solve this puzzle is to guess randomly. The hash function makes it impossible to predict an outcome, so the only way to obtain the desired number is by trying lots of numbers and applying the hash function. Since even the slightest alteration in the number can give an entirely different output, there is no way of knowing which numbers will work.

The first miner that is able to obtain a resulting hash that falls in the specified range is announced victorious over the rest of the network. All other miners will stop working on the specific block and start on the next one. As a reward for finding the correct hash, the victorious miner obtains some bitcoins, at this moment 12.5. The difficulty of the calculation is adjusted frequently, such that it takes on average ten minutes to process a block. This is done to allow for a steady and diminishing inflow of new coins over time.

But why does cryptocurrency have any value?

Not that we roughly know how a cryptocurrency network works, a big question remains. How is it possible that currently one bitcoin is worth thousands of euros, while it only exists somewhere in a network? For the answer to this question, we must take a step back and look at the origins of currency. In the very beginning, the value of a certain good or service was determined by the amount of labor needed to produce it. The need to exchange these goods and services led to currency. Initially this was done simply by exchanging these goods and services directly, for instance trading a cow for ten chickens. However, as time went by, other commodities such as gold were being used as medium of exchange. Gold became a currency.

But how did gold get its value? Of course, this did not happen overnight. People spent time and resources in mining this gold, which supported its value. A similar case can be made for Bitcoin, or any cryptocurrency. A lot of people are spending time and resources to build a network of transactions and are rewarded for this with cryptocurrency. Cryptocurrency is produced by the labor it requires to build the blockchain.

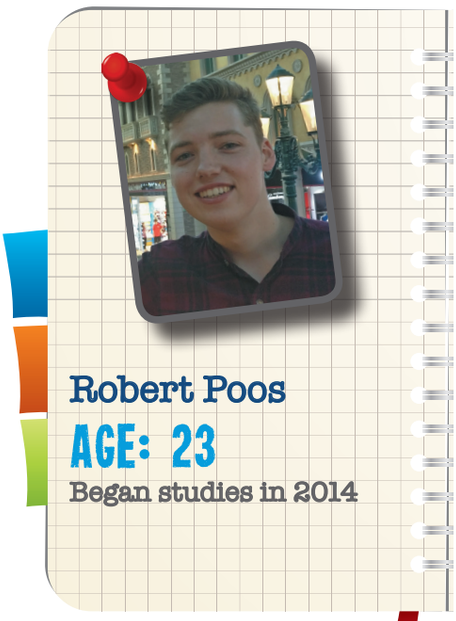
There is still a hole in this story, since spending a lot of time and resources on something, does not automatically make it valuable. Over the past months I have spend a lot of my time and resources on writing my thesis, but whether it will be of any value remains to be seen.

However, using the properties of cryptocurrency earlier in this article, it is quite easy to see why cryptocurrencies have some properties that could make it a very good medium of exchange. The fact that it is decentralized, and therefore not controlled by banks or other authorities, and the fact that all transactions are publicly available, are examples of such properties.

Currently, the value of cryptocurrency stems largely from the fact that people believe in its future value, as it is still very hard to use cryptocurrency as a proper currency. However, the underlying technology is very promising. Innovations like blockchain have applications in all kinds of domains, not necessarily related to cryptocurrency. Do you want to know more about these applications? Make sure to read the rest of this Nekst!

Coffee.Code. Repeat.

Between May 19 and 20 the team of 'Astrics Elite', consisting of econometricians Guus Vlaskamp, Martijn van 't Hooft, Thomas 'Coenraad' van Manen and myself participated in the Xomnia Datahon: Stop Food Loss & Waste.



The Xomnia Datathon is a hackathon where teams of students compete against each other to create the best data-driven solution for a social concern in 24 hours organized by Xomnia, a big data company located in Amsterdam. For this edition of the datathon the theme was 'Stop Food Loss & Waste' and our challenge was to come up with a solution that would contribute to reducing the waste or loss of food.

Since the goal of the event was already known before the start, we prepared ourselves the evening before by brainstorming possible approaches while enjoying some ice cream. The next morning, we left Tilburg by car to the location of the competition in the center of Amsterdam. And, as we found out, the car is not the most practical means of transport in Amsterdam's historical center.

When we did all arrive at the Xomnia office we received our Astrics-blue datathon shirts and together with the other teams got an introductory presentation on the problem we were going to tackle. To help us have a comfortable and productive 24 hours, the organizers assigned us our own office. As it contained a TV, couch and even a hammock (which we might have broken) we could not complain.

After being introduced to the essential things, like how the coffee machine worked, we started our work with the first goal: creating a project plan. While discussing our ideas from the preparations with the domain experts, we learned that most of them were rather ambitious to do in 24 hours. But soon enough we got our 'golden' idea and presented it at the first project check. The judges were not yet convinced, so we had to do some alterations to the idea. After discussing some of the problems with the experts we soon got a good grip on what our solution had to look like and how to get there.

Quickly dividing tasks among the four of us we started working on our solution. While enjoying a lot of coffee, snacks and bopping to the beats of Jacin Trill and Joris Voorn provided by our own DJ Coenraad we coded into the night.

At around 4.00 hours in the night I decided it was time to get some sleep and started inflating my air mattress. My fellow teammates thought the same and we decided to all take some rest. After a quick two hours of dreaming about R code and Shiny webapps I was woken again by the sound of Coenraad's 6.00 hours alarm clock. With help of some double espressos and a quick facewash we were ready to get back at it. With the deadline of 14.00 hours closing in we still had a lot of work to do.

Would you like to join the hackathon team? Contact info@Asset-Econometrics.nl

After a quick update on the status of the model, the webapp and the satellite images it turned out that we had a problem gathering data from the Google Maps API. With some help of domain expert and hero Chris, we could quickly continue gathering all the data we needed. Time was ticking…

Our progress was only briefly interrupted by a quick breakfast where we discovered the existence of ten new types of hummus, and again we continued working like a well-oiled machine. With only a few minutes left on the clock we finished our solution and powerpoint for the final presentation.

When the deadline was there it was time for the presentations. Each group had exactly 180 seconds to present their idea. Our idea was presented by Coenraad where he managed to impress the judges. Unfortunately, the judges were not impressed enough for us to win a prize. The winner of the Xomnia Datathon was the team of Schiphol/Xomnia with their ambitious and innovative idea for a food storage app.

Overall, I very much enjoyed the experience and had a lot of fun during the datathon. Food Loss & Waste was a very challenging subject which gave room to innovative ideas. I am very proud of both our solution GeoCroP and my amazing teammates Martijn, Coenraad, and Guus, who all did a great job. ●

GeoCroP

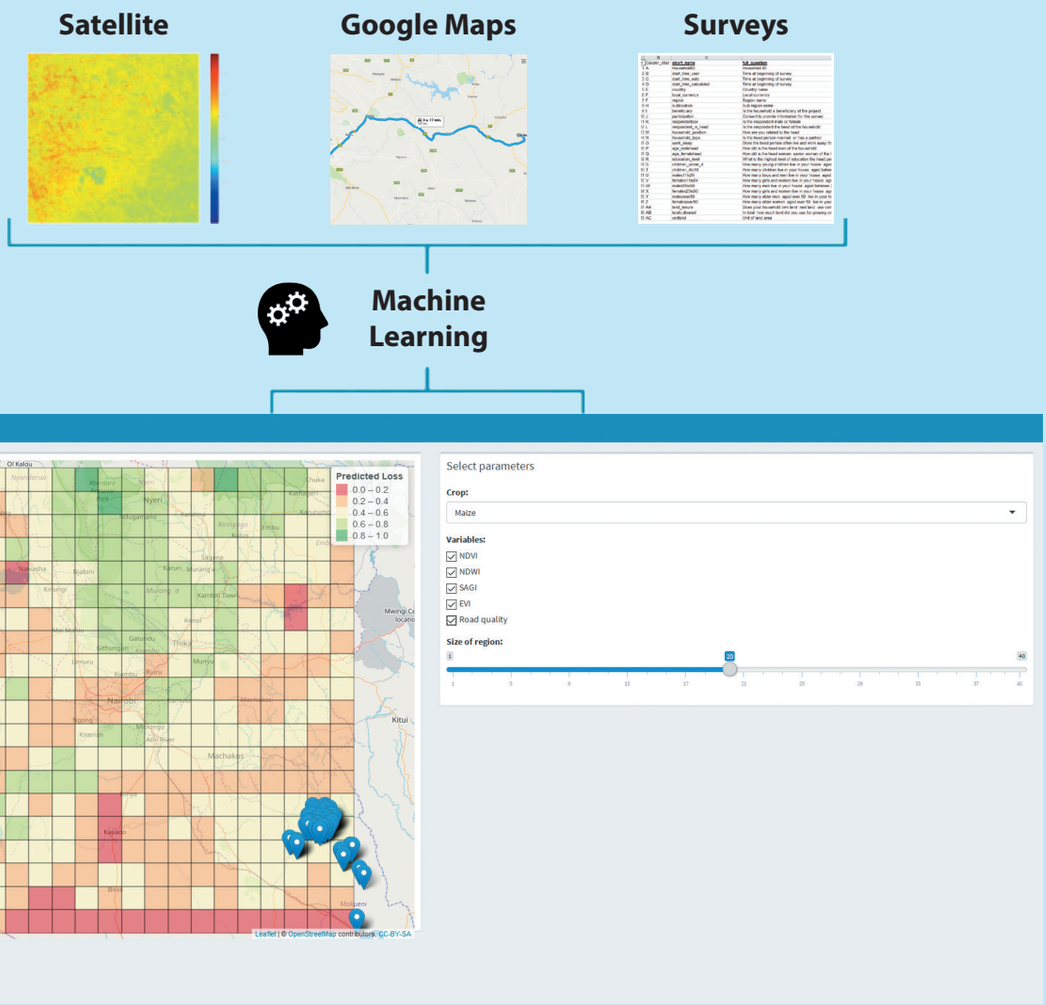
Our solution GeoCroP, which stands for Geographical Crop Placement, is an online webtool consisting of a map with a colored grid overlay. Its goal is to help governments and farmers in Africa selecting the right crop for the right area such that food loss is minimized. The focus of GeoCroP is on the production and harvesting of food, which is the phase in food production resulting in most food loss in Africa.

For each of the grid squares on the map a value of average food loss is predicted for the area inside the square. When food loss for the chosen crop is minimal in the specific area its square turns green and when potential food loss is high the square turns red. This way GeoCroP provides an easy overview on where potential food loss is highest.

The machine learning model behind GeoCroP is trained on existing farms using a combination of survey data of these farms, satellite images of their location and Google Maps navigation data. From the survey data we calculate a food loss score for each farm, which we then use as dependent variable in our model. All farms in the survey data come with their location, so we can link these to satellite imagery of the farms. Data like vegetation health, ground hydration and others are extracted from the satellite images and combined with a quality of infrastructure in the area based on the Google Maps data. These are then used as our 'predictors' or independent variables.

The now calibrated GeoCroP model can be used to calculate a potential food loss score for every area of which satellite images are available. Since we only had 24 hours we decided to focus purely on a square area of Kenia but given that satellite images of every area in Africa are freely available, the GeoCroP model could easily be scaled up to the entirety of the continent. Also, survey data from farms in almost all countries in Africa are made public for a variety of crops which makes extra training of the model and the addition of more crops easy.

The result, as can be seen in picture provides an advice on what areas of a country are suitable for what type of crops such that food loss is as little as possible. This can help farmers determine what crops to grow and can help governments and other organizations designating farm land. The flexibility of the using satellite imagery makes the tool very flexible such that it can be implemented to combat food loss under different circumstances.



Bitcoin as a Payment System?

Ron Berndsen about the financial infrastructure of cryptocurrencies

Some people trade cryptocurrencies just to make a quick profit. Others see it as a way to escape fiscal obligations, whereas some people believe that they invest in the payment system of the future. Even though the overall public excitement seemed to have cooled down over the past couple of months, the existence of cryptocurrencies still forces us to face major, fundamental questions about the way our payment system is designed.

Text by: Dominique Bavelaar

Ron Berndsen

Professor dr. Ron Berndsen holds the chair of *Financial Market Infrastructures and Systemic Risk* in Tilburg and is head of the Market Infrastructures Policy department at the Dutch National Bank. When you look at the names of his positions, you might start to think that he is specialized in financial market infrastructures, and you are right there. I had the chance to have an interesting conversation with him about the payment system behind cryptocurrencies and how this differs from the system that we have adopted in the context of the euro, which we use on a daily basis.

In order to understand the differences in infrastructure design between 'normal' currencies and cryptocurrencies, it is good to first have a look at how the Eurozone payment system actually functions. Prof. Berndsen: "When it comes to payment handling, we consider three different layers: one for consumer and retail payments (1), one for large value payments between banks among each other (2) and one for the trade in financial securities and derivatives (3). When we consider cryptocurrencies, the second layer actually does not exist in this setting: there is no financial institution in the world that performs its transactions in bitcoins."

When it comes to personal finance, cryptocurrencies do play a role, since everyone can acquire and sell them, but the number of shops which actually accept crypto's as a way to pay for their goods is quite low. Therefore, the transaction volume in terms of retail payments is small, but when we look at the total value of crypto's that is traded each day, the buzzing number of €14 billion pops up, which almost equals the Dutch annual healthcare expenses!

Since a few months, also some crypto derivatives showed up on the market. However, they seem to have a rather speculative nature and the variety of products is much more limited than on the ordinary financial market, but futures and CFD's are relatively easily accessible. However, the European Market Authority is currently implementing regulation which makes this much harder, since it considers the highly speculative nature of these products undesirable.

‘When you borrow money from a bank (...) the money you receive is newly printed money’

When it comes to the actual infrastructural design of daily consumer payments in the Eurozone, prof. Berndsen states the following: “When you make a payment by card in a shop at the terminal, the terminal sends information to your own bank that you want to transfer money. Then your bank debits your account and adds your credit sum to a so called mirror account. After that, information is sent to the bank of the shop owner that you have initiated a payment to his account. Then the bank of the payment receiver adds your payment to the shop owner’s account.” A benefit of cryptocurrencies in this case is, that a transfer between two individuals can be handled much faster. “Each transaction has to be verified for which the verifying computer owner gets a reward,” Berndsen explains. “However, the verifying process costs a lot of computer power and is hence relatively expensive.”

