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Triangle

Nature, the Great
Optimizer



>>
Special
The
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>>
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Flow Traders

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**Practical
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Preface

A Fresh Start to a New Semester



At the time you joyfully lay your hands on a brand new issue of Nekst, you are hopefully a few beautiful Christmas memories and ECTS richer. On the left of this collection of words you see an advertisement from the Red Cross, who seek econometric knowledge in order to serve humanity. So in case you already lost your Christmas spirit the past month, this call will hopefully bring it back to life a little.

This edition's special is an interesting discourse on the interplay between econometric results and societal debates. The triangle is about fractal structures in practice and in the practical report, the role of factor investing in emerging credits is discussed. Moreover, an extensive report about the International Business Tour to Seoul is provided and our editorial staff visited two former board members who expanded the Asset | Econometrics family. Of course, several (in)formal activities get the attention they deserve.

At the end of the magazine an exciting photo challenge is launched, so be sure to check that out too!

Yours cordially,

Dominique Bavelaar
Editor-in-Chief

COLOPHON

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6

Travel Diary IBT Seoul 2018



18

Interview with prof. Hamers



Advertisements

Cover	Red Cross
4	Career Platform Tilburg
33	Flow Traders
Cover	Willis Towers Watson

Articles

1	Preface
5	From the Board
6	IBT 2018: Seoul
10	Cycling Dinner
11	Column: Theo Nijman
12	Triangle
15	Finance Expedition
16	KOALA
18	The Teacher

Table of Contents

20

Interview with Steven
Debets from Flow Traders



40

Let's Talk: What's your
Favorite Music?

34

The Role of
Statistics in
Society



20	Interview: Flow Traders
22	Committee Profile
23	Econometrics in Practice Day
24	IBT Photo
26	Special: The Future of EOR
29	Column: Bas Dietzenbacher
30	Practical Report
34	Special: The Numbers Game
38	Familiar Faces

40	Let's Talk
42	Freshmen Weekend
43	Christmas Dinner
44	Quatsch!
45	Puzzle
46	Graduates
48	Carnaval Photo Contest
49	Agenda



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Dear Members,

When receiving this beautiful issue of Nekst, you probably just finished all the exams of the first semester. I hope these went well for all of you. More importantly you have just celebrated the holidays with your loved ones and had some time to escape the pressure of everyday business. The start of a new year is, however, also a great moment to reflect on the year behind us and to look forward to a brand new year.

Looking forward we cannot miss out on the National Econometricians Day, better known as the LED, which will be held in Nieuwegein on February 7. Also the Strategy Tour will be organized in collaboration with study association SCOPE | Vectum from Maastricht. From February 21 till 22 you will get the opportunity to visit four consultancy firms in different kind of sectors. We will also organize the Master Experience Day and Connection day on March 19. Do you want to know what it is like to work at a company after your Master? Then join us at the Connection Day! Are you still in the beginning of your study and want to orientate? Then we invite you to join us during the Master Experience Day.

Next to all these opportunities to invest in your future career we also offer many informal activities to meet your fellow students. You might join us during the Lustrum Trip to Athens or you could visit us during one of the monthly afternoons. We will also have an informal activity with Pipple and the renowned pre-carnaval party is coming up soon!

Besides the parties there are many ways to meet your fellow students. Do you want to make new friends, make fun together and organize great events for the associations? Then we have a challenge for you! In February, the new committees will start and

we invite you to take part in one of them. Are you the sporty kind of econometrician? Then the Sport Committee might suit you best. Do you want to give the new freshmen a great opportunity to meet each other? Then join the Freshmen Weekend Committee. Are you more interested in a formal Committee and organize a business oriented event? Then the Finance Expedition Committee or the Econometrics in Practice Day Committee might be the perfect fit for you. We also have a new committee that will organize a hackathon in cooperation with Asset | SBIT, so if you are interested in a collaborative project, this will be the perfect fit for you! For all committees have a look on our website, www.Asset-Econometrics.nl, or contact us on info@Asset-Econometrics.nl. We are more than willing to tell you more about all the opportunities.

Last but not least I would like to take a moment to thank everyone that have worked so hard to bring the association to an even higher lever. A special thanks to our active members that worked continuously and unselfishly for each other. In the end the association is made by its (active) members and they have done an astonishing job in making the association a warm and welcome place for all of us.

On behalf of the board,

Quirien Raat

Chairman Asset | Econometrics 2018-2019

Econometricians Explore Seoul

written by **Hans de Ferrante**

On the early morning of Monday October 22, 21 Asset | Econometrics members and I flocked to Schiphol Airport. The day marked the first day of the Asset | Econometrics International Business Tour (IBT). Most of us started the IBT how we would end it; having slept about half of the recommended eight hours, keen to rest our eyes on the long haul from Warsaw, where we would be having an overlay, on our way to Seoul, the destination of this year's IBT. The booklet the commission had put together informed us that the title for the first day was "Poolse tafereelen", which loosely translates to "dramatic scenes in Poland". And boy did we have some Poolse tafereelen: while waiting at the gate in Warsaw, now all basically asleep, our flight got cancelled.

Luckily, our airline of choice, LOT (with only coincidentally the cheapest flights) handled the situation with great care, and was able to quickly place seven of us, myself included, on flights scheduled to Seoul with a layover in Moscow. Shortly after, Jasper and Dion were informed they would travel together via Doha, Qatar. Their delight in this romantic getaway did not last long, as all other participants were also assigned a seat on this flight. Relief set in at the realization we would all make it to Seoul on the scheduled day of arrival. Little did we know that the Moscow flight would be delayed, and seven of us – myself included – would stay the night in Warsaw. Despite this hassle, we decided to make the best out of our time in Warsaw, with the highlights being feasting on the hotel's delicious carpaccio buffet and Arike sleeping through our loud games in a bar in downtown Warsaw.

The next day the seven of us were luckier

reaching Seoul, where we quickly headed to the Dutch embassy. There, we rejoined our Qatari friends and Bas, the IBT fonsille who saw chance to fly in from his research fellowship in St. Petersburg. They had spent the morning visiting SAS, the American analytical software company and main sponsor of the IBT. At the Dutch embassy, we were given a presentation about Korea, which provided us with a bird's-eye view of the country we were visiting. Among others, we got to know about the popularity of plastic surgery, Korea's big conglomerates, their perceptions of the Dutch, and the fast economic growth that characterized the country after the Korean War.

We also briefly spoke about Korea's politics, which we assumed to be a current topic in light of former President Park's 25 year jail time. She was jailed for leaking state secrets and siphoning off funds to Choi Soon-sil, her close friend and daughter of a shamanist cult leader who is jokingly referred to as the Korean Rasputin. At the embassy we learned this episode was not too extraordinary, as being president is a good predictor for future jail time. That in Korean politics some more peculiarities are involved, became clear during a later visit to the National Assembly, Korea's national parliament, where we were told Korea's assembly members had only exchanged physical fights for verbal disputes some ten years prior.

One point that particularly stood out at the embassy is how serious Koreans are about education; young Koreans have the highest level of tertiary schooling among OECD countries. This fixation on education starts early: it is not uncommon for Korean parents to shell out hundreds of US dollars



on private tutoring, or to send their children to Chinese school to acquaint them with the Western counting system. The end goal of this spending is a great score at Suneung, the central college entrance exam. Suneung day is not only a serious matter for students and their parents: on the exam day airplanes are not allowed to take off during the English language listening section and businesses are open late en masse to prevent traffic jams. Even as few as two mistakes on this full-day test can preclude entry to Korea's top 3 universities.

For the IBT, visits were scheduled to two of these universities. We first visited Yonsei University, located near the bustling student area of Hongdae, where we were guided over the stunning campus by two Korean students. They were noticeably trained

for the matter, with an almost suspicious thoughtfulness. For instance, they saw fit to do the walking tour backwards so that we would not miss a moment to fire questions at them, and asked more than a dozen times whether people in the back could hear them. A visit to the second university near the end of our trip, Korea University, started with a similarly stiff campus tour. With large open spaces and beautiful buildings, the campus was reminiscent of Yonsei's, although there were some notable differences: where Yonsei was adorned with navy blue banners and images of eagles were scattered across its campus, Korea University was engulfed in crimson red and images of tigers. Vaguely familiar was Korea University's slogan, "Libertas, Iustitia, Veritas". Our guides, Kelly and Jennifer, did not have a translation when asked for one. They were

quick to point out, however, that it came from Harvard, as did the crimson red; Yonsei's navy blue was Yale's.

Scheduled after the campus tour was a lecture by prof. Myeon-jae Lee, a Korean professor of econometrics who had spent some time at Tilburg University. He welcomed us and told us about the warm memories he had from his time at Tilburg University, collaborating amongst others with prof. Arthur van Soest. He lit up in particular speaking about the faculty's soccer team, with whom they not only beat the students' team but – to his surprise – also went on to win a national tournament. He continued speaking about difference-in-difference estimation, including some interesting extensions I had not seen in our courses. Somewhat tragicomic to the lecture – but in



line with what we had heard at the embassy – is that the center stage example featured plastic surgery as the treatment and “beauty level” as the outcome.

After the lecture, we had lunch with prof. Lee’s econometrics students. We spoke about life in Korea and life in the Netherlands. It made me realize we have it quite easy, with great job prospects and a lot of free time in comparison to Korea, where the extreme competition takes a real toll on students and job prospects are poor – even for econometrics graduates. After lunch, some of us headed back to the hostel to change into hiking attire – prof. Lee and his students were astonished with how unsuitable our business casual attire would be for the city hike we had planned together. During the hike itself it became clear why prof. Lee had won the soccer tournament; the man was an athlete, darting up the mountain leaving us and his students gasping for air.

Besides SAS and universities, we also paid a visit to Blocko, a Korean blockchain startup. There, we were received by an endearingly nervous Korean employee and a German programmer who had extended his stay in Seoul to develop blockchain modules for Blocko. They managed to veer away from most of the buzz surrounding it, and discussed with us the underlying technology rather than empty promises as to how it would revolutionize the world.

We also visited the Samsung Museum of Innovation, for which we traveled to the city of Suwon. Samsung maintains a big presence in this city, which houses its largest

R&D center with some 130 buildings and 70,000 employees. Among the products being developed there are the well-known Galaxy Note series. The museum itself consisted of three floors, representing the past, present and future of technology. Especially the future was fun, with a big surprise to us how much we had all desired the companionship of Samsung newest fridge, which was equipped with a personal assistant and cameras that allow you to livestream your food while you’re out of the house.

On the cultural/historical front, we paid a visit to the War Memorial of Korea and its Korean Museum of War. This museum tells the history of the Korean War, which lasted from 1950 until 1953, when an armistice was signed. That Seoul was not left unscathed had already become clear to us during the visit to Yonsei University, whose main buildings still show bullet marks, and our visits to the various Joseon dynasty palaces, which were all rebuilt from scratch. The museum showed us, however, how almost all settlements on the peninsula were destroyed by 1953.

We also made a trip to the Korean border. However, the North and South had begun removing land mines from the fortified border earlier in the week which meant that we could not visit the Joint Security Area (the presumed highlight of any tour to the Korean border). With the rainy weather also blocking any views of North-Korea, leaving us at a vantage point watching images on a television screen: the tour was not the most exciting part of our trip. Interspersed in the program was ample free

time which we used to enjoy Korean food and further explore Seoul. We particularly frequented Korean BBQ restaurants, where meat is served raw and tables are equipped with gas or charcoal stoves. Eating Korean BBQ is somewhat of a ritual, with grilled meat to be wrapped inside a lettuce leaf with seasoning and sesame oil, then to be eaten in one bite. As we were completely unaware of this, we became quite the laughing stock at the first restaurant we visited, although the Koreans were eager to explain. By our last night, we had become quite skillful (although the waiters still jumped in to grill the meat for us). BBQ also comes with a number of side dishes, as did virtually all dishes we ordered in Korea. Perhaps the most famous one is kimchi, the fermented cabbage dish. Most of us quickly stopped feigning to care about these. For drinks, we often had beer (“maekju”) with a local rice wine (“soju”), the mix of which makes “SoMaek”.

Spicing up our beers with soju often meant we were more than keen to go out. Fortunately, Seoul also had a lot to offer in that department. Close to our hostel was Zen, a local bar where students would hang out, have drinks, and play games. Most of the group had discovered it early on in the IBT and it quickly became the go-to bar. We also visited three bars and a club with the Seoul Pub Crawl in Itaewon, a district which features many international bars and where many expats live.

Highlight for me was when we celebrated Halloween there, joining Koreans and a Kim Jong Un impersonator dancing on the



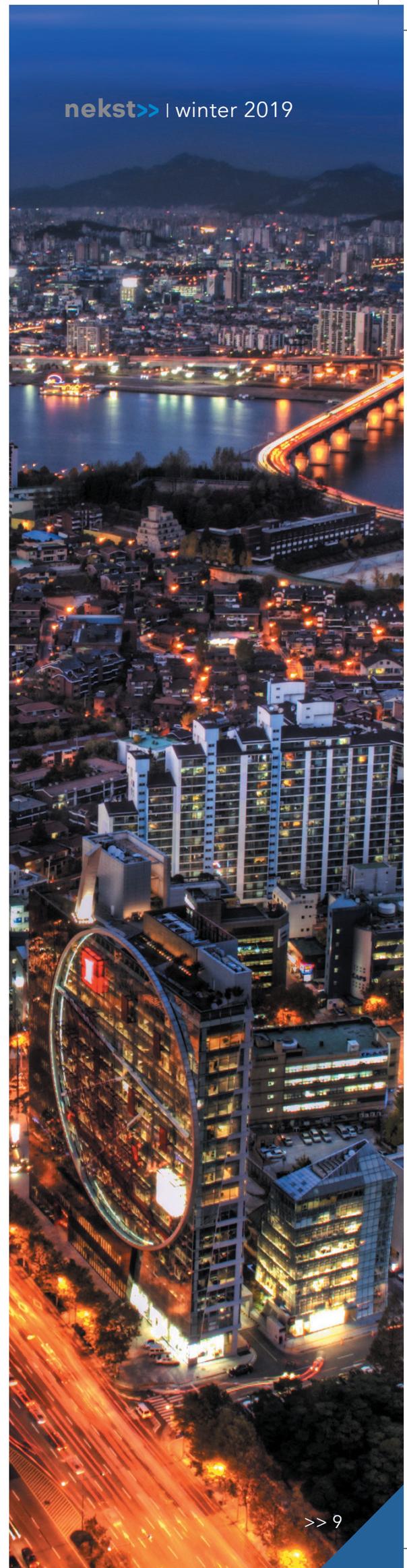


streets until the late hours. Days we did not make it to a club we often ended up showing off our singing voices at a five-story karaoke place near our hostel, where each room was equipped with four microphones. Bonus was the view they offered over Hongdae, the student area close to our hostel, as the exterior walls of each private karaoke room were made from glass.