A lot of cryptos on the market are linked to or based on Bitcoin or Ethereum, two of the most well-known coins, and their value is also expressed in terms of BTC or ETH. How does that work? Berndsen: “These so-called altcoins (‘alternative coins’, red.) differ in terms of infrastructural design. The code is more or less copied, but the issuer makes an adaptation to, for example, the way of encryption or the verification process.” And how does Ethereum differ from Bitcoin then? Berndsen: “Ethereum aims to be a kind of database of contracts, which trading agents have agreed upon. It has nothing to do with Bitcoin or mining at all!”

Coming back to the fundamental questions about the design of our payment system, I referred to in the first paragraph: the biggest difference between the euro currency and a cryptocurrency, is the way it is issued. Berndsen: “Whereas the euro is issued by the European Central Bank or commercial banks, cryptocurrencies are issued by so called *miners*[1]. For Bitcoin, it is relatively transparent how many bitcoins are issued and are yet to be issued. For other currencies, this is less clear or they use a different algorithm. However, the basis is that new coins are issued in reward for some form of verification.” Regarding this verification process, one actually deals with one central question: what commodity belongs to whom at which moment? Berndsen: “One needs to arrive at consensus about this question. Bitcoin’s mining process deals with this in the extreme case that you do not trust any other counterparty in the world; as opposed to the ‘classic’ situation in which you do business with people who you know at least a little bit.”

“But how are new euros actually issued then?” is something you might have started wondering by now. Berndsen: “You have two main types of money, this holds for every currency in the world: central bank money and commercial bank money. Commercial bank money is, as the name already suggests, issued by commercial banks: when you borrow money from a bank, for example if you want to buy a house, the money you receive is actually newly printed money. Of course this is bound to restrictions, but that is basically how it works. In case of central bank money, the central bank opens a kind of auction for all Eurozone banks in which they can bid for which interest rate they want to borrow that money.”

Also the question what money actually is, becomes relevant: “In economics, money is generally defined by three characteristics: a medium of exchange, a storage of value and a unit of account.”, Berndsen explains, “Cryptocurrencies can definitely function as a medium of exchange and as a unit of account. However when it comes to storage of value, cryptocurrencies lack the stability in value that is needed to be of use as a reliable payment system. ”

“Saying something about the intrinsic value of a cryptocurrency is quite hard,” Berndsen states. “Saying that the complexity of the blockchain *puzzle* that needs to be solved for a transaction is a measure for the value of a currency is not true: the puzzle and its solution themselves have nothing special about it, rather than just being complex. →

[1] See Blockchain for Dummies on page 7.

The only way to quantify the intrinsic value of a cryptocurrency is to evaluate how well it would function as a way of payment in the future[2]. In case of the Bitcoin currency, I am quite sceptic about adoption by the general public. However, Ripple has- in principle- more potential in this respect, since the company behind this aims to be a kind of 'intermediate player' between all possible cryptocurrencies." Since liquidity on the crypto exchange market is far from guaranteed, Ripple aims to make it possible to convert your crypto's to another kind of cryptocurrency (for example, to trade Zcash for cryptoguilders[3]). Berndsen: "However, for the transactions Ripple performs, the Ripple coin itself does not have to be used, so also here it is not clear at all."

When speaking about usage of crypto's in the future, Berndsen notes the following: "I am not among the people who claim that crypto assets are just a hype, which will cease to exist in a few years from now. Especially since interest rates are very low nowadays, people will still be tempted to invest in cryptocurrencies as an alternative to regular stocks or bonds. I do not consider it realistic nor desirable though, that ordinary consumer transactions will be done in, for example, bitcoins in the near future." The latter mainly because of, as indicated earlier, the absence of value storage within a crypto currency and the fact that the costs of a transaction are relatively huge.

Another drawback of cryptos in general, in the current situation, is liquidity: "At the moment, there are hundreds of different coins, most of which have a really small market capitalization. In such a setting, it is not attractive for big players to buy and sell such currencies, since they are much more sensitive to demand or supply shocks than ordinary stocks and bonds. So when you have invested in such a coin, it is hard to get your money out of it, since when you offer them for sale the price drops dramatically."

'A major benefit of a cryptocurrency like Bitcoin, is that transactions are not bound to place nor time'

There is an edge that crypto's have over ordinary currencies, though: "A major benefit of a cryptocurrency like Bitcoin, is that," Berndsen states, "transactions are not bound to place nor time. You can transfer bitcoins anywhere, anytime and the second after you made your order, the bitcoins are already transferred. In contrast, when you transfer euros, no matter whether you pay by card to a shop owner or if you pay back your friends by Tikkie, your transaction first needs to be verified by the bank, which also has limited opening times, and hence it takes at least a day before the transaction is officially settled. Until that time, it holds the so called 'reservation' status."

However, the European Central Bank is working on this: "There is a project going on, which aims to make those instant payments possible for euro transactions as well.", Berndsen states, "The ECB was working on this already, but because of the emerge of cryptocurrencies, the urgency of the project has been increased."

When it comes to blockchain, the technology behind a crypto transaction, Berndsen sees some opportunities[4]: "When it comes to cybersecurity or supply chain management, a lot of companies see Blockchain of potential use. It is also a transparent, efficient and safe way to store information, so institutions, also in the non-financial sectors, investigate interesting applications".

We hence see, after all, that, even though cryptocurrencies might not be a replacement for our current payment system, the existence of cryptos and the way they address inefficiencies which exist nowadays still brings interesting challenges to improve our financial sector. We would like to thank prof. Ron Berndsen for his time and useful insights.

' In case of the Bitcoin currency, I am quite sceptic about adoption by the general public'

[2] In the interview with Teunis Brosens on page 17 you can read more about this!
[3] The informal 'crypto version' of the Nederlandse Gulden, the Dutch pre-euro currency.

Lucas Jacobs
AGE: 20
Began studies in 2015

Build your Network!

From Monday April 9 until Friday April 20, the 20th edition of the Economic Business weeks Tilburg (EBT) took place. During these two weeks, students from TiSEM are given the opportunity to get to know companies via multiple ways: company presentations, workshops, individual conversations, business lunches, informal activities and training, orientation, and case days.

The opening of the EBT took place before April 9 actually, namely on the evening of Tuesday April 3 at the Auditorium of Tilburg University. This event is called the Business Night. Prominent speakers were present during the evening: I found Tiny Sanders and Jeroen Dijsselbloem particularly interesting to listen to.

During the EBT of 2016 and 2017, I was a participant as well, but I did not take part in as many activities as I did this year. In any case, I recommend every student of TiSEM to take part in the EBT even if you are just in your first year. This year, I also participated in a workshop and individual conversations in addition to company presentations.

Workshop

The workshop I attended was hosted by Priogen, an energy-trading company. Do you want to work at a trader later in your life? Then you have to pass a math-test, which is well-known to many. This test went reasonable but certainly not thunderous for me. I must admit: I have been training my mental arithmetic skills almost every day at least once after this day. After that I participated in two other games of which one was a trading game: tons of fun there!

I also had individual conversations with both a.s.r. and Solid Professionals, the first being an insurance company and the second being a consultancy company. From all activities I did during the EBT, I think I learned most here. My first individual conversation with people from a company, which was during the EPD of this year by the way, was not such a big success. I think many who had their first individual conversation may have had struggles as well. The problem is the constant consideration between being serious or being informal, being spontaneous or being thoughtful. Because it is impossible for anyone to be 100% spontaneous and 100% thoughtful at the same time: the two always go at the expense of each other.

Unconventional advice

So let me give a few hints with regard to these conversations. Although these hints may be stating the obvious for some, I hope they might be of some help to others. The most important thing I experienced, and this may sound absurd but yet I think it to be the case, is that it is better for you to say one or perhaps even two foolish things during the conversation while being relaxed than to say nothing stupid at all while being very guarded and prompt in picking your words.

This may sound very counterintuitive to econometricians, and indeed in the presence of econometricians it is not wise to say or do a dumb thing, but the people you are talking to during such a conversation possess such a mindset that they are not so likely to attach a significant negative value to these little "mistakes". If you are too "Argus-eyed", the conversation might become uncomfortable for the company people.

As for the choice of being serious or informal, this is conditional on where you are in the conversation. In the beginning the choice is simple of course: informal. Do not make the mistake to eagerly start talking about "the content", that which it is all about! You know little to nothing about the precise organization of the company let alone the problems with which each department of the company generally deals.

Therefore, the probability that you say something that is generally not the case for the company is relatively high. As already said, "mistakes" are allowed to be made but this particular kind of mistakes can easily be avoided by letting the company people gradually take you to the content instead of initiating the "content talk" yourself.

As soon as the content talk has started, the level of seriousness can be varied by yourself within some bounds. Just make sure that you slightly decrease this level during the last two minutes of the conversation because it may be experienced as uneasy to end the conversation in a very "serious" manner. ●

Are you excited about participating in the Economic Business weeks Tilburg and building your own network? Save the date: the upcoming EBT starts with the Business Night on April 1, 2019!

Man, don't get Upset!

The title of this column may sound a bit strange, or may sound like a wise lesson for life. But this is just a column about the board game 'Mens-erger-je-niet'. I am quite sure many of you have played, or still play, this popular board game. It is the Dutch name for the board game Ludo which was introduced in 1896 in England, as a variant of the Indian game Pachisi. In 1910 a new version under the name 'Mensch-ärgere-Dich-nicht' came to Germany and thereafter to other European countries: 'Mens-erger-je-niet' in the Netherlands, 'Ne t'en fais pas' in France, 'Fa med knuff' in Sweden, etc.

In my first column I mentioned that I have analyzed many games together with Ben van der Genugten (now emeritus professor of Statistics). Ben has retired, and spends his time differently now, at least that is what someone would think of a retired professor. But when Ben is playing 'Mens-erger-je-niet' (loosely translated as 'Man, don't get upset') with his beloved grandchild, he cannot resist thinking about the best strategy to play. I am sure Ben lets his grandchild win, but still, answering the question how one should optimally play does not get out of his mind. So he started to analyze, and asked me to join.

The game 'Man, don't get upset' is usually played with four players. Every player has four pieces of a particular color, a starting area and a home column of four fields (in the middle of the board). In turn, players move a piece dependent on the outcome of the roll of a die. When a piece has circumnavigated the board clockwise over 40 fields, it proceeds up the home column. The game ends if a player gets all his pieces in his home column. He then is the winner of the game.

The game owes its (Dutch) name from the upset it causes a player when his pieces are kicked off the board by an opponent. These pieces must start again at the starting point. This is somewhat compensated by the joy of kicking your opponent's pieces from the board.

If a player has two or more possible pieces which can be moved, he must choose which piece to take. Rationally he wants to take the piece which maximizes his probability of winning the game. But in almost every situation it is unclear which piece this is. There are a lot of aspects which can be taken into account. For example, he can move his farthest piece on the circuit to get it as fast as possible at a safe field in the home column; or, he can choose to always hit an opponent's piece whenever possible; or, he can move a piece outside the kick range of the opponent's pieces; or, he can just move a random piece to confuse the opponents.

An exact analysis of win probabilities for different strategies is complex. We therefore calculated these probabilities by simulation using MATLAB, with a simulation run of 100,000 games, leading to an accuracy of ± 0.5%.

Surprisingly, the strategy to move the farthest piece on the circuit and that is often played, performs badly compared to other simple strategies. The haphazard strategy to move a random piece even performs much better, and has similar quality as a strategy that prioritizes kicking pieces of the opponent off the board. We developed some new strategies taking direct threats of pieces into account and the exact positions of the pieces on the board. It turned out that the new strategies outperform the simple strategies which only take one aspect into account. And the good news is that one of the (new) strategies can be easily applied in practice! The best performing strategy, however, requires some serious calculation.

It will be interesting to investigate whether our two new strategies can be improved upon, and preferably in such a way that the improved strategy can be easily played in practice. Might this be something you can think of during the summer period, on the beach or in the swimming pool, or in a bar using the back site of a beer coaster? Good luck and happy summer holidays!

Marcel Das
Marcel Das is the director of CentERdata and professor of Econometrics and Data Collection at the department of Econometrics and OR.

Cryptocoins: Biggest Hoax Ever or a Blessing to Mankind?

Opportunities cryptocurrency offers the private sector

The regular financial sector makes the impression to have a slight antipathy to whatever smells like cryptocurrencies. To what extent is this true? We spoke with Teunis Brosens, senior Economist at ING, and he provided us with some nice insights in how the financial sector deals with the existence of cryptocurrencies.

Teunis Brosens

Text by: Dominique Bavelaar

When it comes to the role of cryptocurrencies in the classic financial sector, a clear distinction needs to be made between blockchain infrastructure technology on one hand and cryptocurrencies and tokens on the other. Brosens: "Banks and financial corporations are performing quite some research regarding blockchain in the context of process optimization. However, in the Netherlands as well as on the international playing field, banks do not actively invest in cryptocurrencies." The latter is not motivated by the fact that they actively hate or fear cryptos: "The main reason we are not investing is because of the lack of regulation in the field of crypto-tokens," Brosens explains, "As a bank, you have to comply with a big set of rules, also consisting of requirements to prevent all kind of illegal activities. When you buy, for example, a bitcoin, the seller from which you acquire your asset is completely anonymous and hence we cannot guarantee that we or our customers are not facilitating money laundering or subsidizing some kind of terrorist organization. Another example: when the seller happens to be situated in Iran, our office in the United States will face severe fines because of breach of trade sanctions."

Will banks then never touch cryptocurrencies? Brosens: "A necessary condition is that adequate regulation will be implemented and that it becomes clear from a legal perspective to what extent financial institutions are allowed to trade in cryptos. In the Netherlands, at least supervisors have been warning consumers about the risks. The AFM (Autoriteit Financiële Markten) warns individual investors for shady coinmarkets, but they have no supervisory powers over crypto exchanges or new coin issuance (ICOs)." That issuance of a new coin works as follows: an individual or company offers their coins on a digital market place, and investors can buy those coins. Some coins are de facto unofficial 'shares' in a company, other function as a store of value with as ultimate goal to be used as a payment system. Legally, these coins are no securities[1], so regular supervision is not applicable to the extent in which it applies for stocks and government bonds.

There are some developments though: "European Union wide, national supervisors have agreed upon an anti money laundering policy and →

[1] A security is a financial asset that can be traded.

in the United States law makers are implementing legislature which broadens the definition of securities," Brosens states, "Because of the fact that every cryptocurrency is not stored centrally, it is impossible to completely forbid it, especially not on a national level, since the internet allows us to enter coinmarkets all over the world."

But do crypto's really threaten the financial sector? Brosens does not think so, at least not in the western world: "In Europe, a lot of people are enthusiastic about cryptocurrencies because of their interest in the technology or out of idealist perspectives. However, the broad public over here does not need a replacement for their current payment system, since the Euro is extremely reliable and governments do not censor expenses," Brosens explains, "In other countries like Venezuala or North Korea, for example, it might be of use for individuals to transfer money anonymously or to store their money in order to be protected from hyperinflation."

Also the idea of coin issuance by companies, so called ICO's (Initial Coin Offerings) might be of use in the near future: "For start-ups who start off with little cash, but great ideas, such a coin offering may be a perfect way in order to raise money," Brosens states, "In the early beginning, it is not possible for a company to get a loan at a bank, since they require some stability, or to issue stocks on the exchange markets. Via an ICO, people from all over the world who believe in the plans of a company, are able to invest their money by buying those coins." This is also interesting from an investor's point of view, since he can also invest small sums of money, as opposed to what is the case on the regular stock market. Moreover, existing financial institutions can offer their expertise to advise investors which coins are worth buying.

Blockchain

Coming back to the earlier mentioned blockchain technology, Brosens sees opportunities, but also some threats: "From an IT perspective, blockchain is way more inefficient than a central database, since all your data is divided over different nodes, which obviously takes more storage space and increases communication bandwidth." So for issues concerning databases within one company, blockchain would not be a good alternative to already existing technology. However, in cases where data needs to be transferred between multiple financial institutions, especially when you do not trust the other party completely, blockchain could be useful, as Brosens illustrates: "The best example of a situation in which blockchain technology can improve the status quo, is international trade financing. The steps in such a process are already the same for hundreds of years, with huge piles of paper which all need to be signed by different trade partners and banks. Since the emergence of the internet, those piles of paper are sent by mail, but then they still need to be printed and stored and signed, scanned and emailed forward. So all in all, a lot can go wrong during this extensive administrative process. Blockchain technology can be a solution here, since when you store the data you need in the blockchain, the counterparty can access it immediately, while at the same time, your data is safe. You have to do this with other parties together, since working on a blockchain which can just be used by your own company, is rather stupid. The strength of a blockchain-like technology is that you can share data in a safe way, but if you do it on your own, you should better make a regular database, for the reasons mentioned earlier." However, Brosens stresses that the big step is the fact that all these processes are being digitalized, not per se the blockchain technology.

'The strength of a blockchain-like technology is that you can share data in a safe way'

Intrinsic value

When asked to what extent crypto market values are predictable, Brosens is clear: "Not at all!". He does state, however – similar to what Ron Berndsen states[2] - that the intrinsic value of a cryptocurrency can be measured by how well it would perform as a payment system. Brosens actually performed such an analysis for Bitcoin, the most well-known cryptocurrency. And now this article becomes even more interesting: if you believe that Bitcoin will eventually replace all money in the world, its value would equal the world's total amount of cash money in addition to the sum of all demand deposits, divided by the amount of bitcoins that are currently in circulation, resulting in a value of 1 BTC = $1.7 million. So if you really believe in this scenario, which Brosens by the way does not, the price at the moment I am writing this, 1 BTC = $7,600, is still a bargain for you. Also in a less radical, but still extremely optimistic scenario of a market share of 1% of all global transactions, one bitcoin would be worth $18,000. However, in case Bitcoin does not succeed in expanding its market share in terms of payments facilitated, the intrinsic value is almost zero!

This does not mean that all prices will go to zero, though: "As said, people will remain attracted to and intrigued by cryptocurrencies because of the anonymity and technological complexity," Brosens states.

When it comes to research in the future, the fundamental question of the desirability of decentralization has become important because of the emerge of cryptocurrencies. Brosens: "In terms of research to database structures, it can be interesting to investigate the use of decentralized databases, like blockchain. Also for economists and policymakers, it becomes important to think about how markets actually function and how that can be improved."

In case cryptocurrencies will stay relevant in the future, regulation to protect individual investors needs to be implemented by lawmakers. Brosens does acknowledge the challenge the emerge of digital financial assets offers to the financial sector, but does not see it as a direct threat to their business models.

[2] See the article *Bitcoin as a Payment System?* on page 12

Crypto as a new way of life

We also contacted Marc van der Chijs, who has been an entrepreneur all his life, but radically changed his life as soon as Bitcoin emerged. He founded multiple crypto investment funds and can safely be seen as one of the most successful crypto-adepts in the world. He will explain his vision on crypto's and how it has become such a success.

Text by: Dominique Bavelaar

Marc van der Chijs

Marc van der Chijs has a completely different view than Teunis Brosens: "Within a few years, crypto will become the most important category of financial products in the world! That is why universities, as well as the curriculum of the Econometrics & Operations Research program, should pay more attention to the analysis of cryptos, instead of the classic assets."

That analysis, in terms of the prediction of future price evolutions, is not as impossible as we are often inclined to believe, insists Van der Chijs: "Because crypto markets are not yet efficient, a combination of both a technical and fundamental analysis makes it very well possible to predict prices." Just like in the analysis of ordinary (financial) products, supply and demand of a coin are the main drivers in the price mechanism. However, in the context of crypto's, scarcity is caused a bit differently: "It often happens that a coin, relatively small in terms of market capitalization, is pumped (i.e., investors place buy and sell orders on themselves in order to rack up the price, red.) without the coin becoming better," Van der Chijs explains. "Other coins add or alter certain elements of existing coins, like more anonymity or improved smart contract languages, causing the number of interested buyers to increase." The Bitcoin-hype seems to have cooled down a bit the past few months, though. However, price levels remain at a substantial height. Van der Chijs: "This is simply because the intrinsic value of Bitcoin is based on the Bitcoin blockchain. This is the safest way to store digital data that is available in the world. People acknowledge that."

About the immense diversity of available coins, Van der Chijs notes the following: "Bitcoin has the biggest potential, because it has, as said, the extremely safe Blockchain technology behind it and its source code is the most tested crypto code of all. All other cryptovaluta are directly or indirectly building upon the Bitcoin concept, but are all less decentralized, less safe or transactions can be altered afterwards, as is the case for Ethereum nowadays."

Van der Chijs also believes that the blockchain technology creates enormous opportunities: "The most important application, which is useful on the short term, is asset tokenization. This means that you can store all your assets on a blockchain. Also governmental institutions are planning to implement Blockchain in the near future."

We have already spend quite a lot of attention and ink on technology, as we already told quite much about blockchain and its future application(s). But there is more, also in terms of innovations: "The most spectacular thing that will happen in the near future, is the emergence of the Lightning Network. This is a system which concerns instant payments between two agents, such as doing a transaction in Bitcoin. Lightning Network makes it possible for Bitcoin to become a way of payment for the bigger public. Most people do not yet foresee the enormous impact this is going to have on society!"

As we see, crypto's and the technology which drives their emergence, offer a lot of potential and challenges to both the financial sector and individuals, most of which do not care too much about cryptocurrencies, yet. It will be interesting to see which role financial institutions will have in the future and I am very curious to find out to what extent cryptos will have increased in relevance in a few decades from now (which on its own seems an interesting topic for a Nekst Mirrorpiece in 2028). We would like to thank both Teunis Brosens and Marc van der Chijs for their time and both interesting and relevant insights.

Working towards an Even Better Campus

Opening of 'the Cube'

In the past months a new, modern, mysterious building slowly appeared at the horizon of Tilburg University. From both the railway-side as from the campus-side the new building stood out, however, no student really understood what the new building was actually doing there. Next academic year however, this building will become part of everyone's daily life, since the building will be used from September onwards. On June 12, the official opening took place. During this opening, many prominent members of Tilburg University gathered in the so called 'Cube' to get a first impression of the new building on the campus of Tilburg University.

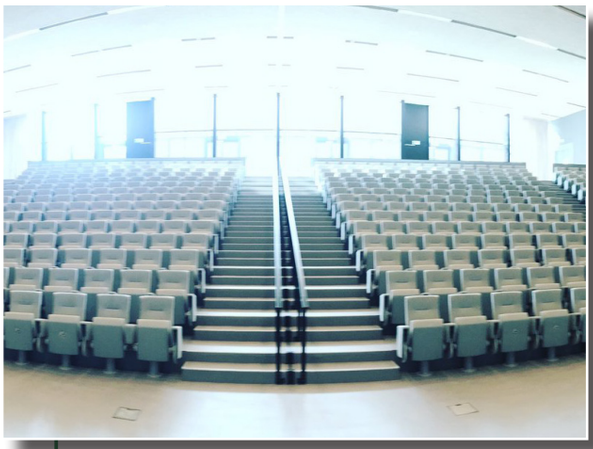
Text by: Linda Torn

The first thing that stands out is, of course, the name. When the construction of the new building started, in January 2017, the building was called the Onderwijs- en Zelfstudiecentrum (OZC, Education- and Self Study Centre). However, when the building was almost finished, the Executive Board decided they wanted another name for the building before it would be used. The new name became 'Cube'. For econometricians this name might be a little bit disturbing. As you might see on the pictures, the new building does not have equal sides, as should be the case with a cube. Unfortunately, not all the people within the university are as mathematically precise as we are. Hence, from now on we have to live with the name 'Cube' for a building which is not cube-shaped. Another problem: a building with the abbreviation 'C' already exists, so a more creative abbreviation for this building has to be found. This abbreviation is not known yet, and hence we have to wait until September to see what the university comes up with.

Although the name causes some questions, there are of course a lot of positive things to tell about this new building. First of all, there will be 350 extra workplaces for students in Cube! As you might have noticed in the past year, the library becomes fuller and fuller, and therefore those extra workplaces are not an unnecessary luxury. There will also be more workplaces to work on group-assignments. Furthermore, Cube offers innovative education and examination methods, such as the possibility to do digital exams. And, of course, no university can be possible without lectures. Therefore there are also extra lecture halls in the new building. In short, Cube is really built with the focus on students, and will give students everything they need to run through their studies in a smooth way.

Besides the focus on students when building Cube, there was also attention for sustainability. The building got the certificate Breeam-NL, four stars (out of five) excellent. This means that the building scored excellent on the points management, health, energy, transport, water, materials, waste, use of land, ecology and pollution. So, we can in good conscience study in this beautiful new building.

To get a first impression of Cube, take a look at the pictures on these pages. If you want to see even more, you can already take a look at the exterior of the building (behind the Prisma building). For the interior, we unfortunately have to wait a little longer. But, do not worry, in about sixty nights of sleep we can finally enter the building and enjoy all the advantages it has to offer.



LECTURE ROOM

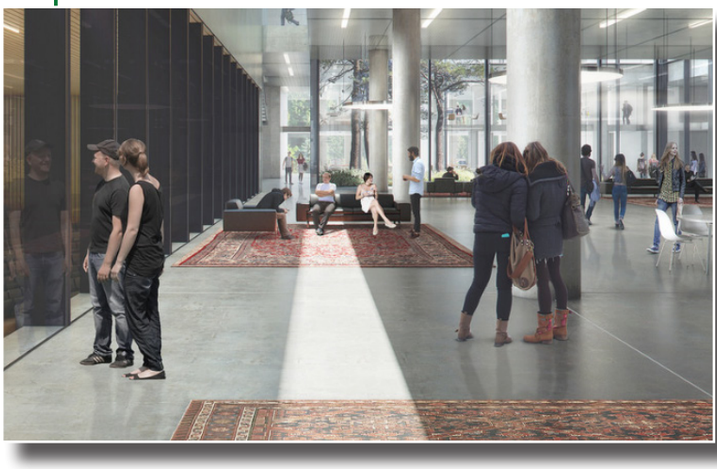
BIRD'S-EYE VIEW

CUBE

CUBE

FRONT VIEW

LOBBY



STAIRS

Mirror Piece

There is no need to deny it: data is hot. While usually commodities or resources see an increase in demand when there is a scarcity, data seems to show the opposite relationship; even though the amount of data doubles every two years, data (and anything related to it) is becoming more popular every day.

Text by: Ennia Suijkerbuijk

While I am sure we are all aware of the fascinating principle of exponential growth, there is still one statistic I would like to point out to grasp the enormity of this trend: between the dawn of civilization and 2003, all humans on earth together created five exabytes of data; now we create that amount every two days. Arizona State University even estimated that the volume of business data worldwide, across all companies, doubles every 1.2 years. With this increase of volume, the need for people capable of handling data and IT is also rapidly increasing, along with the need for people who are capable of handling people that handle data and IT.

Someone who might have foreseen this trend is professor Dick den Hertog, as he dedicated a column to the emerging field of business analytics back in 2012. In his column, he described several reasons why analytics was important for companies, analyzed the unique levels that can be distinguished within the field of business analytics, and advised students to follow the developments within this field.

While 2012 might not seem to be such a long time ago, quite a lot has happened since then. First of all, Earth did not cease existing on December 21, 2012, implying that the Maya civilization (along with plenty of other doom thinkers) was wrong about the timing of the end of the world. Other world-changing events since 2012 include Donald Trump's election, the rise of cryptocurrency, and the future departure of prof. Dolf Talman from Tilburg University.

Clearly, this world is not the same as it was in 2012. This makes us wonder: how much has really changed regarding the field of (business) analytics in the last six years? Has the popularity of BA passed its prime, or have we only seen the tip of the iceberg yet? Read the next two pages to find out Dick den Hertog's vision from 2012, as well as a 2018-update on the topic from our editorial staff!

'Arizona State University even estimated that the volume of business data worldwide (...) doubles every 1.2 years'

The Future is Bright with Business Analytics

Despite the financial crisis, there is still much need for people that are trained in quantitative methods. The expectation is that this demand will even increase a lot in the near future. The reasons for this can be explained by what is now called 'Business Analytics'. INFORMS, the worldwide society for Operations Research and Management Science, gives the following definition: 'Business Analytics - the scientific process of transforming data into insight for making better decisions.'