A hike in Bukhansan national park provided a welcome antidote to all this overeating and soju abuse. I opted to take the intermediate trail to Baegundae peak, the highest in the park. Others chose the expert trail, whose narrow paths with cliffs on both sides implied they returned with near-death experiences. To the Korean hikers we encountered in the park we must have looked like lost tourists, as virtually all of them were dressed from top-to-bottom in specialized hiking gear – this includes, of course, walking sticks. Especially near the top of Baegundae peak, inclines became very steep, with steel cables and ropes a necessity to prevent sliding from the slippery

rocks. The views from the top were rewarding, with great views on both sides of Seoul's metropolitan area.

Activities I have failed to mention were a cycling tour on Yeouido Island and a city tour through Suwon (including to an eyebrow-raising toilet museum). A recurring theme during these (and other) visits was shrieking at chairs so comfortable falling asleep was all but guaranteed. When we headed back to the Netherlands via beloved Warsaw, it was for me thus with mixed feelings; I longed for some real sleep and was keen to be productive again, but also felt sad the extremely fun trip was over. Key to this fun was of course the extraordinarily enjoyable and laid-back group and the great organization by Claire, Robert, Wenxin, Arike, Max, and Koen. ●



Cycling Through the Different Holidays

On Wednesday November 7th the annual Cycling Dinner took place. As the name already suggests, this is an evening where we have to cook for each other, while cycling to each other between the different dishes. In couples of two you either had to make a starter, a main dish or a desert, while conforming to a theme that was given to you. I paired up with Niels and we had to make a desert with Halloween theme. This year, all themes were a certain holiday.

We started the evening together with Berrie and Martijn, with a starter that Polle and Tim made for us. Their theme was World Animal Day and decided to make soup with bruchetta. Although this does not sound like it has to do anything with World Animal Day, they thought of something smart to make it do. By making eyes and a mouth with crème fraîche and by putting the bruschetta on top of the soup bowl, such that they looked

like ears, they still created something that looked like an animal. Although they admitted that this was an idea they just thought about a few hours earlier, this was a very original way to make a starter according to the given theme. After chatting for a while it was time to go to our next stop.

After the delicious starter we just had it was now time for the main dish. Together with Annabel and Karlijn we had to go to Mirte and Britte, who also got the theme World Animal Day. Finding Mirte's was difficult, since number 10 is apparently not always between number 8 and 12.

Mirte and Britte decided to change the theme to Eat No Animals Day, which meant they made a vegetarian meal. They made a beetroot risotto with goat cheese (because of World Animal Day) and walnuts. This was something that I had never eaten before, but it was very tasty. Now, Niels and I had



Jeffrey Buijk

Master EME

Age: 22

to prepare our desert. Bas, Pierre, Jelle and Bastiaan were the lucky people that joined us for desert. Apparently Jelle and Bastiaan had a stressful preparation of their meal, since they still had to move a table between different houses, between their starter and main dish. As mentioned before, our theme was Halloween and we decided to make a Witch Hat, which was an idea of Niels. We put an ice cone on three ice cream scoops with white chocolate flakes, caramel and chocolate sauce. While eating our desert, we watched football, since Ajax was playing against Benfica, which was an important game. Unfortunately, Jelle had to leave early because he had to be present at the drink on time, but the rest stayed to talk a bit and watch some football.

Around 10 o'clock we went to the drink, which was at the Heuvel Gallery in Tilburg. It was a nice evening, where a lot of people were present, also a lot of people that did not participate the Cycling Dinner. During the drink the football match was broadcasted as well, such that we could watch the end of the game. After that the best dishes were awarded with a prize, we unfortunately got second place for the desert behind Emma and Bob. Afterwards, the destination of the Lustrum Trip was announced, which will be Athens. After the drink we went to Polly, after which we called it a night. ●



Transparent Investment Risks

Interest rates are at an all-time low and setting money aside in a savings account will generate very low returns. Investors have to decide whether or not they are willing to take investment risks in their search for higher returns. The concept of risk and the trade-off between risk and expected return are extremely complex for most individuals though. It is well known from the academic literature that many people provide inadequate answers even to simple questions such as

Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: [more than \$102, exactly \$102, less than \$102? Do not know, refuse to answer].

Annamaria Lusardi (who used to teach in Tilburg some 20 years ago) is the world-wide expert in financial literacy. Her research revealed that only 46% of Dutch respondents answered all her three questions of this complexity adequately. Approximately 10% answered incorrectly on all three questions. As an aside, the Netherlands did better than all other countries, apart from Germany. But fortunately nowadays we win in soccer...

A well balanced decision on how much investment risk to take is much more complex than these simple questions. Econometrics has to play an important role here. Many individuals prefer return guarantees when investing, probably because of the option it offers to avoid to really think about risk. Guaranteed future income is a key point in the reform discussion on supplementary pensions in which Netspar is very involved. In 2011 a farewell to guarantees was proposed to be able to better exploit investment opportunities. The labor unions initially agreed, but later referred to the lack of guarantees as "casino pensions" and the proposed reform was cancelled. The irony of history is that this lack of guarantees is now a corner stone in the new contract for supplementary pensions as proposed

by the labor unions. For now the negotiations on this agreement were stopped because of disagreement on the speed of adjustment of the retirement age, but the proposed contract is likely to be reconsidered. Econometricians will have to play a key role in explaining the cost and benefits of guarantees.

The econometrics toolbox contains many instruments to model investment risk. At the highest level of complexity, the Netherlands has a great tradition of so called ALM models (Asset-Liability Models) to model and aggregate all the different risk factors that affect pensions. A model developed in Tilburg is used often in this context and is prescribed by the pension supervisor (DNB) for use in deciding for example whether or not pension benefits are to be cut.

At the level of straightforward individual investment products, such as equity or bond investments, the legislation requires reporting of the 5% quantile of the future value of the investment. The underlying methodology is based on first year's statistics, assuming i.i.d. normal returns with known standard deviations and correlations. Although many students would rightfully argue that returns are fat-tailed and heteroskedastic, I am convinced that this simple tool is very valuable for individual investors who do not understand risk. For more complex products, such as those including derivatives, the Dutch supervisor adopted a model developed in Tilburg that more advanced students could recognize as the Expected Loss above VaR model. Again I am convinced that these models are useful to alert individuals about investment risks.

And in case you would still be wondering what the right answer to the Lusardi question, referred to before, is: In exams the first answer will be most appreciated. However, I am afraid the questions you will get actually get in the exams are substantially harder. ●

Theo Nijman

is professor of Financial Econometrics in the EOR and Finance departments. Theo is Scientific Director of Netspar, a knowledge network with eight universities and many private partners from the pension industry. Besides his academic work, he is heavily involved in pension regulation and reform in the Netherlands.



Nature, the Great Optimizer

Networks often consist of different subnetworks that are run by different providers. When operating on such a network, costs arise at points where the underlying provider changes. Such a cost is called a reload cost. In our research we consider an optimization problem incurring these costs: the Minimum Reload Cost Cycle Cover Problem (MinRC3). In this problem we search for a cycle cover in a graph while minimizing the total reload cost. Our goal is to construct strong and efficient lower bounds for the objective value of this problem. We present two new bounding approaches that can be applied to other quadratic binary problems as well.

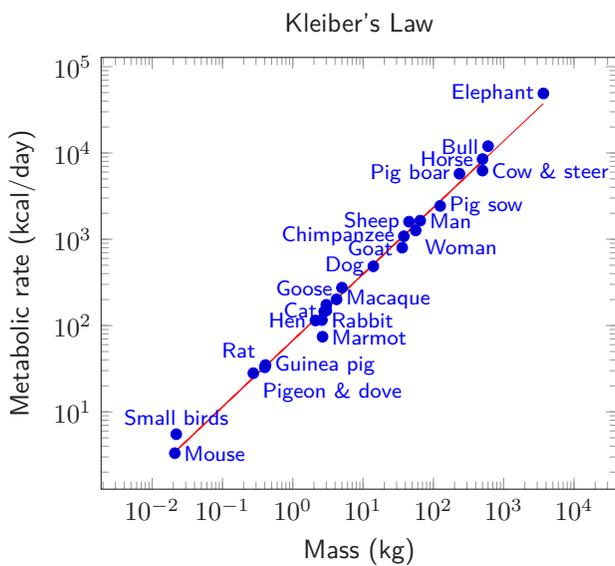


Figure 1: Illustration of Kleiber's Law (Data taken from Benedict [1]).

Life has found a way to inhabit almost every part of our planet. The varying living conditions on Earth have led to the enormous diversity in life that we know today. And yet, there seem to be some general principles underlying biological life. For example, the metabolic rate B of most animals (the amount of energy used at rest per time period) appears to be proportional to $M^{3/4}$, where M is the animal's mass. This observation is known as Kleiber's Law, and is illustrated in Figure 1. In fact, there are more of these observed quarter power scaling laws; for example, the heartbeat rate seems to scale as $M^{-1/4}$, and life span as $M^{1/4}$. But why would all these exponents be a simple multiple of a quarter?

Although Kleiber did his work in the 1930s, there is still no general consensus on where the exponent $\frac{3}{4}$ comes from. One of the most well-known theories is due to West, Brown and Enquist [3] and relies on fractal geometry to explain the origin of this quarter power scaling law.

Euclidean scaling

The metabolic capacity of an organism is the rate at which it can take up nutrients and other resources from its environment and distribute these to wherever they need to go. For example, humans absorb a large amount of nutrients through the intestines, and deliver these nutrients to cells by capillaries. The total metabolic rate is thus limited by the effective surface area a across which these exchanges can take place. In humans, this area a includes the surface of the intestines and the capillaries.

The naive idea about how this effective surface area scales with size is the following. Suppose that some animal is magically doubled in size, that is, its length, width and height are all multiplied by two. The total surface area of this animal then increases by a factor four, and the total volume of the animal increases by a factor eight. Since the total volume of an animal is proportional to its mass and $4 = 8^{2/3}$, you would expect the surface area of an animal to be proportional to $M^{2/3}$. If the effective surface area a scales just like the outer surface area of an animal, the metabolic rate would also scale with $M^{2/3}$. However, Figure 1 shows that nature has managed to improve the metabolic rate to being proportional to $M^{3/4}$. The key ingredients, according to West et al., are fractals.

Fractal dimension

How long is the British coast? The answer is, it depends on your ruler. While mathematical concepts like lines or circle segments may have a well-defined length, the real world is much less idealized. The length of the British coast for example depends on how precisely you are measuring (see Figure 2). There will always be some irregularities in the coastline that a straight ruler ignores. Shorter rulers will allow you to follow the coastline more closely, but they too will eventually face the same problem. Thus, the measured length of the coastline grows as measurement scale decreases.

While this phenomenon, known as the coastline paradox, arises for most coastlines, it does not occur at all for straight lines. Moreover, it may be more prevalent for some coastlines than

$11.5 \times 200 = 2300$ $28 \times 100 = 2800$ $70 \times 50 = 3500$ km

Figure 2: Lengths of the British coast with different precisions (Images from Wikimedia Commons).

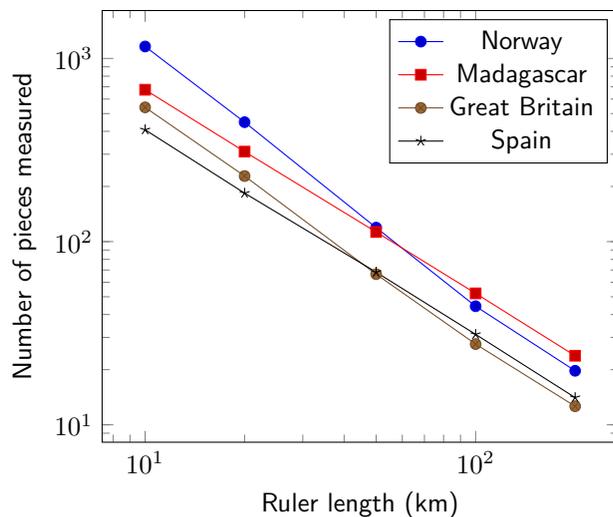


Figure 3: Number of times a ruler can be placed along four countries' outer border (Data taken from the GADM database, only considers largest landmass of each country).

others, depending on how crinkly the coastline in question is. The usual way to characterize the crinkliness of a certain object mathematically is by the fractal dimension d , which we can think of as

$$d = \frac{\log(\text{number of new pieces}/\text{number of old pieces})}{\log(\text{ruler magnification factor})}. \quad (1)$$

For example, if we measure the British coast with a ruler of 100 km instead of 200 km, the number of pieces measured increases from 11.5 to 28. This magnification factor of 2 would suggest a fractal dimension of

$$d_{\text{coast}} = \frac{\log(28/11.5)}{\log(2)} \approx 1.28.$$

Actually, the formal definition of fractal dimension requires the ruler magnification factor to tend to infinity, and then evaluate (1) in the limit. For practical purposes, this formal definition is hard to work with: how would you measure the length of a coast with an infinitely short ruler? Thankfully, it seems that for finite magnification factors (1) already gives a good approximation of the formal fractal dimension. As is illustrated in Figure 3, the logarithm of the number of rulers we can place along a border is often almost perfectly linear in

the logarithm of the ruler length. If you agree that the plots in Figure 3 are approximately linear, then $-d$ will approximate the slope of these linear relationships. Indeed, the slope of the regression line fit to the plot of Great Britain in Figure 3 is approximately -1.27, close to the opposite of the 1.28 we found above. The Spanish border is much less crinkly though, with the corresponding slope in Figure 3 being only about -1.12. Its fractal dimension is so small that the answer to the question whether Britain's border is longer than that of Spain really depends on the ruler with which you are measuring.

The definition of fractal dimension given in (1) can be applied to objects other than lines as well. Take a square with width and height equal to one. If you start with a ruler of length one, you could measure exactly one square. Taking a ruler that is, say, three times as short, you will now measure nine squares. This suggests that our square has a fractal dimension of

$$d_{\text{square}} = \frac{\log(9/1)}{\log(3)} = 2,$$

which is just what you would expect the dimension of a square to be. Note that the fractal dimension of an object will always be lower bounded by its Euclidean dimension: the fractal dimension of a length will always be at least one, the fractal dimension of an area at least two, etcetera.

An alternative perspective on the fractal dimension is the following: instead of making the ruler shorter, we make the object under consideration bigger. This leads to the alternative definition

$$d = \frac{\log(\text{new total measure}/\text{old total measure})}{\log(\text{scaling factor})}. \quad (2)$$

For instance, if we could double the size of Great Britain in all directions, the length of its coast – as measured with a 200 km ruler – would increase from 2300 km to 5600 km. Again, this suggests a fractal dimension of approximately 1.28.