Text by: Dick den Hertog

In the book 'Competing on analytics, the new science of winning' (Harvard Business School Press 2007, written by Thomas H. Davenport and Jeanne G. Harris), several reasons are discussed why analytics is important for companies nowadays. First of all, companies often offer similar products and use similar technology. Second, many previous bases for competition (e.g. geographical advantages or protective regulation) have been eroded by globalization. Third, proprietary technologies are rapidly copied. Finally, breakthrough innovation in products and services seems increasingly difficult to achieve. →

2012

- **After 246 years since its first publication, the Encyclopædia Britannica discontinues its print edition**
- **Highest grossing movie "The Avengers" with 1,519 billion USD**
- **Social network Instagram launches their application on Android**

Optimizing Society for an Even Brighter Future

The Dutch economy continues to keep growing, the purchasing power has increased and the level of employment has been rising steadily; it has taken us a couple of years, but the Netherlands is definitely over Europe's financial crisis that started back in 2009. So what does this mean for the field of business analytics? Should we expect a similar-paced trend for BA as we see for the other sectors?

Text by: Ennia Suijkerbuijk

Before answering this question, let us take a look at what the numbers say. A quick investigation regarding the amount of world-wide Google searches for the term 'business analytics' over the past fourteen years showed a significant increasing trend, as is visible in Figure 1 (next page). In fact, the yearly amount of searches increased with over 800% when comparing 2017 with 2004. Furthermore, it is interesting to see that while Europe and North America are among the more frequent searchers, Singapore is the country in which proportionally the most searches were done. →

2018

- **After 55 years since its first publication, the Univers discontinues its print edition**
- **Highest grossing movie "Avengers: Infinity War" with 2 billion USD**
- **Instagram is currently valued at 102 billion USD**

They then conclude: 'What is left as a basis for competition is to execute your business with maximum efficiency and effectiveness, and to make the smartest business decisions possible.'

Hence, analytics is often the only way to get competitive advantage. Many leading companies are building their competitive strategies around data-driven insights by using analytical techniques and tools. On the website of IBM it is mentioned that 'recent studies show, that organizations that apply analytics outperform their peers. Just look at their financial results: up to 1.6x revenue growth, 2x EBITDA growth and 2.5x stock price appreciation.'

For an important part, this development is made possible by the improvements in ICT. In the past the lack of data was a big problem for many companies, but due to the ICT developments nowadays often huge amounts of data are available. Many companies now face the following problem: we have big data, but how can we extract useful information from this data, and how can we use this information to make better decisions? The answer is: use analytics!

In the previously mentioned book, four different levels of degree of intelligence and competitive advantage are distinguished in analytics:

1. Optimization – what is the best that can happen?
2. Predictive modeling – what will happen next?
3. Forecasting and extrapolation – what if these trends continue?
4. Statistical analysis – why is this happening? →

It hence seems that interest into the field of BA is definitely not moving in a downwards trajectory. In fact, a study from McKinsey predicted a shortage of around 140,000 to 190,000 (big) data engineers in 2018 in the US alone. However, it is not just the need for business analysts that has increased over the past few years, as plenty of other professions regarding (big) data have witnessed a huge surge in demand as well. For instance, McKinsey also predicted a shortage of 1.5 million (!) managers who can manage the engineers and can function as an intermediate between the IT aspect of big data and the strategy aspect.

Another stream that is becoming increasingly more important concerns the protection of data privacy. As most of you know (or noticed due to the dozens of emails in your inbox from all sorts of companies regarding their privacy policy), Europe's new General Data Protection Regulation (GDPR) has been implemented last May 25. The GDPR addresses the export of personal data outside the EU and primarily aims to give residents control over their personal data. As a result of the GDPR, public authorities and businesses whose core activities are centered around regular or systematic processing →

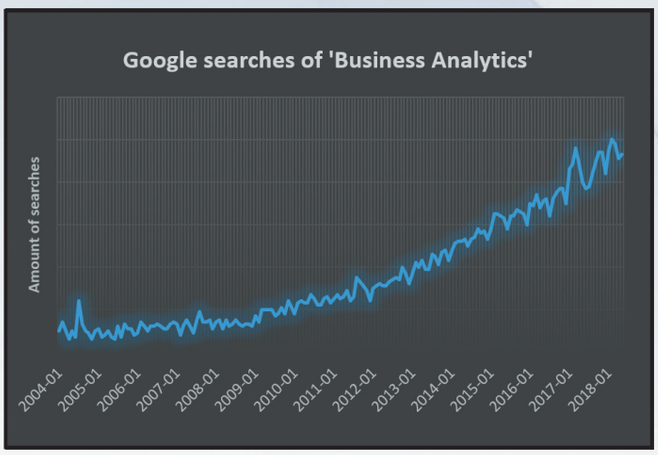


Figure 1: The amount and distribution of world-wide Google searches for 'Business Analytics' between 2004 and 2018.

All of these four categories are important parts of both our econometrics bachelor and master's programs. You can imagine that, since I am a researcher in Optimization, I am proud that the authors put Optimization at the highest level of intelligence and at the highest level of competitive advantage for companies.

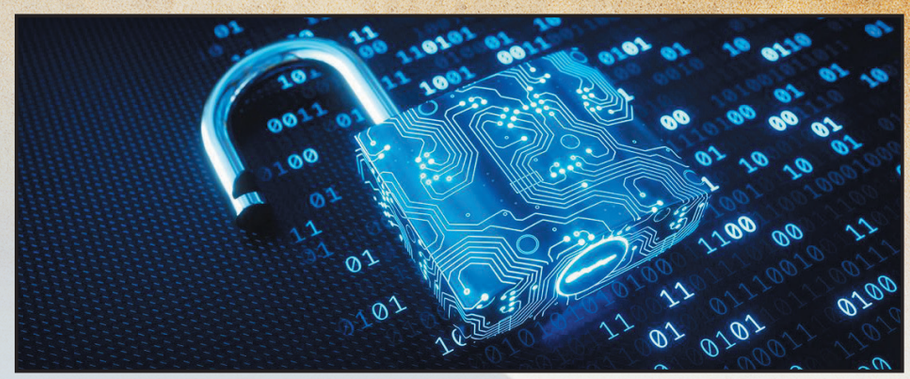
My advice to the econometrics students is to read more on Business Analytics and to follow the developments in this area. Besides the above mentioned book, the same authors together with Robbert Morison, also wrote a second book that is very interesting to read: 'Analytics at work, smarter decisions, better results' (Harvard Business School Press 2007). Moreover, the above mentioned INFORMS society also publishes a very interesting electronic journal on this topic. This journal can be read from the webpage: http://www.analytics-magazine.org/.

I would like to finish with two remarks. The first is that the name 'Business Analytics' is maybe too restrictive. One might think that analytics is only useful for companies. However, analytics is also used a lot in other sectors, e.g. by governments or in medical areas. My second remark is on the slogan of Tilburg University. As you all know this slogan is: 'Understanding Society'. However, with analytics taught at the Econometrics and Operations Research department one can go further: 'Improving Society'! ●

'Analytics is often the only way to get competitive advantage'

of personal data, are required to employ a data protection officer. Thus, with such judicial changes, more and more different types of data-related jobs are born in all sorts of sectors, as well as more and more different types of data-related study programs.

BA is relatively new as a (post-) graduate program, even though the concept of business analytics already arose in the late 19th century, as it was first used by Henry Ford who measured the time to replacement of each component in his newly established assembly line. It has only been in the last decade that more and more business schools started offering a master's program in BA. Of course Tilburg University, being one of the highest-ranked business schools in Europe, accepted this movement and so in in 2016 the master's program Operations Research & Management Science was adapted to Business Analytics & Operations Research. However, while this program is the only one of all three Econometrics master's programs to actually include BA in its name, the other two programs also incorporate BA-related electives.



Like professor Den Hertog, I would also like to finish with two remarks. The first is that it might be good for students who are interested in business analytics to also look at its broader aspect, such as managerial qualities or privacy regulations. My second remark concerns professor Den Hertog's future vision on Tilburg University's slogan; he believes that BA at the Econometrics & Operations Research department enables us to move from 'Understanding Society' to 'Improving Society'. However, why not go even further? With the exponential increase of data, the rapidly-evolving (computer) systems/techniques and the sudden surge of academic BA programs worldwide, we might even be able to move to 'Optimizing Society' or 'Perfecting Society'. ●

ASSET Econometrics

THE BASICS OF CRYPTOCURRENCY & BLOCKCHAIN

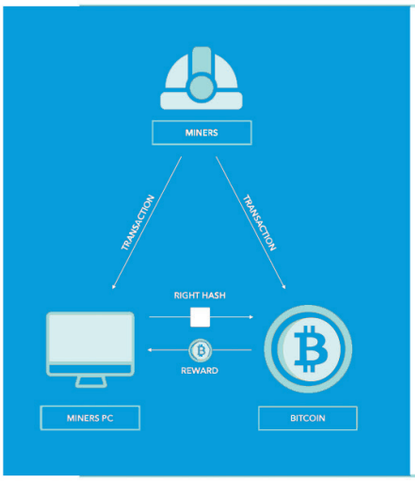
INFOGRAPHIC BY DOM & TOM

WHAT IS CRYPTOCURRENCY?

Cryptocurrency is a digital or virtual currency designed to work as a medium of exchange. It uses cryptography to secure and verify transactions as well as to control the creation of new units of a particular cryptocurrency. Essentially, cryptocurrencies are limited entries in a database that no one can change unless specific conditions are fulfilled.

- Encrypted, decentralized digital currency
- Transactions are added to the blockchain and cannot be altered
- Uses cryptography to secure transactions
- Currency transferred between peers
- Confirmed in a public ledger via a process known as mining
- Value fluctuates just like paper money
- Has no physical form
- Over 1500 cryptocurrencies on the market today

HOW DOES IT WORK?



MINING

Miners try to solve mathematical puzzles first to place the next block on the blockchain and claim a reward.

EXCHANGE

An exchange is a business (usually a website) where you can buy, sell or trade cryptocurrencies.

WALLETS

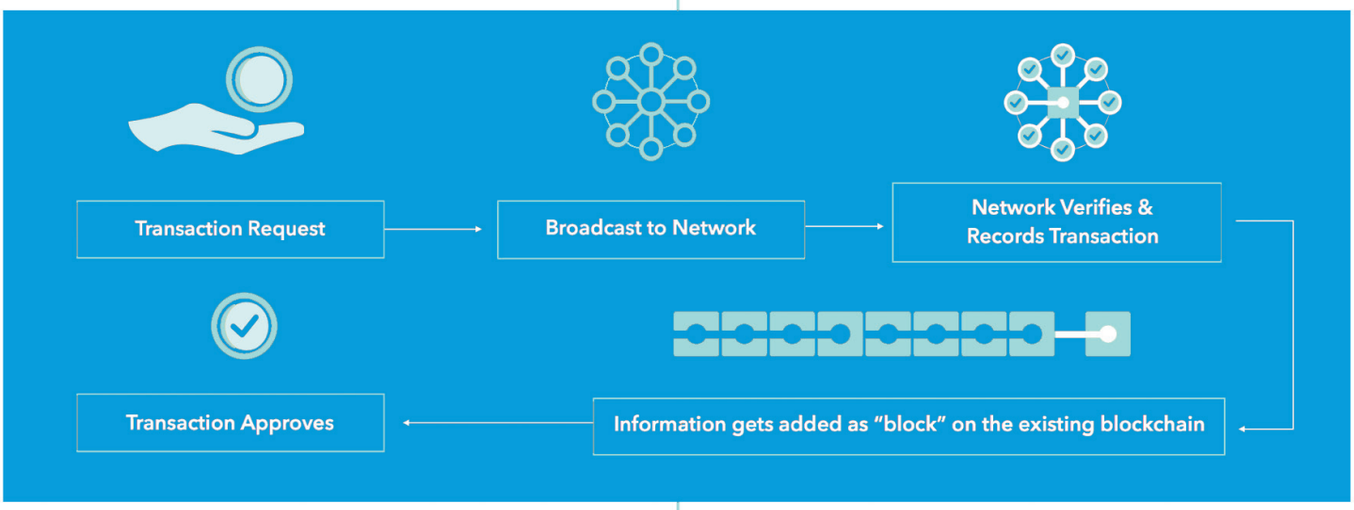
Cryptocurrency wallets are software programs that store public and private keys and enable users to send and receive digital currency and monitor their balance.

WHAT IS BLOCKCHAIN?

A blockchain is a continuously growing list of records, called blocks, which are linked and secured using cryptography. Each block typically contains a cryptographic hash of the previous block, a timestamp and transaction data. By design, a blockchain is inherently resistant to modification of the data. It is "an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way". For use as a distributed ledger, a blockchain is typically managed by a peer-to-peer network collectively adhering to a protocol for validating new blocks. Once recorded, the data in any given block cannot be altered retroactively without the alteration of all subsequent blocks, which requires collusion of the network majority.

- A secure public electronic ledger.
- Highly volatile and experimental
- New data can never be erased.
- A decentralized database.
- The Napster of databases.
- The Internet of Value.
- Can only be updated by consensus between multiple people in the system.

HOW DOES IT WORK?



USEFUL FOR

- Fund Transfers
- Trading
- Voting
- Healthcare
- Fractional Ownerships
- "Smart Contracts"

BENEFITS

- Increased Transparency
- Decentralization
- Immutability
- Ensure Security on Network and Hardware
- Cutdown Corruption
- Protect Against Data Changes
- Synchronization
- Improve Social Systems Worldwide

NOT USEFUL FOR

- Centralization
- High Volume and Low Value Transactions
- Big Data Storage
- Privacy (SSN's)
- Email
- Impermanent Things
  (actions that show up and then disappear)

THE FUTURE OF BLOCKCHAIN & CRYPTOCURRENCY

> "There's two kinds of people in the #cryptocurrency space. The first believe in the technology of utilization. The second believe in asset management. Short term versus long term."

Dom Tancredi,
Co-Founder & CEO of Dom & Tom

SOCIETAL ADOPTION PREDICTIONS

- Will disrupt banking industry first
- Will see adoption from publishing, media, governance, gaming
- Big investments from tech giants
- Micro-transactions between machines will be commonplace
- Hyperledger will be the foundation for blockchain adoption
- Will need to safeguard personal information
- Will need to address environmental concerns

HOW TO GET INVOLVED

- Go to a local Meetup.
- Buy and spend some cryptocurrency and experience it for yourself.
- Concept a Dapp (Decentralized App).

A Less Conservative Variant of Robust Optimization

Although Robust Optimization is a great technique in dealing with uncertainty in optimization, its solutions can be too conservative. In practice, this can lead to robust solutions being disregarded in favor of the nominal solution. This conservatism is caused by both the constraint wise approach of Robust Optimization and its core assumption that all constraints are hard for all scenarios in the uncertainty set. My research seeks to alleviate this conservatism by proposing an alternative robust formulation that condenses all uncertainty into a single constraint.

Text by: Ernst Roos

Introduction

Most real-life optimization problems contain parameters that are not known precisely. To deal with uncertainty, three main classes of techniques exist: stochastic programming, robust optimization and their recently introduced combination distributionally robust optimization.

In stochastic programming it is assumed that all uncertain parameters follow a known probability distribution. Instead of regular (in)equalities, these problems contain chance or expectation constraints. In general, stochastic programming problems are hard to solve, while the true distribution is not always known.

In robust optimization, on the other hand, it is assumed that the uncertain parameters can take any value in a user-specified uncertainty set. Subsequently, robust optimization forces every constraint to be feasible for all possible values in the uncertainty set.

Ben-Tal and Nemirovski (2000) showed that robust optimization can successfully safeguard against potential constraint violation in multiple problems from the NETLIB library. Out of the 90 problems they studied, 27 have a nominal solution that severely violates at least one constraint when the uncertain parameters are allowed to deviate by 1%. Some of the solutions that safeguard against this uncertainty have objective values up to 10% higher than the nominal objective value. Herein lies the main downside of robust optimization: its possibly too conservative solutions.

My research focuses on alleviating this conservatism by applying techniques from a new field called distributionally robust optimization. In general, this approach assumes uncertain parameters to follow a only partly specified probability distribution. In particular, we consider all probability distributions with a user-specified support, mean and mean-absolute deviation. Given this assumption, we require the expected violation of the original constraints to be below some threshold for all such probability distributions.

Reformulation

We consider a general robust optimization problem given by

$$\begin{aligned} \min_x \ & c^\top x \\ \text{s.t.} \ & Ax \geq b \qquad \forall b \in U. \end{aligned} \tag{P1}$$

where $x \in \mathbb{R}^n$ is the decision vector, $c \in \mathbb{R}^n$ and $A \in \mathbb{R}^{m \times n}$ are given parameters and $b \in \mathbb{R}^m$ are parameters that are uncertain.

To alleviate the constraint wise approach of RO, we combine all constraints of (P1) into a single constraint on the sum of all constraint violation. Moreover, we drop the assumption that all constraints are 'hard' and allow some constraint violation α. We also choose to enforce that the solution is feasible for the nominal or expected scenario $\bar{b}$ to avoid solutions with excessive amounts of violation in a single constraint. The resulting formulation is given by

$$\begin{aligned} \min_x \ & c^\top x \\ \text{s.t.} \ & \sum_{i=1}^{m} \max\left\{0, b_i - a_i^\top x\right\} \leq \alpha \qquad \forall b \in U \\ & Ax \geq \bar{b}. \end{aligned} \tag{P2}$$

Observe that for $\alpha = 0$, (P1) is equivalent to (P2).

A disadvantage of this problem formulation is that the standard way to solve the robust optimization problem (P1) is

only tractable for box and budget uncertainty sets on right-hand side parameters using a reformulation introduced by Ardestani-Jaafari and Delage (2016). This tractability issue stems from the fact that this robust counterpart contains the maximum over a convex function.

One of the other causes of robust optimization's conservative solutions is that it only considers the worst case over the uncertainty set, while in reality there is not always a high probability of this worst case occurring. Recent papers in distributionally robust optimization therefore consider the uncertain parameters to follow an unknown distribution that resides in some ambiguity set. One can then consider the worst-case expected violation, that is, compute the expected violation with respect to the distribution in this ambiguity set for which it is highest. Recent papers in distributionally robust optimization show that this worst-case expectation can be computed efficiently for specific ambiguity sets. We thus consider the problem

$$\begin{aligned} \min_{x} \ & c^\top x \\ \text{s.t. } & \mathbb{E}_{\mathbb{P}}\left[\sum_{i=1}^{m} \max\left\{0, b_i - a_i^\top x\right\}\right] \leq \alpha \quad \forall \mathbb{P} \in \mathcal{P} \\ & Ax \geq \bar{b}, \end{aligned} \tag{P3}$$

where $\mathcal{P}$ is the ambiguity set that contains all distributions one considers for b. Although (P3) may seem to be an even more difficult problem to solve than (P2), this is not necessarily true.

Distributionally Robust Optimization

The technique we consider to solve (P3) is the distributionally robust optimization approach developed by Postek et al. (2017). This technique assumes the ambiguity set to contain all probability distributions for b with a given support, mean and mean absolute deviation from the mean (MAD), for which all b_i are pairwise independent. It can easily be shown that this independence assumption is not necessary when the expectation of a separable function is considered. As for right-hand side uncertainty each constraint only contains a single uncertain parameter, the function of interest in this paper is separable and we omit the assumption on independence.

Mathematically, this means that

$$\mathcal{P} = \{\mathbb{P} : \text{supp}\,(b_i) \subseteq [l_i, u_i], \ \mathbb{E}_{\mathbb{P}}(b_i) = \mu_i, \ \mathbb{E}_{\mathbb{P}}|b_i - \mu_i| = d_i, \ \forall i\}.$$

The required support, mean and MAD can often be estimated from historical data, which makes this approach suitable for practical applications.

Given that the ambiguity set is defined as above, we can reformulate (P3) using the following equalities by using (14) Postek et al. (2017). In this derivation we use that the sum of maxima is a separable function:

$$\begin{aligned} & \max_{\mathbb{P}\in\mathcal{P}} \mathbb{E}\left[\sum_{i=1}^{m} \max\left\{0, b_i - a_i^\top x\right\}\right] \\ =& \max_{\mathbb{P}\in\mathcal{P}} \sum_{i=1}^{m} \mathbb{E}\left[\max\left\{0, b_i - a_i^\top x\right\}\right] \\ =& \sum_{i=1}^{m} \max_{\mathbb{P}\in\mathcal{P}} \mathbb{E}\left[\max\left\{0, b_i - a_i^\top x\right\}\right] \\ =& \sum_{i=1}^{m} \sum_{y\in\{1,2,3\}} p_y^i \max\left\{0, \tau_y^i - a_i^\top x\right\}, \end{aligned}$$

where $\tau_1^i = l_i$, $\tau_2^i = \mu_i$ and $\tau_3^i = u_i$ are the support of the worst-case distribution and their probabilities are given by

$$p_1^i = \frac{d_i}{2(\mu_i - a_i)},$$

$$p_2^i = 1 - \frac{d_i}{2(\mu_i - a_i)} - \frac{d_i}{2(b_i - \mu_i)},$$

$$p_3^i = \frac{d_i}{2(b_i - \mu_i)},$$

for $i = 1, \ldots, m$. The derivation above states that the worst-case expected violation constraint can simply be replaced by the expectation of the worst-case three-point distribution introduced above. (P3) can easily be transformed into a linear optimization problem with $3m$ extra variables with linearization techniques for maxima. The resulting linear optimization problem is then:

$$\begin{aligned} \min_{x,z} \ & c^\top x \\ \text{s.t. } & \sum_{i=1}^{m} \sum_{y\in\{1,2,3\}} p_y^i z_y^i \leq \beta \\ & z_y^i \geq 0 \qquad\qquad i = 1, \ldots, m, \ \ y \in \{1,2,3\} \\ & z_y^i \geq \tau_y^i - a_i^\top x \qquad i = 1, \ldots, m, \ \ y \in \{1,2,3\} \\ & Ax \geq \bar{b}. \end{aligned} \tag{P5}$$

Postek et al. (2017) also describe how the best-case distribution can be found based additional information on $\beta_i = \mathbb{P}(b_i \geq \mu_i)$. This yields a two-point distribution with which the best-case expected violation can be computed. Combined with the worst-case distribution, this information can be used to find an upper bound on the cost of not knowing the uncertain parameter's actual distribution. →

Numerical Results

To illustrate the results of our method we consider the `perold` instance from the NETLIB library of linear optimization problems. We only consider a parameter to be uncertain if it is different from zero, as a right-hand side of zero is often known with certainty. We consider the ambiguity set discussed before where each uncertain parameter can deviate a fraction $\epsilon = 0.01$ from its nominal value and has a mean absolute deviation equal to half its maximum deviation.

The solutions we find for varying values of α are plotted in Figure 1. For `perold`, we find that by safeguarding against only 90% instead of all of the possible worst-case violation, one can gain over 1% in objective value compared to the standard robust solution.

In general, for the NETLIB problems, reasoning from the nominal solution, the first half of the worst-case constraint violation is usually very cheap to prevent, while the second half comes at a much higher price in terms of objective value. Moreover, except for three problems, accepting an increase of 1% in objective value safeguards one against over half the worst-case constraint violation for all problems with 1% uncertainty. In fact, for a staggering 47 out of 61 problems over 90% of the worst-case expected constraint violation can be avoided by accepting an increase of 1% in objective value.

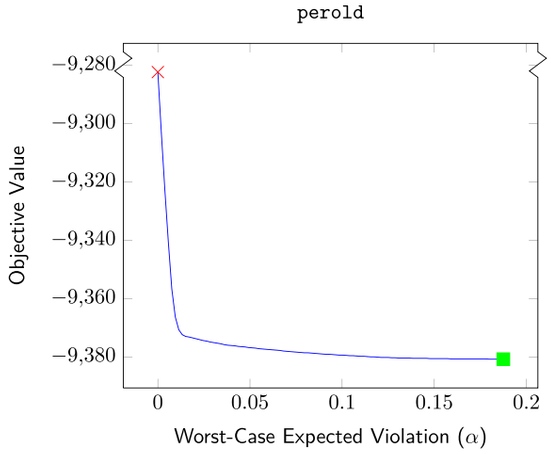


Figure 1: The solutions found by our approach with right-hand side uncertainty for `perold`, shown in blue. The red cross indicates the standard robust solution and the green square indicates the nominal solution.

Conclusion

Conservatism in robust optimization can cause big problems in implementing the solutions. We develop a distributionally robust approach that addresses this conservatism. This research is much more elaborate than I could hope to discuss in three pages. We also consider, for example, uncertainty in the left-hand side of constraints, which introduces new issues with respect to computational tractability. The interested reader can continue reading in Roos and Den Hertog (2017).

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Ernst Roos
Age: 23
Began studies in 2011

Stephan Sparreboom
AGE: 20
Began studies in 2016

BBQ and Beer: a Perfect Match

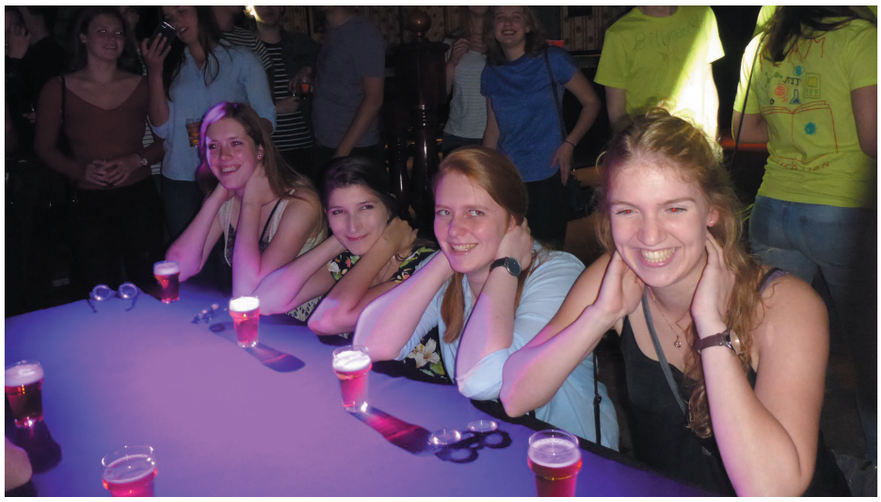
May 17 the yearly beer games drink was organized. Prior to this, Capgemini organized a barbecue where a group of econometricians got the chance to talk with employees about their field of work. I had the opportunity to attend this barbecue, and as a member of the Drinks & Activities (D&A) committee, organize the beer games drink, which in my opinion was the best drink of last year.

Capgemini barbecue

During the barbecue, we got the chance to talk about working at Capgemini. This we could do while eating delicious food, provided by Heuvel Gallery. The employees at Capgemini have not necessarily all studied econometrics. For example, one studied physics and there was also a recruiter. However, their work was related to the work of econometricians and they all have worked together with them. Topics ranged from their day to day life to their student life. One of the things I found really interesting was the interaction between people with different backgrounds. We probably will not work with only econometricians, so the different approaches from people with other backgrounds gives you a new perspective when addressing problems. I got the impression that Capgemini is a very relaxed company to work at, even though there is of course pressure to perform. They also offer a lot of extra activities and have a relaxed working atmosphere. At the end of the barbecue, we got a good idea of working at Capgemini. Being stuffed and hydrated, we went on to the beer games drink.

Beer Games Drink

Since everyone was still recovering from the Astrics cantus the week before, and with exams around the corner, we did not expect a lot of people attending this drink. We were proven wrong as a total of ten teams participated in the beer race and multiple econometricians were cheering on the participants. In the end, around sixty people were present. This year, for the first time, the drink was not just a beer race, but there were also multiple beer games. Of course, we could not leave out two tables to play rage cage, but there also was a table for beer pong and one table with a fun little game I found in the SoLow.



The highlight of the night was of course the beer race. The teams were divided into two groups and afterwards semi finals were played. Before the race, our committee did not have high expectations and our goal was to not finish last. After the two group stages were played, four teams were left standing; "Oud-Oud Bestuur + BdP", "Stoeiloes", "Drinks & Adjes" and "Soepele Boys". Our opponent in the semi-final was "Oud-Oud Bestuur", which we never expected to win. We still do not know how, but we won! So now we had to prepare for the final against "Soepele Boys". After the necessary toilet visits, we were ready to down those drinks! The final was played with two beers each. Unfortunately, we lost. However second place is not that bad I guess... Congratulations to "Soepele Boys!"