A fractal model

West et al. [3] note that the resource distribution networks in many organisms seem to exhibit a fractal-like hierarchical structure, as illustrated in Figure 4. For mammals, the cardiovascular and respiratory systems are the prime examples at the whole-organism level, while similar structures exist within cells. However, unlike mathematical fractals, these hierarchical networks eventually end (hence the term "fractal-like"). Interestingly, the end points do not seem to depend on the size of the organism: all mammals have capillaries, cells, and mitochondria of approximately the same size.

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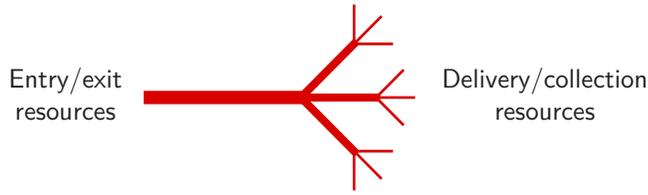


Figure 4: A hierarchical model of a resource distribution network.

As a consequence of these fixed terminal units, we now have that the effective exchange area a – e.g., the total surface of the intestines – can be consistently measured. On the other hand, the fractal-like nature of the distribution network means that a does not have to scale in a strictly Euclidean fashion. Specifically, the network operates in a three-dimensional space, so a could have a fractal dimension d_a satisfying $2 \leq d_a \leq 3$. To see this, West [2] offers the analogy of stuffing sheets in a washing machine. Doubling the dimensions of the machine will increase the volume of the tub by a factor eight. Assuming that you fill up the tub completely, you can now fit in eight times as many sheets as before, that is, the total area of sheets that you can clean increases by a factor eight. The same idea applies to the surface of the intestines: if it were completely space-filling, this surface would have a fractal dimension of three.

The final piece of the puzzle is the total volume v of the biologically active material. For most organisms, this is the total volume of their cells. As such, it is directly proportional to the organism’s mass M . We want to relate the volume v to the area a . To do this, we have to multiply a with some length l . Let l be the length such that

$$v = al.$$

Intuitively, l is a length that reflects the internal structure of the organism: it could for example be proportional to the length of the aorta. Since l is a length, its fractal dimension d_l is at least one.

Optimization

To see how this model will lead to Kleiber’s law, consider an organism with values a_0 , l_0 , and v_0 for a , l , and v , respectively. Now suppose we blow up this organism in all directions by a scaling factor λ , and that the new values for a , l , and v are denoted by a_1 , l_1 , and v_1 , respectively. It follows from (2) that a_1 satisfies

$$\frac{a_1}{a_0} = \lambda^{d_a}.$$

Similarly,

$$\frac{l_1}{l_0} = \lambda^{d_l}.$$

Because $v_0 = a_0 l_0$ and $v_1 = a_1 l_1$ by definition, it follows that

$$\frac{v_1}{v_0} = \frac{a_1 l_1}{a_0 l_0} = \lambda^{d_a} \lambda^{d_l} = \lambda^{d_a + d_l}.$$

In other words, v has fractal dimension $d_a + d_l$. It is immediate from the above that

$$\frac{a_1}{a_0} = \lambda^{d_a} = (\lambda^{d_a + d_l})^{\frac{d_a}{d_a + d_l}} = \left(\frac{v_1}{v_0}\right)^{\frac{d_a}{d_a + d_l}}.$$

Recalling that v is proportional to an organism’s mass, we see that a is proportional to

$$M^{\frac{d_a}{d_a + d_l}}. \tag{3}$$

With this model, West et al. claim that the origin of the quarter power scaling law is that for a given mass M , an organism maximizes its effective exchange area a . Mathematically, this boils down to maximizing (3) over d_a and d_l . Since $2 \leq d_a \leq 3$ and $d_l \geq 1$, the optimal fractal dimensions would be $d_a = 3$ and $d_l = 1$, leading to the exponent in (3) taking value $\frac{3}{4}$. Hence, the effective exchange area a scales as $M^{3/4}$, and since this is the main limiting factor on the metabolic rate B , this model explains why B seems to scale as $M^{3/4}$. ●

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Riley Badenbroek
Ph.D. candidate

An Expedition to Remember

As a student, the first couple of years are mainly spend partying. However, over the years, you begin wondering what the future might have in store for you. Luckily, Asset | Econometrics provides plenty of opportunities to get in contact with different companies. One of these opportunities is the Finance Expedition. During this three-day event, each day one or two companies in the financial sector opened their doors for a group of 24 students from Tilburg University.

As one of the main issues for a student is getting up early, we were lucky to stay in a hotel in Amsterdam. The topic for the first day was Risk Management and the companies Kempen and PwC were on the program. In the morning, we visited Kempen. After being welcomed in the lobby, we were invited to the top-floor of the building to enjoy the view and a cup of coffee. In the company's presentation the numerous different departments within Kempen were presented and experiences were shared by some employees. We were challenged through a case in which we had to make use of newspaper-headlines to form decisions on the firm's portfolio. Afterwards, the company had arranged a lunch where students had the opportunity to ask all their questions. We headed back to the train station, looking forward to the second stop of the day: PwC. At PwC, four employees shared their experiences in the field. In the case we were asked to choose the most appropriate risks in certain situations and present our findings. For me personally, this was the most exciting case as my group won the case and the awesome trophy: an original PwC mug. After this victory, the presenters took us out for a nice dinner. The day was concluded with a drink in the hotel lobby after which we headed back to our rooms.

The second day we took the train to Utrecht, to visit the insurance company a.s.r. The top-

ic of the day was Asset Management. While still impressed of the exterior of the a.s.r. headquarters, we were welcomed by a former econometrics-student from Tilburg. The history, approach and prospects of the company were presented in a fun and interactive way. The case concerned the management of a portfolio through different economic cycles. The winners of the case were invited to a "personal branding" workshop. After the lunch, the visit ended with taking some group pictures and a tour around the innovative building. There was no company visit scheduled for the afternoon so we headed back to the hotel. The board of the expedition had arranged a dinner near our hotel and of course the day ended with drinks in the lobby.

The topic of the final day was Corporate Finance with Rabobank and Deloitte as associated companies. The morning visit to Rabobank taught us about the various different departments within the bank. The case was an example of the problems the presenters mainly deal with: calculating the appropriate credit spread over bonds for various companies. We had to take maturity, outstanding debt and various other factors



Dion Pijpelink

Master QFAS

Age: 21

into account to find the right credit spread. After a short tour, we joined the employees in the lunchroom for pizza. At our last visit, Deloitte, employees of the M&A department shared the challenges they faced in firm valuation based on financial statements. During the case, we had to face these challenges ourselves and engage in several discussions on the topic. The visit ended with an improvised tour around the building and a quick visit to the "VrijMiBo" at Deloitte. The board had arranged a final dinner to close the successful Finance Expedition.

I would like to thank the entire board of the Finance Expedition for their efforts in making this trip a great success. We all took lots of new insights and experiences home from this expedition. ●



The 90s Koala



Frans Fonville

Started studies 2007

Age: 29

This year, the KOALA weekend took place in Lemele where former active members could relive their good old days in the style of everybody's favorite decade: the 90s. After a quick assessment, we found out that everybody present was in fact born before the 00s. You, the reader, however may not have been alive when these heroes started walking the earth. Therefore, some personals are written down, so you may judge for yourself whether you would like to join a KOALA activity in the future.

Twister Twat

You love playing twister with friends and so do I. We should hang out. I am fun for a chat and a beer. But once the twister field is laid out, I will undoubtedly betray you and push you over. Of course I will repeatedly accompany this foul act with the word 'sorry'.

Billiard Minigolfer

You can hire me to stand in for you at a billiard minigolf tournament. Admittedly, it is a sport that is only played at a KOALA. If you let me play all the holes (except the last one), then I will delight you with my Zjon-rays!

White Wine Pong Player

Are you also tired of the same old beer pong game every weekend? Then join my cause and red solo cups, because I have acquired an unlimited supply of sweet white wine during the KOALA auction.





Auctioneer

Looking for some advanced auctioneer skills at your KOALA weekend? Then do not hire me. If, however, you prefer someone who sells items to the first bidder; puts on ridiculously small garments for other people's pleasure; and trades in jam pots without lids, then I am your man!

Nekst Recruiter

I will let you beat me in some games, making you feel superior. Then, when you are most gullible, I will ask you to write something for Nekst. Your intoxicated self shall willingly oblige and only after the weekend has ended you realize that I had won the most important game of all.

Rave Dancer

What is better than meeting your friends from back in the day? Well, I would say *Hakküh* (rave dancing) with them is the best! At the KOALA weekend, I was the murderer on the dancefloor, albeit my moves were mostly hip-hop inspired.

Amaretto Witch

When it comes down to agility and intellect, I should be the hero of your choice. I may come over as an alcoholic when I brag about my skills concerning Amaretto. Yet when you accept my challenge and I reveal my true identity, it turns out I was talking about a game called Ligretto! I will mercilessly suck the joy out of you, while I keep beating you on Saturday night.

Beer Bat

Have you always had a weak spot for creatures that roam in the night? Then I am your guy. When I reach the pinnacle of my beer cantus experience, I will do something utterly stupid that will result in certain reprisal. I shall spread my arms wide as wings, let myself be lifted up from the ground and drink the beer upside down like a real bat!

Event Organizer

Make me responsible for your weekend plans and I will schedule the greatest 90s party of all time. You will have no worries about transport, since my friends can drive you there. And when you need a good thrill: I will happily push you into the mosh pit!

Slinky Sister

My favorite passtime is putting a slinky on my forehead and trying to balance the wiggly item on my face. I am charming in my very own way. You can recognize me by my beautiful association coat for which I happily overpaid at the auction.

Snorlax

Beer, snacks and bunny hops. Does that also sum up your perfect weekend? When I am not doing any of the above: I sleep. I sleep when others cook, when they clean and when some throw up. Still getting blamed for the latter though...



Cycling and Mathematics: Meet Herbert Hamers

written by **Zoë Connell**

On October 1st Michael Vo and I interviewed prof. dr. Herbert Hamers. Prof. Hamers has been working at Tilburg University for 30 years now, which is probably longer than the age of most of his students. You may know him from the course **Games and Economic Models**. Furthermore, he teaches **Mathematics 1 for Business Economics** for which he also wrote the book that is used. Since this year he is teaching the course **Introduction Analysis and Probability** since prof. dr. Dolf Talman has retired. Lastly, he also provides courses at **TIAS Business School**.

When Hamers was young he dreamed of becoming a professional soccer player. Later he adjusted this dream to becoming a sports teacher. Sports were always a big part of his life and that is still the case. When he was 17 he was playing soccer on a respectable

level, but he got a knee injury which meant he would not be able to continue this level. As soon as he recovered, he started playing again, but one match per week would be the maximum and at the age of 26 he decided to quit soccer. When he was 18, he knew that a career as a sports teacher was not optimal with the condition of his knee, so he started thinking about other things he liked to do. He soon thought mathematics was something he enjoyed doing so he enrolled in a mathematics Bachelor at the Radboud University of Nijmegen (at the time it was called Katholieke Universiteit of Nijmegen).

During his student life, prof. Hamers was not an active member of an association such as Asset | Econometrics, but there was no need as there were merely 40 people in his class and everybody knew each other already. At the age of 16 he started working as a waiter

in a bar, which hosted events like weddings for 80-100 people. During his studies he continued working here. Later, he also started working as a student assistant at the university.

At the time, he chose to study his Bachelor and Master in Nijmegen and did it in six years instead of four. He knew it was possible to get a grant for six years so why do it faster? He studied the most applied track there was, which was still very theoretical. He did not really know what to do after his studies, but thought teaching was something that would suit him. In 1988, he applied for a full time teaching position in Tilburg University (a one year contract) and got accepted. He enjoyed it so much that he decided to stay a little longer and he ended up working three years in the same position. At that moment, the university changed the policy and made it mandatory

for teachers to have done a PhD track before they would get a tenure position. He had not really been interested in doing a PhD before, but he got lucky as he got an offer from the same supervisor he had written his Master thesis with to continue that research and he decided to give that a try. The topic of his Master thesis and later PhD was Game Theory. Hamers states that he is happy that he did his PhD after three years of working and not immediately after his Masters' degree, because he thinks that he would not have been ready for the workload at that time.

Prof. Hamers' career path developed quite naturally. When he started teaching in 1988, he said his first lecture was bad, but he kept improving and improving. After his PhD he was supporting writing the book for the course Mathematics 1 for Business Economics and still giving lectures. At some point in time, he thought he met the requirements to become assistant professor, so he got recommended to the dean and received that title. The next step was full

a PhD student who has to opportunity to work on a problem full-time."

Hamers thinks the most interesting thing about his job is the contact with people: "I love talking about puzzles and solving them together, while making them enthusiastic about it. He would not necessarily recommend his students to pursue the same career path as he did, as people should just follow their own path on their own pace. If he could leave his job for a job in the business world, he would not do that because he is very satisfied with his current job. He has worked for CZ for four years one day per week on a problem and he had a good time there, but the contract ended and for him it was okay that it came to an end as well.

As stated in the beginning of this article, prof. Hamers is a fanatic sports man and he is married and has one daughter who is 24 years old. He quit playing soccer around the age of 26 and was not working out for about five years after that. Then he bought his first hybrid bike and made trips of 30 to

“ I love talking about puzzles and solving them together, while making them enthusiastic ”

professor which meant more and more responsibilities, more management tasks and more involvement with companies. Around 9 years ago he acquired this title as well.

"A regular week does not exist. There are periods where teaching is about 80% of the week every week and at other times teaching only takes approximately 30% of his time where the rest can be used for other tasks. These other tasks include supervising theses and conducting research." Prof. Hamers starts his day at the university around 10:00 hours and leaves around 18:00 hours, but usually he spends week nights to conduct research and reading as well where he cannot be disturbed by colleagues. At this moment he has about 80% teaching as he is teaching a new course (Introduction Analysis and Probability) and he has lots of classes at TIAS. He prefers teaching above research in general, but he enjoys puzzling on a problem together with a PhD student or other researchers and loves weeks of conferences as a getaway of teaching every once in a while. He said. Hamers: "I often have ideas to work on and to test, but I lack the time to do that so it is nice to supervise

35 km. In the first year he drove 1,500 km on it. That seems a lot, but gradually this number started to grow over the years, first to 3000, then 5,000, 8,000... It kept increasing from year to year and he bought a race bike. Nowadays he cycles around 13,000-14,000 km per year on the race bike. Just last Saturday he went on a trip of 150 km, which takes him approximately five hours to complete. It became an addiction for him and he enjoys riding his bike through the mountains on sunny days whenever he can. In the beginning, he was cycling with a friend, but that friend got injured and since five years he always rides his bike alone. Being alone has the advantage that he can always cycle at his own pace.