The end of the Beer Games also marked the end of this year's D&A committee. I have had a great time with them and want to thank them for their effort and motivation during this year.

THE TEACHER

The Quantitative Way of Life

On May 18 Dominique Bavelaar and I had the chance to interview Dr. Nikolaus Schweizer. We asked him about his student life, current daily life and future goals. We also tried to tempt him to trade his job for another job using the business world and his childhood dream job.

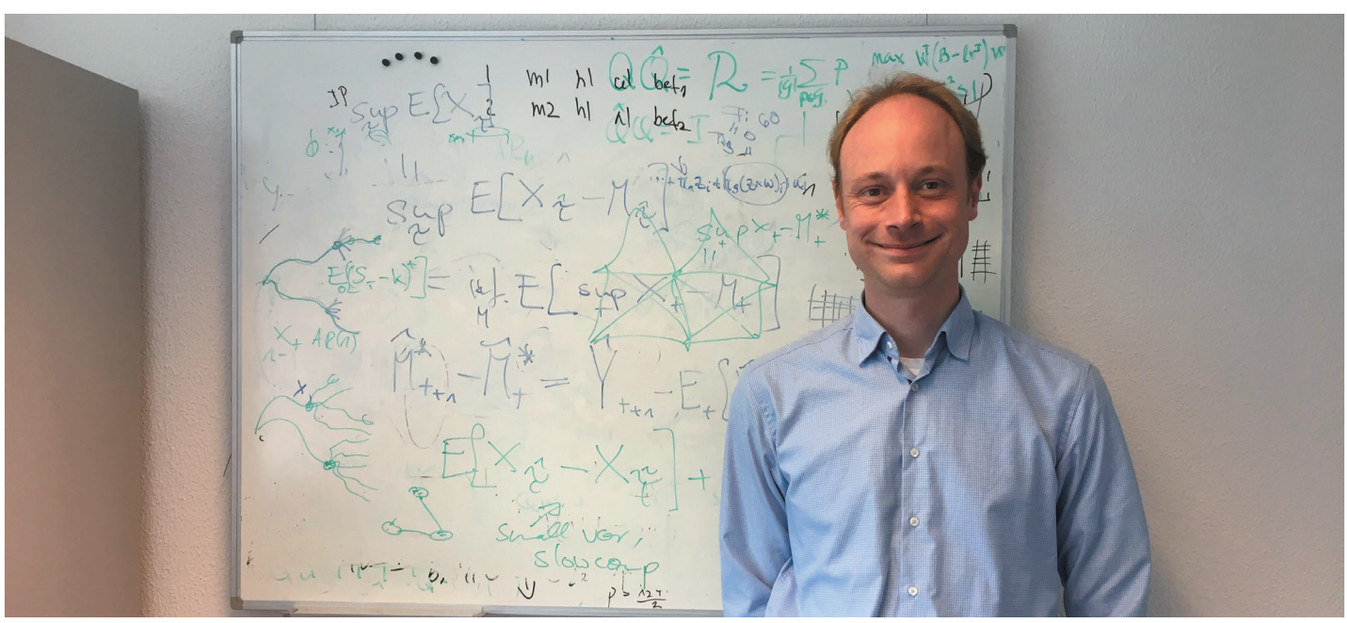
Text by: Zoë Connell

Since 2016 Dr. Nikolaus Schweizer teaches at our university. You may know him from Quantitative Finance and Actuarial Science (QFAS) related courses such as Introduction Asset Pricing and Asset Liability Management. He enjoys the courses he is teaching now, but in the future would like to teach mathematics courses as well. He is interested in knowing how his students see QFAS courses and what they will do with it later in their career. Nikolaus states that studying QFAS does not necessarily mean that you have to work in a bank afterwards.

Nikolaus was born and raised in Cologne and studied Mathematics at the university in Bonn. During his studies he discovered that philosophy interested him as well and he took a minor in philosophy. However, he soon realized that he wanted to pursue a PhD in Mathematics rather than one in philosophy as it started to bore him after two years. Fun fact: he knows philosophy professor Dr. Jan Sprenger here at Tilburg University from his high school and student days.

His master thesis and PhD research was focused on Monte Carlo methods and probability theory specialization. He was working on a problem for his master thesis and decided to broaden this for his PhD, but during his PhD someone else solved the problem he was working on. This meant that he had to start over and he extended his PhD a little. After his PhD he worked in Bonn doing a finance postdoctoral and thereafter one year of postdoctoral in Saarbrücken. He started working in Duisburg as a postdoc and after 2.5 years he thought he should take the next step in his career. He knew he wanted to find a new job. However, he only applied to one job: his current job. Tilburg suits him and he aims to stay here for a longer period. For Nikolaus thriving professionally is very important and he wants to continuously improve. He wants to look back in ten years and be able to say: "Yes, I improved a lot during that period."

Mathematics was always something Nikolaus was good at, so when he had to choose what he was going to study that was an easy task. In addition, his father suggested that it would fit him well. From the beginning of his student career Nikolaus was very serious about his career, even though he knew that he wanted to find a job where the math was more applied. He prefers working in finance and economics over working in pure mathematics, because it requires a broader skill set.



Placeholder Image
Lorem Ipsum

Nikolaus Schweizer

Age:
37

At Tilburg University since:
2016

Specialization:
Quantitative Finance and Risk Management

Of course we asked if he was part of an association comparable to Asset I Econometrics, but he said the study association was quite different. In the study association of his program at the university of Bonn there were only "pure" mathematicians. He said they mainly focused on organizing political activities rather than beer drinking activities, so we can spot the differences there. The way examinations were taken was also not the same as here in Tilburg, as they had weekly assignments and only after two years oral exams. The first two years contained only three courses: linear algebra, mathematical analysis and numerical analysis. He did not work during studying, but did some internships.

When Nikolaus was still a young boy, he wanted to be an archaeologist. He thought it was a very interesting job, however as he grew older he realized it meant a lot of digging and he lost interest… Like all professor interviews we have had, we asked him if he would trade his job for a job in the business world, but he said he never would. Then we asked him if he would trade his job for archaeologist without digging, but that was still not tempting enough. The only profession he would quit his job for was a career as a statistician or teaching some data science courses. He thinks, looking back at his career, that studying statistics would have also given him challenging and fun career opportunities, but he is happy now.

For Nikolaus the life as a professor has worked out better than he expected; he can work on different problems at the same time and he enjoys the level of mathematics he teaches. He thinks that it is currently a good fit between him and the wants and needs of the students. Usually, he tries to work between 10.00 and 19.00, but sometimes he also has to work at home to finish papers. Every week is about 50/50 teaching and conducting research. If he would have to choose between the two, he would choose research because this allows you to do whatever you want to do. Both are equally challenging for Nikolaus. Lastly, he enjoys that some weeks he has to program a bit but he is happy that he does not have to do that all week every week.

Music is very important in Nikolaus' life. He used to play the clarinet and saxophone and he enjoys listening to jazz music. Recently he bought a gramophone and he estimated that he has between two and three thousand records already. Other hobbies include reading, he likes English fiction. He tries to watch 'Kunst und Krempel' weekly, which is a German version of our "Tussen Kunst en Kitsch". Furthermore, he likes riding his bike. He says it is much more fun here compared to Germany, because it is more mountainous there.

Lastly, Nikolaus reads the Nekst and likes the columns 'The Teacher' and 'The Parents of …' most. He also reads about our informal activities because he likes to know who he is teaching. So I figured we should all show our best sides in those articles from now on! We asked Nikolaus for advice for his students and he said that it is very important that you listen to people. You have to take people and their problems seriously. We can contribute a lot with mathematics, but we really have to listen and try to connect to people and understand what they are saying, because most of the time it is actually quite insightful. There are so many communities of experts who just talk to each other because it is easier, instead of transferring their knowledge to the people that could really use it. So we have to work as much on the content as on getting our message across to the people that can use it. ●

Bert & Ernie Questions

✓ Bert	☐ Ernie
☐ Teaching	✓ Research
☐ Tilburg	✓ Cologne
✓ Beer	☐ Wine
✓ Fries	☐ Pancakes
☐ Mental calculation	✓ Using a calculator
✓ America	☐ Asia
✓ Quantitative Finance	☐ Statistics

Sports and Surprises

A year ago my idea of doing a board year was born and it became even stronger during my long days (and evenings) at the rooms of Asset | Econometrics while I was part of the committee organizing the LED (Landelijke Econometristendag). So as soon as the applications were opened last April I wrote my letter as fast as I could, because I was running out of time as soon as the deadline was approaching fast, and send it to the current board. From that moment it had really begun. I had to do my application in front of the board.

Joris Piree
AGE: 21
Began studies in 2015

After a couple of weeks the current board informed me that I would become the new external affairs of Asset | Econometrics and I found out who would become my new "boardies". From that moment on we lost most of our spare time, our agendas were completely occupied. The last couple of years the Asset | Econometrics announcement used to be in the beginning of June. However, due to our current board members cycling the Alpe d'HuZes the announcement was rescheduled to June 19. Therefore, we had to keep our involvement a secret for quite a long time, which was remarkably hard if you have to go to three announcement drinks of other Asset departments a week and usually end up in the city centre afterwards.

'All five of us were present (...) exactly on time, at 9.00 hours'

This became even harder when we decided that it would be a great idea to do one (or multiple) drinks with the five of us at Café de Boekanier, the place where you can find all our members during a Tuesday or Thursday evening. We thought that nobody would find out, but unfortunately this turned out to be different story. Oops!

Luckily, the day of our announcement came soon and we could talk about our upcoming board year. During the day we had a sports tournament with the entire association and a nice barbeque at the end of the day. As you can expect we were already tired from this tournament before our big happening would start. Still we were all very excited for this event as this would be our evening. And it turned out to be a great night.

At first we had to pretend like we did not know anything about the new board and just act like an ordinary member of Asset | Econometrics. At 22:45 the announcement started and one by one we were announced as the new board. From that moment on we would stand on the podium and be congratulated by many of our members and the other candidate boards.

The day after, all five of us were present at the rooms of Asset | Econometrics exactly on time, at 9.00 hours. I guess this indicates how motivated we all are for the upcoming year! Now we can really start with our work. The policy has to be written, the acquisition has to be done and a new budget has to be set up. We are all looking forward to it and are convinced it will be a successful year!

'We thought that nobody would find out, but unfortunately this turned out to be a different story'

Title

The Former Active Members (FAM) activities are always a great way to catch up with the older generation that built the foundation of this association. This day was no different. We had a great activity where we had to do many physical challenges to save an electrical plant from collapsing. After that we had a relaxing dinner where everyone had the chance to catch up with each other.

Text by: Loes van der Linden

We started the activity the way I would always like to start, with drinks and some Dutch snacks called 'Bittergarnituur'. Then it was time to get ready for the game, to save the electrical plant. First we had to split up into two teams. As (ex-)econometrics students everyone was naturally very competitive and the two teams soon became rivals, who both wanted the highest score. As always there was a weaker team and a stronger team, a battle of the sexes did arise, and a remarkable score was achieved.

'In this ultimate battle between the sexes (...) it was no surprise that the girls would come out on top'

To start off, every team member got a bracelet with a card on it. This card should be used in some of the subgames of the Rescue Challenge. There were six different subgames, where your team had the task to rescue the electrical plant from collapsing. In the first game you had to keep an arrow from different boxes in a designated green part. These boxes were scattered in a climbing frame, and you could keep the arrow in the green part by scanning your card. In the second subgame you had to save the building from a fire. In this game there was a canon with balls for every team member. We were supposed to shoot these balls though the circles to keep the 'fire' under control. In the third game our whole team jumped into a ball pit filled with foam blocks. Here we had to find all the boxes, which every team member had to scan.

In the fourth game we played some kind of 'Memory'. You had to choose an object on a screen and then find it again on another screen which you had to climb for to reach it. In the fifth game we had to divide ourselves into two groups which each was assigned a tower. When the light on one of the side of the tower became red, you had to jump to the button to make it green again. Lastly there was a height trail, where you had to make your way across all different kinds of ropes and obstacles to make it to the other side.

It was a fun game, like a big indoor kids playground where even people above the 1.20 meter were allowed. In this ultimate battle between the sexes, experimented on a smaller scale, it was no surprise that the girls would come out on top. After this surprisingly exhausting activity it was time for the men to drink away their sorrows and the women to celebrate. Luckily, we could all do this together in the center of Amersfoort. Here evaluated the 'Rescue Challenge', had some food and enjoyed a couple of drinks.

TITLE

Emma Segers

AGE: 22

Began studies in 2017

Since the beginning of this academic year I have been active at Asset | Econometrics. Early on in the year I was told it would be fun. You meet new people, you connect more with the university, there are fun activities and of course the highlight of the year: the active members weekend (AMW).

When I heard you could sign up for this weekend, I did so without hesitation. This year it was really popular and for the first time there was a maximum of sixty members that could join. Because of the number of sign ups, the organizing committee decided to raise the maximum by ten, however these extra members had to stay in a tent.

After everyone signed up, we got an email with some important information. A packing list, the theme of this year, your team and the subtheme of your team. This year's theme was ''time travelers''. Every group had a different subtheme, which fit within the main theme. We were the lucky ones with the theme knights. There were also teams with pirates, Renaissance, vikings, cowboys and a few more. In total there were ten groups. It was announced in the email that each team had to make a flag and had to create an outfit. This of course requires a good preparation. Two weeks in advance we came together one evening to bring our creativity to the table. A marvelous flag was created, a tough knight was created with the Asset | Econometrics logo on his shield. Furthermore, we wrote a song fitting our team. It was about the knights Melissa and Job, who went on a quest and asked advice from King Thomas. Also, the stallion Joris, princesses Linda and Dominique and dragon Emma are in the song. Eventually the AMW committee loved the song too and we got bonus points for it. Everyone picked their outfit according to their role in the song.

On Friday April 6, the moment was finally there, the weekend could start. With all the teams dressed and well in their outfits, we gathered at the university. This obviously got a lot of attention. When everyone was together and the luggage was collected, we left for the station. From there we would take the train to 's-Hertogenbosch. That is all the information we had. With our team there were a few bumps in the road, we lost one team member, so we decided to leave the group and wait for him. We later found out he went with the group and was already in the train on the way to 's-Hertogenbosch. We got an envelope with several puzzles, which we had to solve together. All the things we would do that weekend, would count towards the final ranking. Therefore, everyone started enthusiastically. They were hard, but what else would you expect when you are with econometricians?