He spends most of his weekends riding his bike and going out to dinner with his family or seeing friends. He enjoys going to festivals and has been to LowLands and Best Kept Secret. Next month he will go to a concert of My Baby (Dutch band) in the Effenaar in Eindhoven. Last but not least, we asked Hamers if he had advice for his students and the only thing he answered was: Enjoy your time. ●



prof. dr. H. J. M. Hamers (Herbert)

Bert & Ernie Questions

Bert/Ernie
Research/Teaching
Wine/Beer
Tilburg/Hilvarenbeek
Fries/Pancakes
America/Asia
Using a calculator/Mental calculation



Trading the Lecture Room for the Dealing Room

An interview with Steven Debets on his daily life as a trader

written by **Dominique Bavelaar**

Flow Traders holds office in Amsterdam, separated from the central station by a few minute tram ride. Steven originates from Limburg and studied Econometrics (Master: QFAS) in Tilburg. During his studies he was member of T.S.R. Vidar and Asset | Econometrics, a period which came to an end 10 months ago, after which Steven joined Flow Traders.

"I actually have never taken any other company into consideration. It really appeals to me that in Flow Traders, you make use of the skill to look at patterns and processes in an analytical way, which you learned during your studies."

A typical day in office

Of course we asked Steven how he applies these skills during a day on the trading floor. Steven tells us about two scenarios: one relatively quiet day and one which is more busy and hectic and they happen to be of quite different nature: "My alarm goes off at 6:45 hours after which I head to office, where I start at 7:30 hours.", Steven explains, "Then we start off with calculating the values of the products we sell and verifying our pricing models. After that we start trading. When it is busy, for example after major political events or societal turmoil, traders make 50 trades a minute! This means you have to be really quick while making decisions." This is not the case every day though: "When the market is quiet, we

are mainly occupied with improving our models, which are used to forecast price movements. However," Steven proceeds, "there are always unexpected events in terms of price movements and it is part of your job as a trader to feel whether you have to improve your model, or that you are dealing with an outlier." According to Steven, this part of the job puts the most pressure on a trader, though he indicates he actually likes the challenge this brings. This actually is a vital characteristic for a successful trader at Flow Traders, Steven stresses: "If you are not able to cope with stress, this certainly is not the right job for you."

During his job as a trader, Steven works together with approximately 50 other

traders. Note the “works together” here, since at Flow Traders employees get a bonus in case the team as a whole performs well. Steven: “For that reason, the atmosphere is really relaxed and everybody wants others to make a profit too.” Besides traders, also quants and software developers are part of the Flow Traders company: “The quants are occupied with econometric analysis of stock and equity markets. They are,” Steven explains, “developing new forecasting models or improving already existing ones. These models have to be implemented in software, which our software developers build themselves.” This software is top-secret and is hence not sold to parties like banks or other financial institutions.

Flow Traders is specialized in selling so called *ETF's*, *Exchange-traded funds*, which are actually ‘baskets’ of different stocks or bonds bundled together. The demand for these products has been increasing lately, mainly because they have relatively low transaction costs when compared to buying all the tradable assets one by one.

Development within the organization

After you join Flow Traders as a Junior Trader, you start with a training program, which lasts approximately half a year. Since a new cohort of traders consists of people with different backgrounds (Applied Mathematics, Econometrics or Physics for example), not everyone is on the same page in terms of financial market knowledge. Steven: “During this program you are taught everything you need to know about stock products and pricing. It is a bit more practical than the courses during your Econometrics studies, since it is tailored to the daily work as a trader.” These *klasjes* really bond with each other: “For example, you have to organize a party for the whole company with your training class and during the training program you work intensively together.”, Steven illustrates.

Most of these traders are also very young: the average age of a trader is 32 years old. If you perform very well, you can promote to the function of head of desk and eventually head of trading, which grants you more responsibilities, resulting in that you have to coordinate your team while being a little less occupied with programming and trading. The structure is not that hierarchic, though: “It happens often enough that the CEO himself makes a chat with me or asks me to do something in person.”, Steven adds.

Challenges and developments

The job as a trader is quite intense and the biggest challenge is to stay sharp all day. This is not a big concern for Steven, though: “Since I actually really like the intensity and the variety of events during the job, I have no problem at all to stay sharp.”, Steven explains, “I often compare it to online poker, which is also quite demanding in terms of concentration and energy, though since it is a fun activity – at least in my opinion – it is easier to stay sharp for a longer period of time.”

Challenges on a company-wide level lie mostly in staying ahead of competition. Steven: “Since we are very specialized in ETF's, we can actually stay ahead in this specific field. There are other trading companies, each of which distinguishes themselves by specializing in one particular product. Banks are less specialized and focus more on individual stocks or bonds, hence they are not competing with our business. They actually might be interested to buy one of our products rather than competing with us.”

In terms of developments within the organization, Steven notes that Flow Traders is more and more becoming a technological company, rather than a financial business: “The situation used to be different, since we had a lot of financial specialists, who traded based on their financial knowledge.”, Steven explains, “However, more and more technology becomes available and trades can be handled faster and faster.”

The company also becomes more and more international: since it is hard to find talent, Flow Traders recruits from all over the world, having a global orientation program in Singapore, Hong Kong and New York City. This results in that employees speak English among each other. A nice benefit of the international-mindedness of Flow Traders is that if you want to join one of the offices in the cities, mentioned a few lines earlier, for a few years, that is possible too!

Finally, Steven states something interesting: “As a trader, you can make a lot of money if you perform well. However, even if money did not play a role, I would still want to do this job, since I like the challenge and complexity so much. That is actually the most important.”

We would like to thank Steven for his time and his interesting insights in the daily life of a trader. ●



Steven Debets

Age: 24

Function: Trader
Alma Mater: Tilburg
Universiteit
Study: QFAS

FLOW ■
TRADERS

It is Going to be Legend(b)ary

Maybe you have noticed some events that can be called remarkable: the logo of Asset | Econometrics has changed in October and stickers with this new logo can be found everywhere. Also a pre-party, with a guy dancing in a strange suit, has taken place and a committee, both mysterious and important at the same time, was formed. All this is because of the eighth lustrum of Asset | Econometrics: on March 15 2019, our study association will exist 40 years. As a member of the one and only Lustrum Committee, I will tell you the ins and out about the theme, the logo, and the most amazing committee.

It all began in the winter of 2018. The call to send a letter of motivation to join the eighth lustrum committee because for this important committee, a letter of motivation had to be written. After a lot of contemplation three girls (Nienke, Jeannine, and Lisan) and one guy (me) were chosen to be part of this committee. As a result, we had our first meeting in the beginning of March where we were informed that Loes was joining our committee as a member after her board year. In the following month, we met twice with the Almanac committee to brainstorm and to elaborate ideas for the lustrum theme. In this month, Annabel joined our committee as well, since we could use her enthusiasm and social skills. Together with the Almanac committee we finally made our decision: 'Asset | Econometrics: The eighth wonder of the world' would be the theme for the eighth lustrum.

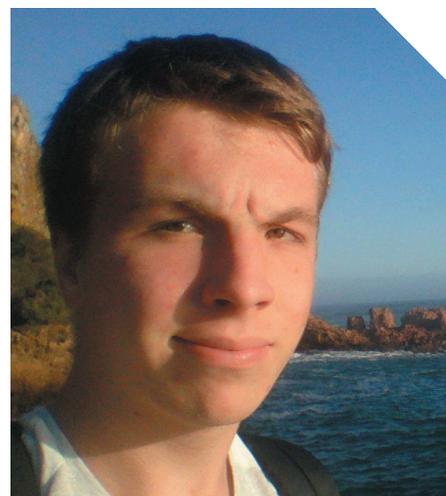
The next steps consisted of thinking about a suitable logo, the announcement party, a lustrum website and the location for the lustrum activities. Writing this in a just one sentence does not justify the effort that multiple people put in it. Pepijn Wissing and Lotte Bruijninx and of course other people as well, spent hours making a beautiful lustrum logo. This logo, by the way, is not a

diamond but a ruby which is the stone that signifies the 40 years.

Of course, we needed an event to reveal our theme. However, this sounds easier than it actually was. We had to decide whether to celebrate this pre-lustrum party with other lustrum departments or not. After endless discussions, we finally decided to organize it with the other three departments: SBIT, A&F and Economics, but with a condition: we had to make an announcement movie so great that it would blow away the other departments.

This movie should contain the suggestion of our theme but should not give away the theme in the first minute. Fortunately, I am in a committee with girls that are very creative and how to make an incredible movie. So after a few months, Annabel and Nienke made a script for the movie and we bought a green screen which we could use to pretend to be in front of the wonders.

One of the ideas that came up during our meeting was that it was very epic to have an Asset | Econometrics suit. We soon realized that buying such a suit would be way too expensive and making one was presumed to be too difficult. But that last claim turned out to be false: my own mother was very sweet and made an incredible suit in no-time which surprised everybody including myself (thank you, Wilma). After knowing all the details of the script and finishing the suit it was time for the filming day. Although the filming day was a little bit chaotic, it was a very funny day because of all the jokes that were made and all the committee members



Bernard van den Broek

Bachelor EOR

Age: 21

in strange outfits laying on a green screen.

Due to the editing skills of our beloved chairman Nienke, the announcement movie was ready and therefore we were ready for our pre-lustrum party. Together with three other departments which also will celebrate their lustrum upcoming year, we had a great party on October 4 where we showed our incredible lustrum announcement movie and the beautiful handmade Asset | Econometrics suit. One lesson I learned that night is that dancing in a suit for like 170 people can be a little awkward, especially if you are the only one dancing.

At the moment I am writing this the entire committee is very busy with a lot of important subjects like the lustrum song, the external affairs and the activities. This all because we want the lustrum week, which takes place from April 29 until May 4, will be a week to remember. In the following volume of *Nekst*, we will give a detailed explanation of all the activities during our lustrum week including a special piece of the implementation of the theme: the eighth wonder of the world. ●

“We finally made our decision: ‘Asset | Econometrics: The eighth wonder of the world’ would be the theme”



Where Theory Meets Application

written by **Dominique Bavelaar**

Both the reader and his Editor-in-Chief can agree that it was very hard to ignore the fact that the annual Econometrics in Practice Day has taken place. Over 60 students as well as six companies, from different branches were present during a remarkable day during which attendees had the opportunity to expand their network and broaden their horizon.

The day started off with some tea and coffee, after which Indatables and Osis held a presentation, their employees explained what it is like to work for their respective company. Students made a choice for one of these upfront. I personally attended the presentation of Osis, a Dutch Fintech company specialized in credit risk. They explained how they validate the models they use in practice and the two presenters shared their different visions on how macroeconomic events affect people on an individual level. Indatables is a data science company which focusses only on the data science. They explained how they use mathematical techniques to solve their customers problems. These techniques relate mainly to the BAOR and EME Masters.

After a short break, Veneficus and Zanders had their turn. Veneficus brought a former active member of Asset | Econometrics, who seemed happy to be back. Veneficus is specialized in data analytics and, especially, factual decision making. Zanders is a consultancy firm, focused on the financial and actuarial sector. They told us about what it is like to solve and present a solution to someone else's problem and gave a nice insight in the type of clients they do business with.

During the lunch, which followed after the second round of presentations, some students had the chance to have a speed-date with one of the companies present. An ideal opportunity to network while enjoying a delicious meal, set up by the amazing Esplanade café crew.

This sounds already very exciting, but it gets even better: Dynamic Credit and Anago hosted a case. During this case students had to work themselves on a project that was set up. The ideal way to actually experience what it is like to work as a graduated econometrician. Dynamic Credit provides asset management and advisory services. Anago is specialized in planning solutions for commercial organizations. After the case round, a networking drink took place during which a few drinks were drunk.

As Fortune, bono animo in nos, has decided, this article's writer also served as chairman in the committee that organized the EPD. Hence I can fully understand that you are somewhat skeptical about whether or not this piece is written completely objectively. For that reason, I asked some attendees about their opinions and impressions of the day.

Britte Kragten: *"After the presentation rounds and lunch I attended the case, hosted by Anago. I liked it very much, also because our team did a good job!"*

Job Hoven (committee): *"I was accepted into the EPD committee and first I did not know what I could expect because I have never done a formal committee before. It was very cool to organize and join this event and to get in*

touch with all these exciting and ambitious companies."

Dirk Cremers: *"It was very nice for me as a second-year student to get to know more about what you can do after each of the three Masters. I did not know much about companies and what they do, so it is nice to get insight in that. This EPD helped me also to know more about the applications of the theoretical knowledge from your studies."*

Polle Dankers: *"At this moment I do not yet know what I want to do exactly after my Bachelor. Currently I am mostly interested in the BAOR Master, but I did not really know which companies are active in this segment. I have a much clearer picture right now!"*

If you attended the EPD, I hope this piece brings back the good memories. In case you, one way or another, missed out on this edition: I hope you have already got a little bit excited for next year's edition as I am sure the new committee will make it just as much a great success.

Also on behalf of Asset | Econometrics special thanks to all company representatives that were present, all attendees, as well as to all my committee members who excelled in whatever they did. ●



IBT 2018: Seoul







The Future of EOR

As science will always keep on improving, we were wondering: how will our studies Econometrics and Operations Research be like in the future? What kind of developments can be expected? And most importantly, how will this affect the study program and the future/career perspective of graduated students? To answer these questions, Marieke en Cas sat down with professors from the three different Master fields to hear their viewpoints about these matters. The professors that were interviewed are Martin Salm (Econometrics), Renata Sotirov (Operations Research) and Bas Werker (Finance).

written by **Marieke de Leeuw**



dr. M. Salm

At the moment, the EOR Bachelor consists, in its first year, mainly of theoretical and mathematical courses, which provide the students with a strong theoretical basis that is of use in the remainder of the study program. The courses become gradually more practical-oriented in the second and third year of the Bachelor program. When asked whether this composition is expected to change, the professors all agree that they do not expect a significant alteration in the structure of the EOR curriculum within the upcoming years. Martin Salm says that: "The Bachelor studies EOR in the Netherlands are really unique compared to what is offered in the rest of the world. There do not exist many study programs where students get such rigorous training in mathematics and statistics and where these are later on combined with practical applications. This is a good thing and the pure theoretical mathematics courses in the first years of the Bachelor should definitely stay." Renata Sotirov agrees with him: "The strong theoretical basis for the applied methods is the main strength of the EOR program and this should not be changed." Bas Werker adds to this: "The topics in finance and actuarial science have been quite the same over the past years and these will continue on being relevant in the future."

Despite the fact that the professors that were interviewed all agree that EOR graduates still need to be well-trained in tough mathematics, they do expect some minor adaptations of the study program in the future. Martin Salm thinks: "Maybe, at a certain point during the studies within some course, more attention could be paid to how to obtain data and how to prepare a data set for analysis. Now, it is often the case that students get to work on an assignment



prof.dr.ir. R. Sotirov

concerning some data set, but with this data set already cleaned and prepared for them. However, many students will be working with data in their future career, which actually involves a lot of data cleaning and preparing in the beginning before one can actually start doing analysis on it. This matter could be easily implemented in courses that already exist and it has already been in some of them." Regarding this, he points at the course Improving Society Lab as a good example, where students get to deal with a real-life case from a company and are asked to solve the problem, just like it is done in business. Renata Sotirov adds to that: "There might be small changes in the computer programs that students are trained to use during the study program. Python programming has already been introduced instead of the course on Java programming in the

second year of the Bachelor, as the former is more widely used in business nowadays. The same holds for the increasing use of R in data science topics; this software package has also been introduced in combination with data-related courses. The Master programs or sometimes also third year Bachelor courses are from time to time adjusted to relevant trends in the field, but the main courses in the Bachelor will stay the same."

We already heard Renata Sotirov and Martin Salm about programming software



prof. dr. B.J.M. Werker

regarding possible adaptations in the study program due to emerging trends in business. Over the last two decades, computer programming namely has grown more and more important for us econometricians. Acknowledging that fact, the program nowadays consists of one obligatory and one elective course focusing entirely on teaching the students programming skills. Do the professors expect computer programming to become even more prominent within the curriculum in the upcoming years? Renata Sotirov thinks that "the balance between programming and theory in the Bachelor program is just right at the moment. In the field of optimization, good programming skills are crucial to find the best solution in the fastest way. Both in the Business Analytics and Operations Research (BAOR) Master program and in the BAOR-oriented

Bachelor courses, programming is used a lot." However, it is necessary to develop a strong theoretical basis first in order to be able to find the best solution at all. She thinks that some adjustments in the curriculum can and will be made as new trends occur and new optimization softwares are developed. "In business, cloud computing is often done, but that is not really covered in the curriculum (yet) right now. This could be something that might be implemented within the Bachelor and/or Master programs in the future." Martin Salm about program-

"The strong theoretical basis for the applied methods is the main strength of the Econometrics and Operations program"

- Renata Sotirov

ming: "Being able to do computer programming is very important when one needs to work with data. The theory comes back in programming so that we can nicely combine and integrate it within the study program. This is already done quite well in a lot of courses, as across the curriculum, there are quite some practical assignments for which the students have to work with different types of computer software." Bas Werker, however, has a completely different view on the importance of programming for future EOR students: "I do not expect many changes to the amount of programming within the study program in the upcoming years. On the contrary, I actually expect that within a couple of decades learning programming skills will not even be part of our study program anymore. The reason for this is that there are some programs in the higher professional education (HBO) that completely focus on programming. Graduates of such study programs are exceptionally skilled programmers that are able to deal with different software packages. When companies want to hire pure programmers, they will search specifically for this kind of students on the labor market. I believe that the role of the academically educated students will develop to be more focused on creating the models that need to be implemented by the programming staff and to interpret the

results that are obtained. All in all, I suspect that the programming work will be left to HBO graduates in the next decades." With these different views on the importance of programming for the EOR studies, only the future holds which professor's expectation will become reality.

As has become clear already, the interviewed professors think that part of the study program could be adjusted if relevant trends emerge in research or business. Then, the next question is: are they hoping for any breakthroughs or developments in their fields? Martin Salm says that: "The quality of research keeps on increasing. This is happening incrementally, but fast. In our field it is not like in physics, where there are these big breakthroughs from time to time. The topics in our field of science will move along with the major topics and concerns in society. I am working mostly on health economics which is really a hot field at the moment. However, at the time when I was a student, a lot of research was conducted on unemployment as this was the major concern in society back then." Renata Sotirov: "Everyday there are a lot of new and improved methods being developed to solve larger and larger problems. Scientists are constantly working to solve these problems not only by heuristics, but also with methods to find the

exact solution." One of the biggest unsolved problems in mathematics is known as the P versus NP problem. Renata Sotirov: "From time to time, someone claims to have solved it, but up to now a small mistake is spotted in every claimed proof. If it were solved, this would be very big news in the field of optimization." Bas Werker believes that research in finance will develop gradually as well. "The models in finance will develop to incorporate knowledge from behavioral economics more and more. These results from experiments are crucial to know how people make decisions. Besides that, I hope that soon there will be an agreement on the new pension system in the Netherlands. But that has a lot to do with politics and only a little with science."

After having had three interesting conversations with these professors, only one conclusion can be drawn: EOR graduates face a bright future, due to the unique combination of theoretical and practical skills acquired during their studies. These skills can be of benefit to society in many different ways, whether it be in the field of finance, data analysis or optimization. ●



Bas Dietzenbacher

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It is a Small World

Some jobs in business require or give the opportunity to travel a lot, both domestically and internationally. Consider, for instance, an internal meeting with colleagues at the headquarters, a course on the newest developments in your profession, a sales appointment with potential customers and a consultation or presentation to current clients are just a few examples involving travelling beyond the daily commuting between home and work. How boring travelling in a traffic jam or a full train during rush hour can be, how exciting a business trip to an interesting place actually is. What about jobs in academia? Well, professors are not only travelling between lecture rooms and their office.

Although not very frequently, teaching can occasionally bring professors to different places. Next to their regular classes at their main university, they may be hired to teach a course at another university. These professors for instance have a very successful class, or the other university has a (temporary) lack of certain expertise to teach a specific course. Some professors even have multiple jobs such that they are affiliated with more than one university. However, teaching at a different place boils in most cases down to a single guest lecture or a few lectures at a summer school. Summer schools, or spring/autumn/winter schools, are primarily for knowledge remediation or advancement of the participants, which can be students or professional workers of any level.

In general, the travel activities of professors are actually not related to teaching, but to research. I am again not talking about commuting, but about giving seminars, attending conferences and symposia or paying research visits (abroad). A seminar is a form of academic instruction. It usually is a presentation about recent research of the speaker to an advanced audience consisting of other academics,

research staff, and postgraduate students. In a sense, giving a seminar can be considered as teaching to professionals. An academic conference or symposium is an event composed of several short seminars in which different researchers in a certain field present and discuss their work with fellow experts. It serves as a platform for exchange of ideas and information between various researchers and may last for multiple days. Whenever two or more researchers have a common interest in a specific topic or idea, they can bundle their abilities and start a joint research project. This can be very fruitful since two know more than one after all. During the several stages of the research, it may be convenient to visit each other for some time. These research visits are then hosted by a university to which one of the collaborators is affiliated.

Although I am not a professor, I consider myself fortunate to have had several opportunities to travel for work. In 2018, my job has not only allowed me to travel to Tilburg, Maastricht and St. Petersburg, but also to Bilbao, Paris, Bayreuth, Glasgow, Reus, Moscow and Rochester – the latter being actually the place where I am writing this piece of text. To me, these seminars, conferences, and research visits are very beneficial for getting feedback on my work and learning from the work of others. Besides, it enables me to meet other people in the field and build an international network, which can be helpful for my future career. Of course, when travelling to a foreign city, I usually exploit the opportunity to combine the formal activities with informal sightseeing, a little bit in the same spirit as the International Business Tour organized by Asset | Econometrics. This year I was lucky to join this trip for the fifth time. Travelling is inspiring and fun! ●

Factor Investing in Emerging Credits

Emerging credit markets have become an increasingly attractive asset class in the past decade, due to a variety of reasons. Although factor investing has in general been on the rise as an investment strategy, little is known about these so-called factors in this particular asset class. This report, based on research conducted during my graduate internship at Robeco, will shed light on the role of factor investing in emerging corporate bond markets.

written by **Lennart Dekker**

Introduction

A large stream in the literature documents the presence of so-called factor effects in the cross section of asset returns. Portfolios based on these factors contain a premium beyond the market premium in different asset classes. Each factor exposes the investor to a systematic source of risk or anomaly, allowing the investor to harvest these premia. However, most of this research focuses on stock returns in developed markets. In addition to this, *Blitz et al.* [1] is one of the studies containing evidence on factor effects in emerging stock markets. Besides, *Houweling and Van Zundert* [3] and *Israel et al.* [4] extended this research to corporate bonds in developed markets. Nevertheless, the ability of common factors to explain the cross section of corporate bond returns in emerging markets is unclear. This report will therefore focus on factor effects in emerging credits. More specifically, the well-documented factors Low Risk, Size, Value, and Momentum will be investigated.

Low Risk

The idea behind the Low-Risk factor is that less risky assets tend to have higher risk-adjusted returns. The Capital Asset Pricing Model would predict a positive relationship between risk and return, which is the exact opposite. However, empirical evidence shows that this positive relationship is often absent. Low Risk is constructed by combining the credit rating and the time to maturity of the corresponding bond. For both components, cross-sectional Z-scores are constructed and the Low-Risk score is simply the sum of these two Z-scores. The rationale behind this is that both credit rating and maturity contain important information about the riskiness of a bond. The Low-Risk portfolio includes the bonds with the lowest score on this metric. One might think it would be straightforward to define the Low-Risk score as the historical volatility of returns. One of the reasons for not adopting this definition is that recently issued bonds do not have a long historical returns series, making it hard to estimate this historical return volatility.

Size

The Size factor is based on the tendency that assets of smaller companies earn higher returns on average. Size is defined as the sum of the market values of all bonds issued by the same issuer. Hence, bonds issued by the same company will have the same score on the Size factor by definition. For this reason, the Size factor selects the smallest issuers, rather than individual bonds.

Value

The Value factor tries to identify 'cheap' bonds, i.e., bonds with a relatively large credit spread given the default risk. Each month, the following regression is considered:

$$\log(S_i) = \alpha + \sum_{r=1}^R \beta_r I_{ir} + \gamma M_i + \delta \Delta S_i + \epsilon_i.$$

Here, S_i denotes the credit spread of bond i , I_{ir} is a dummy equal to one if bond i has credit rating $r \in R$, M_i is the time to maturity of bond i and ΔS_i is the difference in the logarithms of the current credit spread of bond i and the 3-month lagged credit spread. The Value score is then defined as the residual of the regression above, since the residual corresponds to the relative mispricing ($\epsilon_i = \log(S_i) - \widehat{\log(S_i)}$). The intuition behind this is that a high residual means that the observed credit spread is relatively high compared to the expected credit spread based on rating, maturity and the past 3-month change in spreads. This is exactly the type of bond that the Value factor tries to select.

Momentum

Momentum is based on the idea that past winners tend to outperform past losers in the future. Stated differently, assets that have performed well in the past tend to have good performance in the future as well. The Momentum score is defined as the cumulative return over the past six months. This score is implemented with a lag of one month to account for short-term bond price dynamics. The Momentum portfolio includes the bonds with the highest past cumulative returns.

Portfolio construction

For each bond-month observation in the sample, a value for each of these four factors is calculated in the way described above. For each factor, five quintile portfolios will be constructed for each month separately. First, bonds are ranked according to their score on a certain factor as explained before, after which the five quintiles are made based on this ranking. The quintile portfolio is then defined as the quintile containing the bonds with the best score on that corresponding factor. The quintile portfolios are constructed on a value-weighted basis. The holding period for each quintile portfolio is equal to 12 months, meaning that an overlapping portfolio strategy is applied. Namely, at time t , a certain factor portfolio consists of the quintile portfolios constructed at time $t - 11, t - 10, \dots, t - 1$ and t . Performance of the factor portfolios will be measured against the market portfolio, which is the entire cross section of corporate bonds present in the sample. The analysis will focus on excess returns, defined as the total return of a bond minus the return on a duration-matched treasury with the same currency denomination. The return on a duration-matched treasury can be interpreted as the risk-free rate.

Results Backtest

Table 1 contains the results of taking long positions in each factor portfolio. In addition, a multi-factor portfolio is constructed by allocating 25% of wealth to each single factor (final column). It follows that Size, Value and Momentum have positive information ratios that are highly significant.

	Mkt	LR	Size	Value	Mom	1/N
Return	3.30	2.37	8.28	7.62	5.36	5.91
SD	6.07	2.65	6.73	10.86	6.34	5.85
SR	0.54	0.89**	1.23**	0.70	0.85**	1.01**
IR		-0.24	0.90**	0.73**	0.74**	1.35**
TE		3.81	5.56	5.95	2.77	1.93
Turnover	44%	52%	63%	73%	92%	70%

Table 1: This table contains the results of the Low Risk (*LR*), Size, Value, Momentum (*Mom*), and multi-factor (*1/N*) portfolios. The average excess return (*Return*), the standard deviation (*SD*), and the tracking error (*TE*) are in percentages. Furthermore, the Sharpe Ratio is denoted by *SR*, and the Information Ratio is denoted by *IR*.

Note that a positive information ratio indicates outperformance with respect to the market. In contrast, Low Risk shows a negative information ratio because its mean excess return is lower than the mean excess return of the market. Hence, Low Risk only shows outperformance on a risk-adjusted basis, since the Sharpe ratio is significantly higher than the Sharpe ratio of the market. The multi-factor portfolio shows the highest information ratio and therefore the highest out-performance.

Relation between factor portfolios

It could be the case that returns on a certain factor portfolio can be explained by other factor portfolio returns. For instance, it might be possible that the Value factor and the Low Risk factor capture similar bonds. To find out the relationship between the factors, the following regression is considered:

$$R_i = \alpha + \beta R^M + \sum_{j=1, j \neq i}^4 \gamma_j \tilde{R}_j^{EM} + \sum_{j=1}^4 \gamma_j \tilde{R}_j^{DEV} + \epsilon.$$

Here, R_i denotes the monthly value-weighted return on factor portfolio i , R^M denotes the value-weighted return of the market, and \tilde{R}_j^{EM} denotes the return on the emerging market factor portfolio j . Finally, the returns on the factor portfolios constructed from developed market bonds (\tilde{R}_j^{DEV}) are added to investigate whether the factor portfolio returns in emerging markets can be explained by their developed market counterparts. The results are shown in Table 2.

	Low Risk	Size	Value	Momentum
Intercept	1.32%**	5.95%**	0.89%	3.05%**
Market	0.40**	0.70**	1.63%**	0.93%**
Low Risk EM	-	-0.72	0.75	-0.51
Size EM	-0.03	-	0.03	-0.01
Value EM	0.04	0.05	-	0.03
Momentum EM	-0.09	-0.07	0.08	-
Low Risk Dev	0.07**	0.17	-0.38*	-0.03
Size Dev	-0.01	0.09	0.09*	-0.10**
Value Dev	-0.02*	-0.04	0.20**	0.04
Momentum Dev	-0.04	0.01	-0.21	0.29**
Adj. R^2	0.86	0.40	0.85	0.87

Table 2: This table contains the results of the regressions of the factor portfolios on each other. The columns denote the dependent variable in the regression, whereas the rows denote the explanatory variables.

It follows that Low Risk, Size, and Momentum obtain significant intercepts (or alphas). Hence, the outperformance of these factor portfolios can not be explained by the market return and the other factors from both emerging and developed markets. This result highlights the potential diversification benefits of the multi-factor portfolio. Only the outperformance of the Value portfolio seems to be explained by the other factor portfolios. In addition, it follows that Low Risk, Value, and Momentum load significantly on their developed market counterparts, i.e. Low Risk from emerging markets tends to move in tandem with Low Risk from developed markets and so on.