Once in 's-Hertogenbosch, half an hour later than the other groups, it turned out we were going to do a Crazy 88. We received the tasks via a phone. Tasks included building a pyramid with your team, singing an unknown song, doing a somersault in a store, performing as a street artist and many more. This way, it did not take much time for us to see the entire city. Eventually this gave us more hints for the next location: Eindhoven! So, on we went, with our team to Eindhoven. Once we arrived there, the next game was already prepared, like real geocaches we had to find different

places throughout town, to complete sentences. Therefore, we had to pick a clever route, to visit as many points as possible. However, we had to watch our backs, as not to get hit by the snipers Rachel and Britte (with water guns). On this map was also our last location of the day: Eersel, that was where our camp location was. We had to be there by 18.00 hours, so we had to race to make it on time. After good teamwork, a good planning and some fast running, we made it there in time with a lot of answers.

When everyone had arrived at the location and got some rest, we ate pasta and then the evening program could begin. Different games had to be played with the team. Notable was that everyone gave their all. It was fun to see how seventy econometricians fully committed to a game of "schipper mag ik overvaren". To end the Friday right, we finished with a beer cantus. Lots of famous songs were sung and obviously we drank some beer. All together a very successful first day!

The next day we started off well, with some gymnastics. It was mandatory to be present, and if you were not, you would get a penalty in the final ranking. Next to the camp location was a big field with lots of activities, games and assault courses. The entire planning of Saturday consisted sport and games. In addition to the assault courses, there was an egg race, bottle football, Belgian hide and seek. Also, on this day it seemed to be a tough competition. Students who seemed to be your friends before the weekend, turned into your worst enemies. During this day our team did a little better than the Friday night. We were a true diesel engine, and just had to get going. The Saturday afternoon ended with a game of object bingo. The number called, had to be covered up with objects you could find on the location. After this game we had a nice barbecue. Also, we were really lucky with the weather this weekend, it was wonderful. Tropical temperatures made sure everyone could sit outside in short sleeves and with their sunglasses on.

To end the Saturday in style, we went to the local pub in Eersel. The staff was a bit surprised at first to see seventy students walking in, while normally thirty guests would be considered as a lot. Eventually though, they found out that we brought nothing short of a party with us. This day was also a big success!

On Sunday morning the organizing committee announced what we had been fighting for all this time. The final ranking determined which part of the grounds you had to clean up. Our team proudly ended in 9th place. This meant that together with the Egyptians, the number ten in the ranking, we got to clean the kitchen. You can imagine what the kitchen must have looked like after three days with seventy students. After the entire location was all cleaned up, we were picked up by the bus for a good ending to the day. The bus drove us to a swimming pool in Eindhoven, where we could recover from the busy weekend in the pool, hot tub or outside in the sun. You could also go to the bar to claim some fries, an ice-cream and some lemonade for the Asset children's party. We hung out there for a while and eventually we took the bus back to Tilburg. Once we were back at the university, a couple of us went to Café Brandpunt for dinner to wrap up the weekend, while others went home.

Altogether, it was a great weekend, where I met a lot of new people and had a lot of fun. It was very well put together by the AMW committee, which really deserves a compliment. It was a lot of fun and you will definitely see me next year!

TITLE

Marijke Lijzenga

AGE: 22

Vice President
SCOPE | Vectum
2017-2018

Already a few months ago the Strategy Tour took place. For the ones who participated in the event, I hope you enjoyed it! We look back at a successful first edition of the event and a great cooperation between Asset | Econometrics and SCOPE | Vectum.

All of this started in October last year, when Anne and Rachel called me to ask whether we would be interested in organizing an event together focused on strategy consulting. As it is quite a specific target group, we could reach more students by organizing it together and make it a better event in terms of quality.

We were immediately enthusiastic and in the beginning of November we started to arrange all the practical things. By this time, Capgemini already confirmed their participation for the original set up of the event organized solely by Asset | Econometrics. Luckily, they were happy with the new set up, so our first company was set. Additionally, there were a lot of things that we had to think about; from making a proposal to the LOES to how we would arrange it financially to the brochure for companies. We also made a list of companies that would be interesting to contact so that we could immediately start contacting them once everything was set.

'With Christmas coming into play, it was quite hard to reach some companies. Therefore, we decided to change our strategy a bit'

By the end of November, we started contacting the companies. Every week, we updated each other on the current statuses and how we would continue. Unfortunately, we were already quite far in the academic year and most companies had already other events organized around that time. With Christmas coming into play, it was quite hard to reach some companies. Therefore, we decided to change our strategy a bit as the event was getting closer. We first looked on the internet to find lists of companies that could possibly be interesting for the event. Then, we contacted as many companies as possible. By the end of January, we decided that it would not be possible anymore to make it a two day event as we would still need three more companies and we also had to look into practical arrangements like hotel and transport.

A week later, Monitor Deloitte confirmed their participation, which we were really happy about! From then onwards, we started organizing all the practical things for the event itself. The hotel, bus, name tags, program booklets and presents were all arranged, with great help from the committee. The hotel was in a remote area and therefore we decided to take a bus to the hotel. Even though it was a bumpy ride with our bus driver Piet, it was quite convenient and also nice to meet everyone already the night before the event.

On the day itself, everything went perfectly and it was nice to have Piet driving us around. We look back at a successful first edition of the Strategy Tour and are looking forward to organize it again next year! I would like to thank the committee, Bas, Thomas, Rachel, and especially Anne for all their work and the good communication! It was great to work together with you!

An Insightful Tour

On March 1, together with 16 Asset | Econometrics members I embarked on a journey to visit two of the leading strategy consultants in the Netherlands. Due to the distance that needed to be travelled during the activities the committee decided to start off early and travel to a hotel a day in advance.

Text by: Guus Vlaskamp

This meant we were able to start the actual day quite early. After meeting all of the participants and having a good night's sleep we left the hotel to travel to Capgemini's headquarters in Utrecht. Here we were introduced to the company and the way it works by two employees. After a short presentation filled with personal anecdotes and nice insights in the company's culture we were presented with a case. This case consisted of quite a number of aspects returning in daily consultancy work, from brainstorming to presenting. An aspect which kept returning in the way Capgemini's employees approached a problem at hand was the fact that feedback was one of the most important pillars in the process. "Feedback is the breakfast of champions!" We were encouraged to give feedback to each other as well, which became more and more natural to do, resulting in a very open and honest environment. Our morning at Capgemini was concluded by a delicious lunch and off we went again.

As this activity truly is a Tour we jumped on our bus and took the bumpy ride to Amsterdam, where we were invited to visit the Monitor Deloitte office. Again we started with a presentation where we were introduced to Monitor Deloitte. The distinction between Monitor Deloitte and Deloitte is one that needs to be made, since this is quite a clear difference. Deloitte is the overlapping company, with a broader perspective on consulting, where Monitor Deloitte is the subsidiary mainly focused on strategy consulting. Three employees then continued to tell us more about the daily practices of a consultant at Monitor Deloitte. These talks provided us with some nice insights and gave a more personal impression of the company. Afterwards we continued the afternoon with a case study . We were divided into a couple of groups and had to tackle a problem for a client. During this case the employees present provided us with a helping hand and a bit of insight in the Monitor Deloitte way of approaching a problem.

The day was concluded with a drink on the top floor of the Monitor Deloitte offices, overlooking Amsterdam. A large number of employees attended this drink, which gave us the opportunity to get even more different perspectives on the company. With our capitol in the background, we reached the end of this tour. I really enjoyed this activity and think it provided me with some very valuable insights in the different companies visited during the day as well as the field of strategy consulting overall. I would like to thank the committee and boards of both Asset | Econometrics and SCOPE | Vectum for organizing this event.

Let's Talk!

Text by: Anouk Claassen

Asset | Econometrics Activities

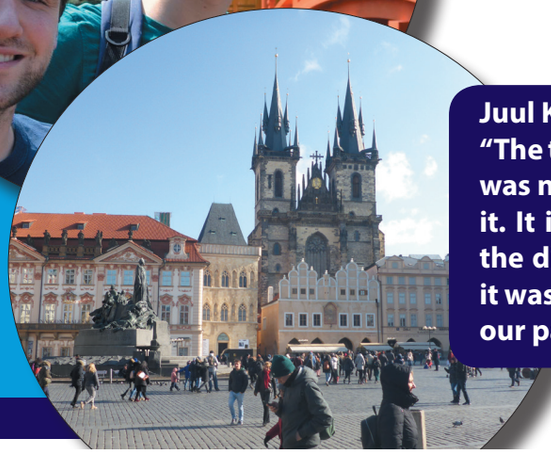
In front of you is already the last edition of this Nekst's volume, which means that the academic year 2017-2018 has almost come to its end. A perfect reason to look back on everything that happened this academic year. Hopefully you have passed your courses, had some good holidays, and liked all the activities organized by Asset | Econometrics. The important question we want to be answered in this 'Let's Talk' is: What was your favorite Asset | Econometrics activity of last year?

Rachel van der Velden:
"I think the best activity for me will be Alpe d'HuZes. We already raised a lot of money and I am really looking forward to it."

Anouk Verhagen:
"Wie is de Mol?-weekend! Of course the weekend itself was a lot of fun, especially the confessions. But it was maybe even more fun to see how enthusiastic other departments responded to it."

Bas Dietzenbacher:
"The International Business Tour, because of the unique international experience and the extremely successful karaoke night."

Bas Ramaekers:
"The "Wie is de mol? – weekend! Does that even need an explanation?"



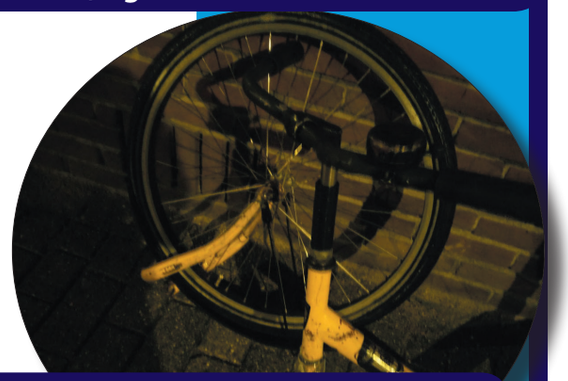
Juul Kooijmans:
"The trip to Prague! It was the first time that the trip was not just a weekend and it was definitely worth it. It is the perfect opportunity to mingle with all the different econometrics cohorts. And of course it was a nice plus that we got almost the entirety of our participation fee back."

Job Hoven:
"My favorite activity was the Active Members Weekend. It was really nice to see a lot of active members together and seeing that everyone was actively involved. The most fun part of the weekend was the morning gymnastics, especially because of some of the unhappy hangover faces."

Nina van Diermen:
"The improvised cantus during the Batavierenrace while several persons where looking at us wondering what we were doing. The weekend was the perfect combination between beer and sports with a lot of enthusiastic people. "

Karlijn Koerts:
"That was indeed great. Doing a cantus with a megaphone on a green, sounds wonderful, right?"

Polle Dankers:
"I really liked the Active Members weekend, because Dirk organized it, but who is Dirk?"



Tom Scholtze:
"The tosti I ate with Vera after my bike broke down on the way home from Vidar after the COdE beercantus."

Linda Torn:
"I had my best time while participating in the National Econometricians Day. I set up the committee last year and it was great to see how they succeed in making this a great edition. Furthermore, I had some interesting cases which gave me useful insight for my future career."

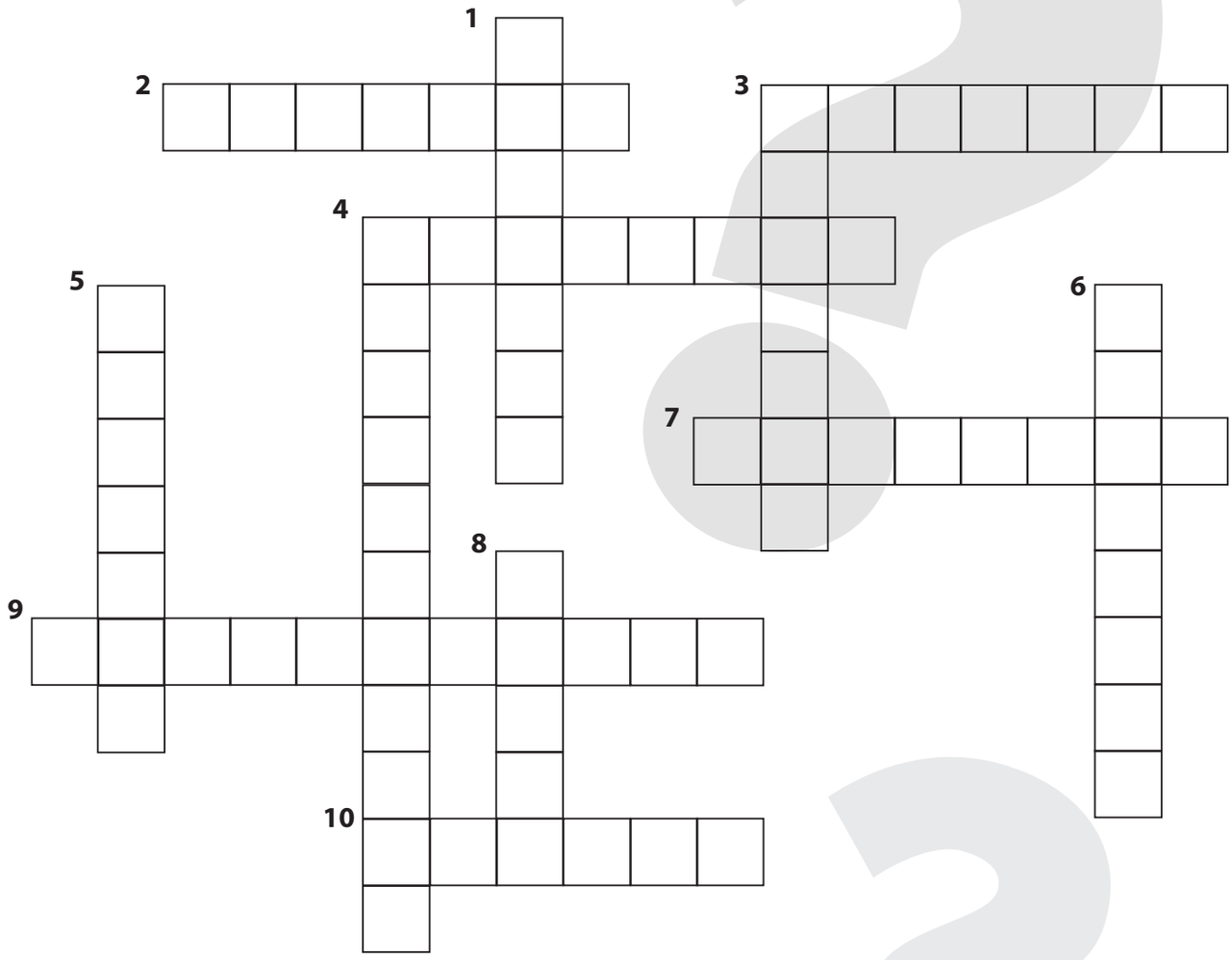
Till NEKST Time!