Country & Sector effects

Especially in emerging markets, the country decomposition might influence the risk and return on a certain portfolio considerably. We also know from developed markets that sector decomposition matters. To find out whether the country or

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sector to which a bond belongs also plays an important role in emerging credits, the methodology from *Heston and Rouwenhorst* [2] is applied. The following regression is considered for each month separately:

$$R_{i,t} = \alpha_t + \sum_{k=1}^K \beta_{k,t} I_{ik} + \sum_{m=1}^M \gamma_{m,t} C_{im} + \epsilon_{i,t}.$$

Here, $R_{i,t}$ denotes the return of bond i over month t , I_{ik} is a dummy variable equal to 1 if bond i belongs to sector k , and C_{im} is a dummy variable equal to 1 if bond i originates from country m . After imposing some constraints on the coefficients, all dummy variables can be included without having multicollinearity. Weighted least squares is applied to this model with the weights being the market capitalizations of the individual bond observations. Under these conditions, α_t can be interpreted as the value-weighted return of the market at time t . The coefficients $\beta_{k,t}$ and $\gamma_{m,t}$ can be interpreted as the pure industry effects and the pure country effects respectively. In other words, the return of a bond can be decomposed into the value-weighted return of the market and deviations from this market return by countries and sectors. After estimating this model, the average volatility of the pure sector effects ($\hat{\beta}_{k,t}$) turns out to be equal to 2.34%, whereas the average volatility of the pure country effects ($\hat{\gamma}_{m,t}$) turns out to be equal to 4.76%. Hence, these results suggest that country effects are larger than sector effects. Given the nature of emerging markets, this result intuitively makes sense.

Conclusion

To conclude, it follows that portfolios based on Low Risk, Size, Value, and Momentum obtain Sharpe ratios that are higher than the Sharpe ratio of the market. Hence, well-documented factor effects turn out to be present in emerging credit markets as well. In addition, the multi-factor portfolio shows high and significant outperformance, since it obtains the highest information ratio. This indicates the presence of diversification benefits over the factors. The results also show that Low Risk, Size, and Momentum obtain significant alphas after controlling for other factor effects. Finally, it turns out that country effects are larger than sector effects, as one would expect in emerging markets. ●

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The Numbers Game

written by **Ridho Hidayat**

Our society revolves around numbers. Whether we look at our exam results, our weight on a scale, or our salary on a payslip, numbers are all around us. We even use numbers to quantify various abstract concepts: gross domestic product (GDP) to measure our economy, IQ scores to measure intelligence, and polls to measure the public opinion. All for good reason, because such measures help us to understand the world around us. They give us a grip on even the most abstract concepts, by looking at them from an objective and factual point of view: numerically. Well, that often seems to be the general consensus. However, using numbers is not quite as objective as we are often led to believe. In this article, I will elaborate on the (mis)use of numbers by considering several examples and explain why we should question numbers just as much as we question words.

Using statistics

First, we take a closer look at every economist's favorite subject: statistics. This field of mathematics provides us with powerful tools to analyze data samples, which can be useful to infer conclusions about a given population. While these techniques are surely important, the philosophy of statistics is often undervalued. Most people are mainly interested in point estimates, confidence intervals and finding statistically significant differences. However, if we forget to think about the meaning, justification, use and misuse of statistics, we can easily end up misinterpreting the results.

Consider the following example: "The average income of group A is higher than the average income of group B." What can we infer from this statement? A common misconception is that this statement provides information about every individual in these groups, for instance that the people in group A are better off than the people in group B. However, all we know for sure is that at least one person in group A has a

higher income than the average income of group B, and at least one person in group B has a lower income than the average income of group A. It is possible that if Bill Gates is in group A, that on average every person in that group is a millionaire, while actually everyone besides Bill Gates is extremely poor. This is just a simple example, but it can become more controversial if, for instance, you look at IQ rather than income.

In 1994, Charles Murray and Richard Herrnstein published *The Bell Curve*, in which they stated that on average black Americans have a lower IQ than white Americans [6]. While this statement holds true in terms of test scores [3], we have to think carefully about the interpretation. For instance, can we conclude that black people are genetically less intelligent? Definitely not, and here is why.

First of all, to get a more complete picture of the test scores, take a look at the distributions that can be seen in Figure 1. It shows that there are indeed a lot of white Americans with a higher IQ than black Americans, but there are also a lot of black Americans with a higher IQ than white Americans. Nothing shocking so far, but there is something much more important: intelligence is not the same as one's IQ level. While this seems obvious, it is a distinction that is often blurred. Intelligence is the ability to acquire and apply knowledge and skills. However, an intelligence quotient (IQ) is a total score derived from several standardized test to assess human intelligence. It is an approximation of human intelligence, which is a very abstract concept, and there is a lot more to this IQ score than meets the eye, which shows that numbers are not purely objective.

IQ tests primarily measure an abstract way of thinking, such as completing series of numbers, understanding metaphors, and spatial reasoning. For many of us, it is natural to relate these skills to intelligence, because they play a dominant role in our society. A

lot of modern jobs require such abstract thinking. However, is this merely what intelligence is about? The answer to that still remains a value judgement, hence it is subjective. If you would go back in time and ask some tribe what determines intelligence, they would probably give completely different answers: skills such as hunting animals, cooking or building houses.

Even if we compare our test results to those from the people who lived a hundred years ago, the results are already striking. Using their norms, the people today would have an average IQ of 130, and using our norms, our ancestors would have an average IQ of 70 [5]. However, this does not mean that we are all gifted, or that our ancestors were all mentally challenged. Over the years, this abstract way of thinking has become more important, which also resulted in a shift in education. Gradually, we developed these skills, and we therefore became better at these IQ tests. The social environment has a major impact on IQ. Going back to the American example, besides an income inequality between white and black Americans, there is a difference in the quality of the schools in the neighborhoods they live in, which is likely to have an effect on their ability to think in an abstract way.

In the end, IQ remains a single number based on several countable or measurable aspects of thinking. We up sum these

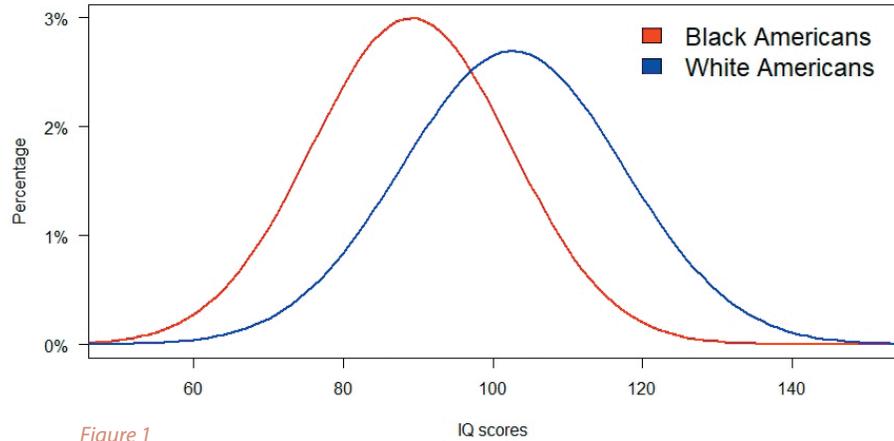


Figure 1

separate intellectual qualities, which is already questionable, and we have to make a selection of the things that we include. Even just for our abstract thinking, we can never take everything into account. For instance, the creativity of a solution, the process of learning a new language, and dealing with mistakes are all aspects that are not measured.

So should we stop using IQ tests? Certainly not, as they also serve a valuable purpose, they can help us to understand people. In fact, the IQ test was initially designed to determine which children needed special education. However, it is important to note that there are underlying values hidden in these numbers. Capturing some abstract concept in a single number can give an insightful and clear approximation, but things can get

really ugly once we stop distinguishing this approximation from reality. Concluding that black Americans are less intelligent than white Americans based on IQ scores is a flawed way of thinking. Stating that there is a genetic difference in intelligence is even less substantiated, to say the least.

The climate change debate

Now that we have discussed the underlying philosophy of numbers, we can take it one step further and ask ourselves: How can we question a number? For instance, numbers are often presented in the news, or used as arguments in debates. Knowing that they are not purely objective, how can we distinguish between a fact and an opinion? Note that there is nothing wrong with using numbers in the news or as arguments. They can definitely give valuable insights into a

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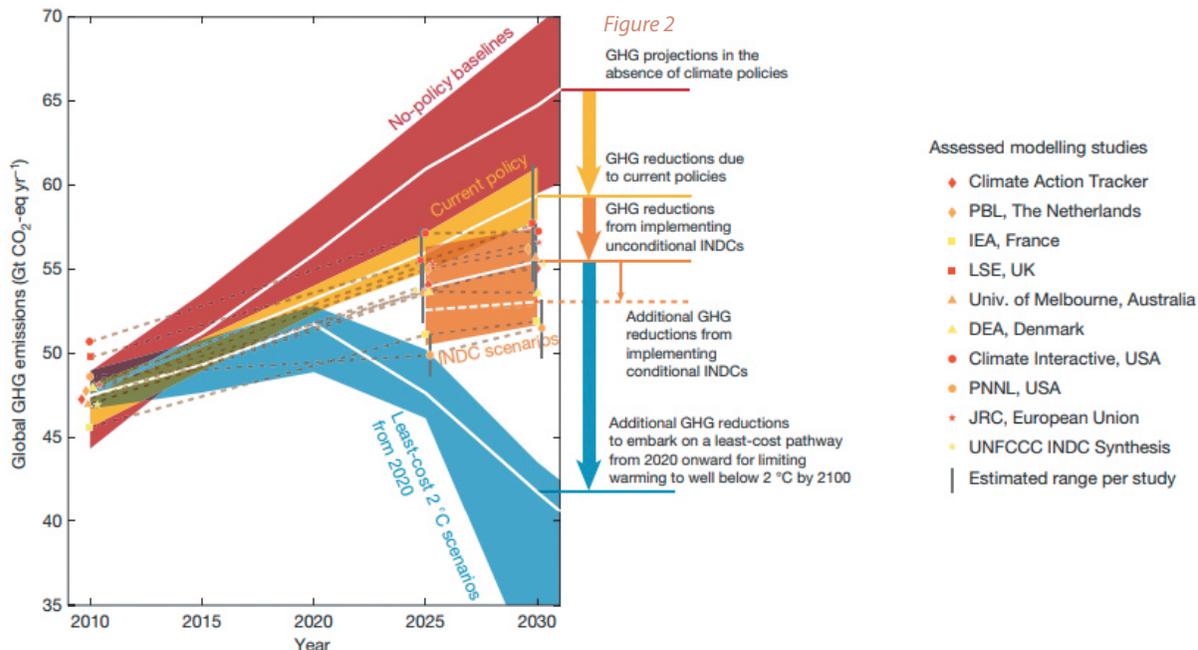


Figure 2

Global greenhouse gas emissions as implied by INDCs compared to no-policy baseline, current-policy and 2°C scenarios. White lines show the median of each range. The white dashed line shows the median estimate of what the INDCs would deliver if all conditions are met. The 20th–80th-percentile ranges are shown for the no-policy baseline and 2°C scenarios. For current-policy and INDC scenarios, the

minimum–maximum and 10th–90th-percentile range across all assessed studies are given, respectively. Symbols represent single studies, and are offset slightly to increase readability. Dashed brown lines connect data points for each study. References to all assessed studies are provided in Box 1. Scenarios are also described in Box 1.

subject and contribute to a better comparison of two sides of a debate. However, we have to be careful that a news item or a debate does not turn into a numbers game. If the numbers are all that matters, the story behind them is often overlooked. Once that happens, we are bound to make crucial mistakes. To provide an example, we take a look at the climate change debate...

Climate scientists have pounded the alarm: governments need to act to address climate change. A radical change of direction is needed. Greenhouse gas emissions have to be mitigated to reduce global warming, or else the world is doomed, is the message nowadays. Such threatening words have fueled the debate on climate change for years. The problem is: How can we be sure that these scientists are right? Mitigating greenhouse gas (GHG) emissions costs billions of dollars, what if we spend all this money for no good reason?

The solution may sound simple: just look at the numbers. That is also what happened when the Dutch cabinet proposed that GHG emissions in the Netherlands should be reduced by 49% in 2030 compared to 1990. The numbers were clear: according to mathematical models, this reduction would lead to a decrease in temperature by 0.0003°C this century [8]. As a result, several opposition parties stated that the proposal should not be accepted. If all this effort results in such a small change in temperature, then clearly people do not have a significant effect on climate change. Reducing GHG emissions is a waste of money, right? There are a lot of problems with this train of thought. Let us take a look beyond the number.

1. Transparency

To start, whenever a number is presented, ask the following question: Where did the

number come from? How was it measured or calculated? Here, there is hardly any transparency in the methodology that is used to calculate this 0.0003°C decrease in global average temperature. Regardless of whether the outcome is true or not, the data, models and assumptions that are used to come to this result should be stated clearly. They are the foundation on which this number is built, and without it, the number loses its power.

2. Context

Furthermore, we should ask the question: In which context should we interpret this number? What is the context of this 0.0003°C decrease in temperature? Without any context, people tend to rely on their gut feeling. It is a number close to zero, a difference in temperature which you cannot feel, so it is probably insignificant. However, if we look at the bigger picture, we can put things into perspective. In 2016, 195 members of the United Nations Framework Convention on Climate Change (UNFCCC) signed the Paris Agreement. Under this agreement, each country, including the Netherlands, must contribute to mitigate global warming. Various studies [9], [11] show the causal effect of carbon dioxide (CO₂) on global temperature. With 0.35% of global emissions, the Netherlands' share of GHG emissions may not be large, and hence the effect of mitigating these emissions may not be large, but it does play a more important role in reinforcing the Paris Agreement.

Therefore, taking into account this context, we look at the effects of all planned actions combined. This can be seen in Figure 2, which shows the development of global GHG emissions in the future [10]. Several scenarios are compared, looking at the countries' Intended Nationally Determined Contributions (INDCs), which are their planned actions following from the Paris

Agreement. For these scenarios, the effect on global warming is estimated, which can be seen in Table 1. Given this context, it can be seen that the global effect is much larger. Also, the Paris Agreement sets targets for the year 2100, so if only the actions until 2030 are taken into account, we miss seventy years of progress. So just like words, numbers should be interpreted in the right context.