Do you have an interesting question or would you like to share your opinion with your fellow econometricians? Let us know via Nekst@Asset-Econometrics.nl!

PUZZLE

The self-fulfilling crossword puzzle

All entries in the following puzzle have to be of the following format:
[NUMBER][SPACE][LETTER][S]
These entries exactly describe how many times that specific letter occurs in the puzzle itself.



For example, if the roster would contain exactly one Q, somewhere in the puzzle there should be entered "ONE Q". If the roster would contain five P's and seventeen E's, the puzzle should contain the phrases "FIVE PS" and "SEVENTEEN ES".
In other words, you enter the word for a number, followed by a space, then followed by the corresponding letter, and finished off by an S if it is plural.

Use a healthy dose of logic to solve this puzzle. Good luck!

Caspar Croonen is the winner of the previous puzzle.
As a reward, he can come and pick up a crate of beer or a pie at room E1.10.
If you want to know the solutions of the previous puzzle, visit www.Nekst-Online.nl.

Can you figure out the puzzle?
Please enter your solutions at www.Nekst-Online.nl/Puzzle. A crate of beer or a delicious pie, whichever the winner prefers, 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!

Vacancy

Job title: Junior Quantitative Risk Analist
Company: Aegon
Location: Den Haag
Contact: Monica Ceulen
06 82528238
monica.ceulen@aegon.nl

AEGON

Job description
Worden er in de toekomst meer of minder mensen arbeidsongeschikt? Wat is de kans dat mensen af gaan lossen op hun hypotheek en wat is daarbij de impact voor investeerders?

Als jij een uitdaging ziet in deze vraagstukken, dan ben je als Junior Quantitative Risk Analyst bij Aegon op je plek. Het kwantificeren van risico's op de producten van Aegon en het optimaliseren van bestaande modellen is maar een kleine greep uit jouw verantwoordelijkheden. Kom jij de afdeling ALM & Methodology van Financiën versterken met jouw kennis en inzicht? Neem dan contact op met Monica Ceulen.

The Story of Moby Dickey-Fuller

Made by:
Loes van der Linden

Quatsch!

Thijs Kramer over belastingen:
"Voor elke euro die je verdient, gaat er 40 euro weg."

Renée Haegens:
"Nee we doen niets random, we pakken deze instance alleen willekeurig."

Rachel van der Velden:
"Eenmaal Ridho equals a lifetime of happiness."

Mama van Anouk Verhagen over een cantus:
"Maar moet je dan ook meezingen?"

Robert Poos:
"Elke WC is een zwembad als je maar klein genoeg bent."

Charlotte Nijman:
"Huh, is dat mijn hoofd? Oh, dat is een spiegel!"

Rianne Meiberg over een raketje:
"Is dit alleen water?"

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. Therefore, we present to you a selection of some striking and funny quotes!
Please mail all remarkable quotes you have heard to Nekst@Asset-Econometrics.nl!

Asset | Econometrics congratulates...

Name: Ruchira Mehta
Title: Solvency II implications on asset allocations
Supervisors: Prof.dr. B. Melenberg, Dr. N.F.F. Schweizer

Name: Luís Calejo
Title: Tactical network design and fleet scheduling for large transportation networks of express carriers
Supervisors: Prof.dr.ir. H.A. Fleuren, Dr. R.C.M. Brekelmans

Name: Wouter Bieze
Title: Airport check-in desk management modeled by a queueing system with group arrivals, a non-stationary arrival rate, and a varying number of servers
Supervisors: Dr. G. Gürkan, Dr.ir.ing. M.J.P. Peeters

Name: Lotte Ruwaard
Title: Product matching using unstructured data: combining images and texts to determine product similarity measures
Supervisors: M.P. Rothfelder MSc, Dr. N.F.F. Schweizer

Name: Boris Ševo
Title: Prediction of defaults among lease applicants: an application of machine learning on decision trees
Supervisors: Dr. P. Cizek, Dr. J.R. de Bresser

Name: Amber Kraak
Title: The impact of application software adoption on team performance
Supervisors: Dr. T. Kantarci, Dr. T.J. Klein

Name: Renée Lenders
Title: Optimization of insurance policies, Insurance companies, agents and policy holders
Supervisors: Prof.dr.ir. D. den Hertog, Prof.dr. J.P.C. Kleijnen

Name: Rutger Bruijnzeel
Title: Predicting Customer Churn Using Automatic Speech Recognition
Supervisors: Prof.dr.ir. H.A.M. Daniels, Dr. R.C.M. Brekelmans

Name: Quirien Raat
Title: A product recommendation system using a deep learning technique - A case study on datasets of customers click through data with low conversion rates
Supervisors: Prof.dr.ir. H.A.M. Daniels, Ir. R.J.M.A. Triepels MSc

Name: Thomas Kenbeek
Title: A comparison of binary predictive models for deal acceptance in the energy market
Supervisors Dr. B. Drepper, Dr. M. Salm

Name: Amy Kieboom
Title: Factors influencing the online registration of a move
Supervisors Dr. M. Salm, Dr. B. Drepper

Name: Berend Stofferis
Title: Modelling uncertainty: a game-theoretical analysis of China's plans to enter the DRAM and NAND markets
Supervisors Prof.dr. K.J.M. Huisman, Prof.dr. P. M. Kort

Name: Bart Dees
Title: Optimal pension contract for heterogeneous agents accommodating for life events
Supervisors: Prof.dr. T.E. Nijman, Prof.dr. A.M.B. De Waegenaere

Name: Rutger Engbers
Title: A tactical decision making tool for the mixed pickup and delivery problem with time windows and cross-docking
Supervisors: Prof.dr.ir. H.A. Fleuren, Dr.ir.ing. M.J.P. Peeters

Name: Martijn Kodde
Title: Spatio-temporal forecasting with neural networks taxicab demand prediction
Supervisors: Dr. O. Boldea, Dr. N.F.F. Schweizer

Name: Lennart Damen
Title: Gas storage valuation and optimisation
Supervisors: Dr. R.C.M. Brekelmans, Prof.dr. P. M. Kort

Name: Daan Marechal
Title: Talking to your customers: product recommendation using a recurrent neural network
Supervisors: Dr. J.C. Vera-Lizcano, Prof.dr.ir. H.A.M. Daniels

...on obtaining their Master's degree.

Summer Photo Contest

Would you rather show off your creativity than your brains to earn a crate of beer or a pie? Or do you simply want to have a shot at both the puzzle prize and the Summer Photo Contest? We challenge you to snap the most original photograph in which you are wearing the new official Asset | Econometrics jacket !

Rules for entry

- Entries are to be sent to Nekst@Asset-Econometrics.nl before September 1, 2018.
- Entries should show both the person entering the contest and the jacket.
- It is forbidden to edit your submission with Photoshop or any other photo-editing software.
- Entries will be assessed on various aspects, such as originality and composition, by next year's editor-in-chief and lay-out editor.
- Entering a submission to this competition constitutes acceptance of the rules.

Agenda

Summer 2018

Tilburg University Cantus

Monday September 3

The very first cantus of 2018-2019 will be a good one for sure. Do you want to participate in this event with unlimited beer and thousands of other students? Then make sure that you subscribe in time!

Department Members Meeting + Constitution Drink

Tuesday September 11

The new board of Asset | Econometrics will officially be installed during the Department Members Meeting of September 11. Afterwards, our first drink of the new academic year will take place where we take a look back at the year of the board members of 2017-2018.

Actuary Day Tilburg

Wednesday September 19

The Actuary Day of Tilburg (ADT) will be organized for the fifth time this year. During this event we will dive into the world of Actuarial Science. The day will consist out of a case and presentations by three different actuarial (consulting) companies. So join the ADT and get a better understanding of the world of Actuarial Sciences.

EOR Business Dinner

Thursday October 4

The EOR Business Dinner (EBD) will take place at Hofstede de Blaak. This three course dinner gives students and companies the opportunity to get acquainted in an informal setting.

Lecturer of the Year Award + Game Afternoon

Tuesday October 9

Which professor deserves a price for his writing skills, teaching skills or has the best style? You can vote in different categories on your favorite professor. After the LotYA, the Game Afternoon takes place with numerous games.

Introduction Activity

Wednesday September 5

The Freshmen students of 2018-2019 will have the opportunity to get to know each other better during games and a barbecue. Do you want to volunteer? Then send an email to info@Asset-Econometrics.nl.

Monthly Afternoon

Tuesday September 18

From 16.00 hours onwards, the first Monthly Afternoon of next academic year will take place! Swing by to play some games, eat something and catch up with your fellow students.

Landelijke Econometristen Sport Toernooi

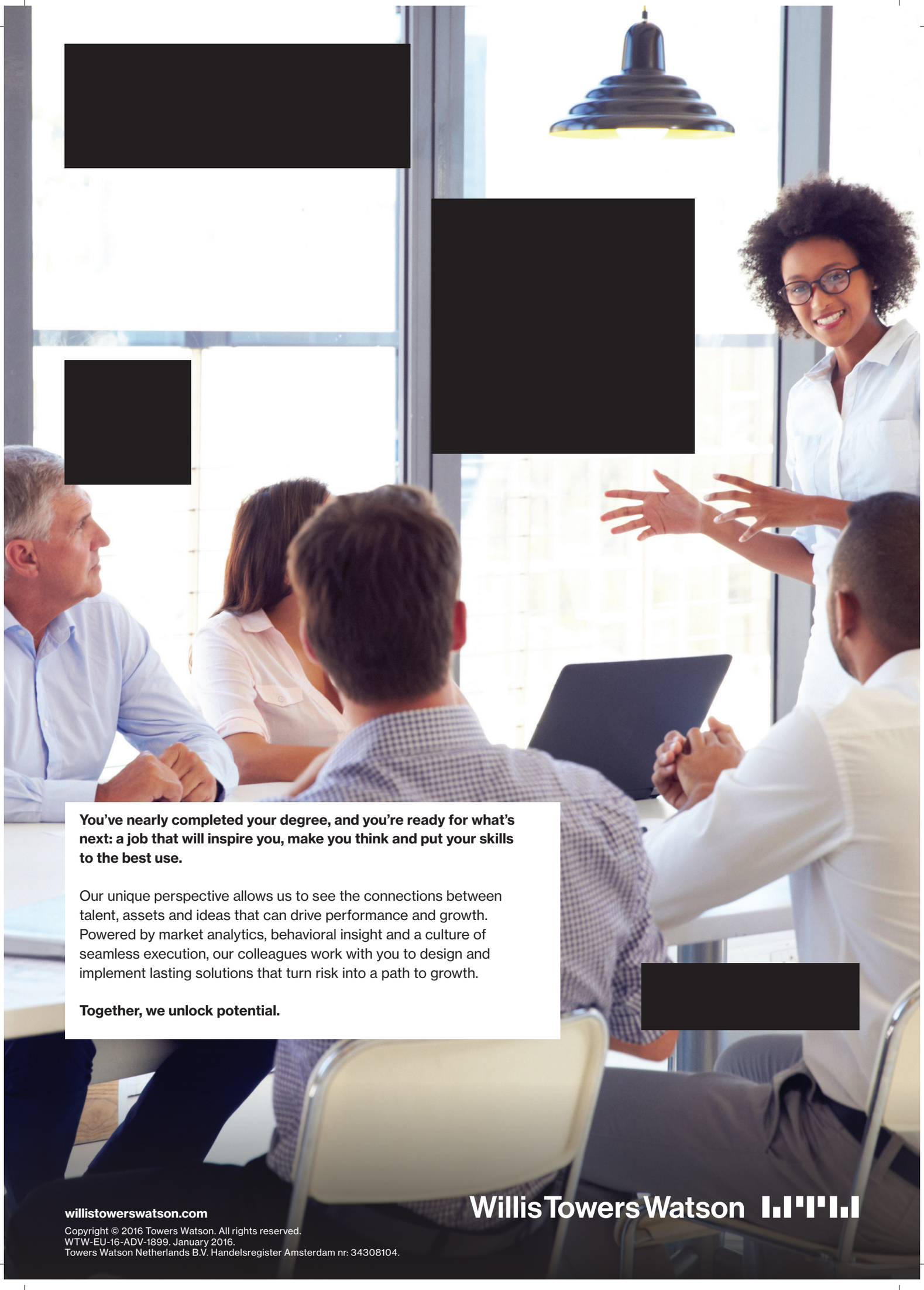
Wednesday September 26

On September 26, the Landelijke Econometristen Sport Toernooi (National Econometricians Sport Tournament/ LEST) will take place. You can take part in different sports tournaments, a barbecue, drink and even a party with sleepover!

Lustrum Theme Announcement Party

Thursday October 4

March 2019, Asset | Econometrics will celebrate her 40th birthday! Before we have our week filled with Lustrum events, we kick off the Lustrum year with a party on October 4. Do not miss this party, because the theme of the 8th Lustrum will be announced!



You've nearly completed your degree, and you're ready for what's next: a job that will inspire you, make you think and put your skills to the best use.

Our unique perspective allows us to see the connections between talent, assets and ideas that can drive performance and growth. Powered by market analytics, behavioral insight and a culture of seamless execution, our colleagues work with you to design and implement lasting solutions that turn risk into a path to growth.

Together, we unlock potential.

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