3. Importance

Another question we should ask ourselves with any number: Is it actually important? Is it a valid argument in the discussion, or is it a just a fallacy? In the case of the climate change discussion, if the decrease in global temperature is small, does that mean the money spent is wasted? To answer this question, we need to review the impact of climate change. A quick Google search on "meta-analysis on climate change effects" shows millions of results, with studies from various angles. For instance, Figure 3 shows the estimated damage as percentage of GDP for varying temperature changes, based on different models [7]. Apart from the economic impact, studies on ecological impact show numerous effects, such as coral reef bleaching, diseases, and extinction risk for a variety of species [12]. Stating that the effects of reducing GHG emissions are small, and that these actions are therefore a waste of money, undermines the actual problem: without change, life in general is at risk. So even if a large investment is needed for a small change, it can be seen as the start of a necessary snowball effect.

4. Consensus

Even after looking at all these studies, we come back to the initial problem of the climate change debate: How can we be certain that these scientists are right? Methodological mistakes may lead to

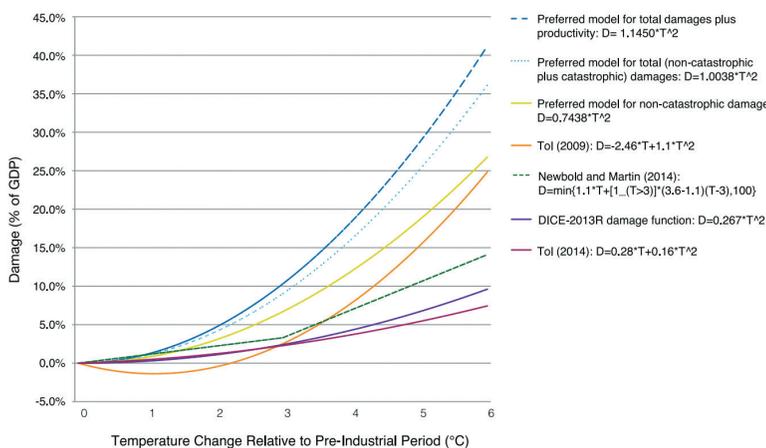
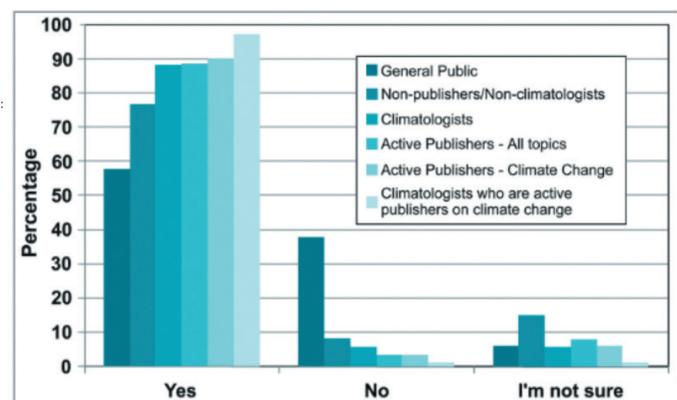


Figure 3



Response distribution to our survey question 2. The general public data come from a 2008 Gallup poll (see <http://www.gallup.com/poll/1615/Environment.aspx>).

Figure 4

Table 1 | Estimates of global temperature rise for INDC and other scenarios categories

Scenario	Global mean temperature rise by 2100 (in °C) that is not exceeded with the given probability		
	50%	66%	90%
No-politic baseline	4.1 (3.5-4.5) [3.1-4.8]	4.5 (3.9-5.1) [3.4-5.4]	5.6 (4.8-6.3) [4.2-6.8]
Current Policy	3.2 (3.1-3.4) [2.7-3.8]	3.6 (3.4-3.7) [2.9-4.1]	4.4 (4.2-4.6) [3.6-5.2]
INDC (unconditional)	2.9 (2.6-3.1) [2.2-3.5]	3.2 (2.9-3.4) [2.4-3.8]	3.9 (3.5-4.2) [2.8-4.7]
INDC (conditional)	2.7 (2.5-2.9) [2.1-3.2]	3.0 (2.7-3.1) [2.2-3.6]	3.0 (3.3-3.9) [2.6-4.4]

For each scenario, temperature values at the 50%, 66% and 90% probability levels are provided for the median emission estimates, as well as the 10th-90th-percentile range of emissions estimates (in parentheses) and the same estimates when also including scenario projection uncertainty (in brackets). Temperature increases relative to pre-industrial levels (1850-1900), and are derived from simulations with a probabilistic set-up with the simple model MAGICC

approach estimations can turn out to be wrong, due to random variation. Often, there are also different studies with conflicting conclusions. Scientists on either side of a debate can even have an incentive to come to a certain conclusion, causing a conflict of interest. Perhaps they have a strong opinion on an issue or they simply receive money for it. Still, we want to make decisions based on the information that is available, so how do we choose what to believe? The answer to that is scientific consensus. If the vast majority of scientists, all with different backgrounds, different data and different methodologies, come to the same conclusion, then we know enough to believe in that conclusion. Science is not about a bunch of separate studies, but about the collection of studies as a whole. If the evidence for a certain conclusion is overwhelming, then a few studies with contradictory results are not going to undermine that conclusion.

On the topic of climate change, several studies aim to measure the scientific consensus. In Figure 4, we can see the results of a survey asking the question: Do you think human activity is a significant contributing factor in changing mean global temperatures? [4] Among the respondents, about 90 percent of all active publishers and climatologists agree that this is the case. Different studies even report a much higher consensus on anthropogenic global warming (AGW) [2]. Of course, we cannot be completely sure if this is the correct conclusion, but uncertainty is the nature of science. In this case, one could argue that there is enough evidence for AGW, even though it is not completely certain. It is important to keep this conclusion in mind, since people tend to reject claims that are uncertain, even though the level of uncertainty is extremely small. So in this example, stating that the dangers of climate change are not proven can sway the public opinion against the need for action. Similarly, tobacco firms have

cast doubt on the exact health effects of tobacco to generate sales [1].

The four aspects we just discussed only form the basis of questioning the numbers we encounter. It is a starting point, and from here we can learn to look beyond the numbers. By learning more about numbers, we can start making up our own minds, instead of carelessly believing every number that is presented. As you may have noticed, I also present some numbers myself in this article. Therefore, I encourage you to challenge my numbers, and look for the complete picture.

Keeping numbers in check

There is still a lot to discuss on the use and misuse of numbers, such as the difference between correlation and causality, and the impact of big data and machine learning algorithms. However, that is beyond the scope of this article. The goal of this article was to bring awareness that we should keep numbers in check. We should not see numbers as the undisputed truth or as synonyms for reality. Instead, we should place them on the same level as words: questioned and discussed. There is a whole story behind every number we see and therefore I would like to advise everyone to go down the rabbit hole. Follow your curiosity and challenge your beliefs. Society does not revolve around numbers, numbers revolve around society. ●

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Inspired by Sanne Blauw, "Het best verkochte boek ooit (met deze titel)", de Correspondent (2018)



A New Member to the Astrics Family

written by **Job Hoven**

Wilbert Kistemaker and Stèphanie van Breda are both econometricians and both started studying at Tilburg University in 2007 and were both External Affairs in a board year of Asset | Econometrics. They met each other in the TIK week (former TOP week). After this they did a presentation together about numbers of Bert and Ernie for a soft skills course That is why they loved the Bert and Ernie questions at the end of this article.

Wilbert is 29 years old and studied econometrics at Tilburg university. At first Wilbert considered going to Eindhoven for Technical Business Administration, but eventually he could not resist the beauty of Tilburg and went for an economical study. One of his friends was familiar with the study econometrics and introduced it to him. It was like love at first sight and so he started his new adventure. During his studies he was a member of the board in 2011-2012. He completed a Master in Operations Research and Management Science, which was more a choice to avoid theoretical statistics and finance. Wilbert was more interested in complex models and trying to optimize them, that is why this Master seemed a perfect fit.

At this moment he still works for TBA in Delft where he did his first internship.

Stèphanie is 31 years old and is -like her husband - a member of the *Astrics*-family. Before Stèphanie made the bold choice to study econometrics at Tilburg university, she first considered to study mathematics. She changed her mind because of the theoretical nature of this study and because her future was really insecure if she would have chosen this direction. She then started her studies a few years before she entered the board in 2009. Mastering in Quantitative Finance and Actuarial Science she continued her study with great pleasure and never doubted the choice she made. Later on Stèphanie did a post-Master called AEMAS (Amsterdam Executive Master of Actuarial Science Program) in Amsterdam, while she was working for Delta Lloyd, which is now taken over by NN. Today Stèphanie works for a smaller company in Gouda called *Posthuma Partners*.

Wilbert describes Stèphanie as spontaneous, open, always happy but also serious and very loyal. Stèphanie adores sports. Besides she plays volleyball. Unfortunately, her volleyball career is on a break due to her

pregnancy. After we asked the same question the other way around to Stèphanie, she describes Wilbert as well in giving compliments, very caring, as a good listener, loyal, a real joker and, not unimportant, quite the romantic. He likes to play korfbal, which he has been doing for years. He also likes making music by playing guitar, while trying to sing at the same time. Moreover he cherishes playing boardgames with Stèphanie. They are both people whose priority is their child and the people they are surrounded with. The quatches are the first thing they read when they receive a new issue of *Nekst*. After that, they make the puzzles and browse through the articles.

They both became a member of Asset | Econometrics during their second year and moved to Tilburg very quick. Wilberts first committee with Asset was the introduction activity and the Symposium Committee. Stèphanie only did the AMW Committee and after that she immediately did a board year. Wilbert choose to do a board year because he was told that it was a great experience and he liked the idea to take a sort of gap year in this way. He said that he developed his soft skills during this year because of his function as External

Affairs officer. Stèphanie spontaneously choose to do a board year when she was in the car with some members of the board and got so excited she immediately applied as candidate. They both surely recommend being external of the board year because it learns you a lot and it is very fun to, for example, visit all the companies at the beginning of the year with your predecessor as his or her successor and at the end of the year you can return with your own successor (Are you still with me?) It is also very useful for your further career to have a network and to develop new concepts. Wilbert got in to TBA because of contacts he made during his studies.

The Bert and Ernie soft skill course we mentioned at the start of the article is, however, not where their romance began since they started as friends. They later joined Asset together and even later they fell in love. Thereafter they married and, right now, they have a real Asset | Econometrics baby, named Feline! Wilbert and Stèphanie married in Zoetermeer and threw a real party, like they were used to, in a real Brabantic way. After that they went for their honeymoon to New Zealand and this is where their story continues because they did not back with just some nice memories and tremendous pictures, which are now hanging in their living room.

On their honeymoon in New Zealand, she got a positive pregnancy test. So this is where our little Felines life quest started. Stèphanie describes her flight back as not very pleasant because she got ill from pregnancy sickness. Luckily her beloved Wilbert was always nearby her during the

flight and all of her suffering certainly paid off because they received a beautiful baby for it in return.

Wilbert and Stèphanie are both from Brabant. Wilbert comes from Oss and Stèphanie is from Middelbeers. They do not have lots of contact anymore with their friends from over there. They moved at the end of their study to Gouda, a city a little north of Rotterdam. Afterwards they moved to Waddinxveen, where they still live. Their parents still live in Brabant, but they regularly come visit to see their beautiful granddaughter again. Wilbert takes a day off each week and Stèphanie works every other week 3 and 4 days. For the remaining days Feline goes to a childminder.

They would like it very much if their older *Astrics* child would choose to study econometrics in Tilburg and even would decide to become part of Asset | Econometrics. Of course, it would be totally legendary if she would also be interested in a board year as External Affairs. I have already no doubts that this would become an amazing board year. But she is free to make her own decisions.

Wilbert and Stèphanie state that they will not use most of their econometric knowledge anymore: "The analytical think capabilities we have acquired are the most useful. And still you see some distributions and use some hypothesis testing on the job." Wilbert and Stèphanie advise econometricians to distinguish themselves by doing what they like most and to enjoy your student life. They advise the board for this year to not have too much stress, to be honest with each other and, most importantly, to also enjoy their board year, because they certainly did. ●



Former Board Members
Wilbert Kistemaker

29 years old

Stèphanie van Breda

31 years old

Bert & Ernie Questions

Bert/Ernie
Studying/Working
 Wine (S)/Beer (W)
 Tilburg/Waddinxveen
 Fries/Pancakes
 America (W)/Asia (S)
 Using a calculator (S)/Mental
 Calculation (W)
 Job (S)/Zoë (W)



Let's Talk!

Some of you might have been tagged already by their online friends in a Dilemma Dinsdag post on at least one of the major social media platforms. In this Nekst, we thought it was about time to bring this phenomenon onto paper. The idea is simple: we put our members for a choice between two not so nice activities. And they simply could not abstain from choosing, since it is supposed to be real dilemma.

We asked our members to choose between the following two statements:

- After showering you need to salve your body with dairy butter.
- Your teeth are actually gummi bears.



Nikkie Damen

I want to salve my body with dairy butter. Otherwise I can never eat potato chips or pizza anymore.

Martijn Oerlemans

I prefer the dairy butter, because when my teeth are gummi bears I can never laugh anymore.

Marijn Paijmans

I choose for dairy butter, but then I will always take a bath instead of going to shower.

Jelle, Nina and Quirien

Dairy butter, otherwise you cannot eat anymore.

Bernard van den Broek

When your teeth are gummi bears your mouth always tastes sweet, but on a day like today when I'm broke I will only become sick of that. Also you cannot eat everything, like meat, so that has not my preference. By salving your body with dairy butter you are greasy and if necessary, you can use a little to prepare your food with. Therefore, no matter how crazy it is, salving my body with dairy butter after showering will be better.

Julia de Kogel

I prefer the gummi bears, because butter stinks and is nasty. Also it is too much effort to take this to the swimming pool all the time. Gummi bears are nice when you are going to take shots. Moreover you cannot eat all food anymore, which is nice, because then I will lose weight. And it looks of course beautiful.

Nadia Cissen

Gummi bears, because those are yummy.

Nienke van der Wal

I want my teeth to be gummi bears, because dairy butter is really nasty, because it will never leave.

Niels Janssen

I definitely want my teeth to be gummi bears, because then I have always something to eat and dairy butter is filthy after showering.

Favorite Music

We also asked our members about their favorite music. This yielded interesting responses, hence bear with us as we guide you through some answers we got.

Bram Marsman

Zanger Kafke. When I listen his music, I always remember the good times with my friends in de Boekanier. I am quite a big fan: I already knew his new single leder Weekend, by heart before the rest of the world even realized he released a new song

Emma Segers

Nick & Simon

Nathan Bun

Racoon - Oceaen is my favorite song since it reminds me of home

Rein Lommerse

My favorite singer is Bram Marsman during a cantus

Quirien Raat

The Beatles, because i like the song 'Led it be'

Bernard van den Broek

Partyfriex & Schorre chef

Job Hoven

I am really into rock music and my favorite band is Arctic Monkeys. I have seen them live once, which was a great experience

Bastiaan Schutte

I like Queen's I Want it All the most

Nienke van der Wal

As long as the music that is played is country music, I am happy. My favorite singer actually is Taylor Swift, however this should stay a secret :)

Marijn Kroes

My favorite songs are Let Me Entertain You from Robbie Williams and Enter Sandman from Metallica

Lotte Gerrits

Demi Lovato is my favorite singer

Bart Rutten

My favorite genre is Indiefolk, in particular I like the Mumford and Sons. My all time favorite song is Where the Streets Have No Name by U2

Renzo Ringhs

Queen - Too Much Love will kill you is my favorite

Bob Suijkerbuijk

Willem de Bruin, famous from hip-hop formation The Opposites, is my favorite artist

Dominique Bavelaar

I prefer 'classic' rock like Guns 'N Roses and The Rolling Stones

It Was a Fresh Freshmen Weekend

In the weekend of October 26 till October 28 the very first Freshmen Weekend took place. It started on Friday at 15:00 hours at the rooms of Asset Econometrics. Here we were divided into groups of about five freshmen. The game started from this moment on and every group got a picture of a building in Tilburg. We had to find this place and take a photo with it. Meanwhile the mentors of each group were busy solving puzzles to unlock the pictures. Although I really enjoyed the game, it was raining almost the whole afternoon, so everyone became very cold. At 16:30 hours we were sent to a café where our mentors were waiting for us. There we found out what country we would be representing for the rest of the weekend. Every group got their own flag to represent their country. In the café, we got the chance to warm up a little so we could start with the crazy 88. This game consisted of various challenges and with every challenge we completed earned points. Some of the challenges were only possible to do in the city, like ordering a hamburger without bread at McDonalds. However, we couldn't stay for

too long in Tilburg, as we were expected at the accommodation at 18:00 hours, which was half an hour cycling. When we arrived at the accommodation every group continued doing the crazy 88 challenges. After dinner, it was time for a pub quiz about our study program and Tilburg. Here we could earn points as well. After the pub quiz there was a beerpong tournament, where every group had to play three games to earn points.

Saturday was a very active day. After breakfast, it was time to play some games including dodgeball. We also had to do a circuit as fast as possible. Then we played lasergame in the woods behind the accommodation later that afternoon. With these games we could also earn points. At the end of the day we had a beer cantus, and some of us were already drunk before the cantus started, not the smartest idea!

Sunday was the last day which ended with a kahoot quiz. The quiz was about the answers everyone gave to the weird questions we got asked earlier in the weekend. It also con-



Nienke Kempers

Bachelor EOR

Age: 18

tained gossips of that weekend. Afterwards, we had to clean everything. Every team had tried their best to earn as many points as possible during this weekend. The winners could choose the part they had to clean first and they received a bottle of liquor as a prize. The losing team had to clean the toilets and showers, as expected. All together I really enjoyed this weekend and I got to know a lot more freshmen! ●



The Econometrics Christmas BBQ

Two econometricians at the door telling you to go all the way up the stairs, upon entering the room receiving a Christmas hat: this had to be the Asset | Econometrics Christmas dinner.

Slowly the room started to fill and after a short while we received some tokens with which we could get our free drinks. This of course meant the first beers had to be tapped. When (almost) everybody had entered and some of the beers were already finished, Patricia (see Nekst 1 for an interview with her!, red.) welcomed us to Smikken en Smullen and introduced us to the concept of the dinner, which would be an indoor barbeque. We all found a seat at the tables and built into those tables we found small gas barbeques where we would be able to grill the meat ourselves. This concept is quite similar to what we call in Dutch "gourmetten". Like most dinners at a restaurant (at least in the Netherlands), we first received bread and herb/garlic butter while we waited for the starters. At this point many of us started to switch to red wine instead of the beer we began with and the starters were first served.

The menu

The starters included melted cheese and a delicious potato salad. A lot was talked about that evening, including the exams,

since most of us had just finished their last exam of the week and this was one of our ways to blow off some steam. During this time the barbeques were lit and tables were called up to go and get their meat. Next to the bar three plates were placed on which there were chicken filets, hamburgers and pork loins. So we all got our own plate and picked up one of each (or two if we were hungry). To complement our meat, there also was a table at which we could compose our own salad. Some of the possible ingredients included cold pasta and corn. After picking up the meat, we were finally able to start grilling. While the hamburger finished quite quickly, the chicken on the other hand took considerably more time to get cooked. This luckily was not an issue, since this meant we had more than enough time to eat everything fresh of the grill and keep track of the pieces still on. Somewhere during the grilling Patricia also went around giving everybody jacket potatoes, which went nicely with the salad and the grilled meat. Of course we did not just eat our meat dry: many sauces were provided to add more flavor to the meal. No dinner is finished without a good desert and luckily for one of our members, Job, this day was his birthday, so this actually also was his birthday meal. While a big bowl of magnum popsicles was presented we all sang him happy birthday and afterwards he went



Bastiaan Schutte

Bachelor EOR

Age: 19

around the room to receive the best wishes and give everybody some ice cream. While the dinner may have been over after that, the event did not stop yet. Beers were ordered again and the tables got cleared. This opened up the opportunity to play a few games, which some of us gladly took. While people were starting to go home, wishing everybody a merry Christmas on the way, some of us started preparing for going out into the city. A few more beers were drunk, a few more games were played and most of the Christmas hats came off, but eventually the party was moved to a bar in the city, which would be the final stop for the evening. To conclude, I would like to say I think the Christmas dinner was a great success and an excellent final event to close the calendar year. Also I would like to thank Patricia for being a great hostess once again. ●



Quatsch!



Quatsch?

Over the past few months, the editorial staff of Nekst received many quotes that relate to the study of Econometrics and to the activities organized by Asset | Econometrics. Hereby, we present to you a selection of some striking and funny quotes! Please mail all remarkable quotes you have heard to Nekst@Asset-Econometrics.nl!

Dominique Bavelaar (tegen Zoë)
Pierre was mijn eerste, maar jij was mijn tweede

Martijn Oerlemans
Wij hebben Sinterklaas en we willen wat creatiefs doen. Sinterklaas komt uit Spanje dus we maken iets Spaans, pizza ofzo

Bob Suijkerbuijk
Zullen we deze zak onderstebuiten draaien?

Yearbook Committee
Hoe noem je een kaas die het koud heeft?
... Een brrrrrie

Annabel Boers
Ik weet niet hoe ik matrices moet vermenigvuldigen
Nienke van der Wal
Annabel, je hebt lineaire algebra gegeven

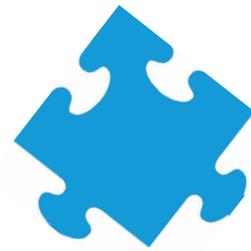
Quirien Raat
Jelles kleine commandant heeft me in mijn gezicht geslagen

Koen van Zon (over zwangerschapsstoelen)
Het is wel overtuigender als je een vrouw bent

Stefan ten Eikelder (over nakijkwerk)
Het was een bewijs van de vorm: Niet alle wegen leiden naar Rome, dus we kunnen Rome niet vinden

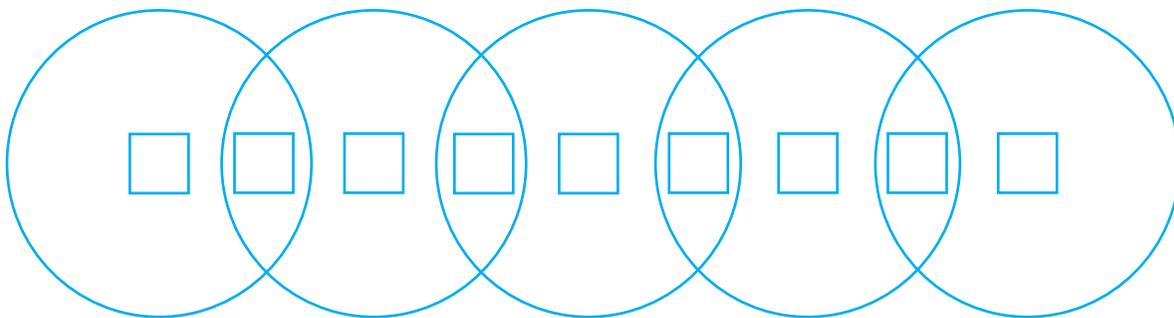


Puzzle



Take the first nine natural numbers (is sunt, 1 up to and including 9). Now try to find a way to place these nine numbers in the squares in the figure below, such that for each circle the sum of the numbers in it equals 11. You have to use each of these ten numbers exactly once.

If you figured out how to do this, now try it for a circle sum of 13, and once again for a circle sum of 14. This edition's puzzle seems easy, but actually turns out to be harder than expected. Namely, if you would have to verify each possible arrangement, you would have to check 24,192 candidate solutions! Hence you better find a way to reduce this amount drastically...



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!

Dennis Jaheruddin 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. The solution can be found at www.nekst-online.nl



Asset | Econometrics congratulates...

Name Vera van der Lelij

Title Improving warehouse operations efficiency by using hard-bordered single-picker zones

MSc BAOR

Supervisors Dr.ir.ing. M.J.P. Peeters, Prof.dr. G. Kant

Name Yvonne Theeuwes

Title Increasing labor market participation of older workers in the Netherlands: the effects of pension incentives, increasing retirement age, and partial retirement

MSc EME

Supervisors Dr. T. Kantarci, Dr. B. Drepper

Name Rogier Bresser

Title Fast and online tree-based classification of following pricing behaviours in a retail market

MSc BAOR

Supervisors Dr. M.P. Rothfelder, Dr. N.F.F. Schweizer

Name Anita Varga

Title The impact of home birth on new born health outcomes

MSc EME

Supervisors Dr. M. Salm, Dr. J.R. de Bresser

Name Ridho Hidayat

Title Churn analysis in the telecom industry: Data mining on imbalanced datasets

MSc EME

Supervisors Prof.dr. B.J.M. Werker, Dr. J.R. de Bresser

Name Jasper Rouschop

Title Predictive Modelling of Sewer Blockage Likelihood

MSc EME

Supervisors Dr. O. Boldea, Dr. P. Cizek

Name Viren Sangwan

Title Modeling Implied Volatility Surface Dynamics

MSc QFAS

Supervisors Dr. F.C. Drost, Prof.dr. B. Melenberg

Name Rob Besten

Title Aggregate production planning with method and customer selection options at Anova Seafood

MSc BAOR

Supervisors Dr. Y. Merzifonluoglu Uzgoren, Prof.dr. G. Kant

Name Jeffrey den Otter

Title Predicting probabilities in extreme data imbalance: a recommendation case study

MSc BAOR

Supervisors Prof.dr.ir. R. Sotirov, Dr. J.C. Vera-Lizcano

Name Jefferson Vegas Morales

Title Forecasting life expectancy development of the Dutch population: updating the projection table 2016

MSc EME

Supervisors Prof.dr. B.J.M. Werker, Prof.dr. A.M.B. De Waegenaere

Name Alexandro Kanakas

Title Statistical analysis in urban regions Estimating the deformation velocity of the buildings in Schiedam using the year of construction

MSc BAOR

Supervisors Prof.dr. K.J.M. Huisman/Dr. O. Boldea, Dr. M. Salm

Name Derk van den Bosch

Title Review of a Value-at-Risk method

MSc QFAS

Supervisors Prof.dr. T.E. Nijman, Dr. N.F.F. Schweizer

Name Juul Kooijmans

Title The impact of childhood health shocks on life cycle health and labor market outcomes

MSc EME

Supervisors Dr. B.M. Siflinger, Dr. M. Salm

Name Jon Daal Thomasson

Title Semi-supervised text to topic classification using domain knowledge and word embedding

MSc BAOR

Supervisors Dr. M.M. van Zaanen (TSHD), Dr. J.C. Vera-Lizcano



Name **Frank Hardeman**

Title Classification of high-end machine errors

MSc BAOR

Supervisors Dr. O. Boldea, Dr. J.C. Vera-Lizcano

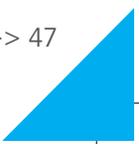
Name **Koen Dekker**

Title Data-driven approach to support decision making in supply chains

MSc BAOR

Supervisors Dr. Y. Merzifonluoglu Uzgoren, Dr. R.C.M. Brekelmans

...on obtaining their Master's degree





Alááááf

Are you, like Snollebollekes, just as photogenic as *carnaval* loving? Then we have good news for you: you can win a pie or a crate of beer by showing us your most original carnival photo! This is, though, subject to one constraint: at least one Asset | Econometrics gadget has to be present in the picture.

Send in your attempt to Nekst@Asset-Econometrics.nl before March 6 and make sure you win the delicacy of your choice!

Agenda

TUE 05 FEB **Male/Female Activity & Drink**
Get your fellow ladies or gentlemen together for the Male/Female Activity! The D&A committee has a fun activity in store for us. Afterwards, our Monthly Drink at Café De Nachtwacht will take place where you can have some drinks and catch up with your fellow econometricians.

THU 07 FEB **LED**
The LED is the largest career event for econometrics students in the Netherlands. This day is perfect to get to know more companies in various fields of econometrics. You can find more information about the program and the participating companies at www.leditbeyourday.nl

TUE 12 FEB **Freshmen Information Day**
During the Freshmen Information Day, first-year econometrics students can learn more about the possible activities that they can do next to studying such as going on exchange and the honors program.

FRI 14 FEB **Lustrum Trip**
To celebrate Asset | Econometrics' 40th birthday, we will visit Athens this year with 40 of our members!
FEB 18 FEB Here, we will explore the city, visit cultural highlights and undertake lots of fun activities together.

THU 21 FEB **Strategy Tour**
Interested in a career in (Strategy) Consulting? Then the Strategy Tour is the perfect event for you! During this two-day event you will visit the offices of four different companies in the field of (Strategy) Consulting where you will have presentations and cases about their projects.
FRI 22 FEB

TUE 26 FEB **LaTeX Training**
Do you need to write reports for your assignments or even your thesis? LaTeX is often used to write scientific documents as it offers an easy way to insert mathematical formulas. Learn all about it during the LaTeX Training!

THU 28 FEB **Asset Pre-Carnaval Party**
Kick off your carnaval week with Asset during the Pre-Carnaval Party!

TUE 12 MAR **Monthly Afternoon**
Swing by our rooms during the Monthly Afternoon! Here you can catch up with your fellow econometricians, have some drinks together and play games like 30 Seconds and Mario Kart.

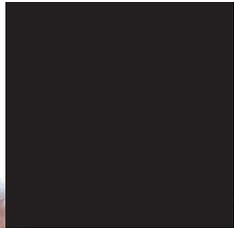
THU 14 MAR **CoDE Beer Cantus**
Do you have a passion for singing and do you like to drink beer? Make it even better by combining them at the CoDE!

FRI 15 MAR **Birthday Asset | Econometrics**
On March 15, 2019, Asset | Econometrics will officially turn 40 years old. Save the date and come celebrate it with us at our rooms!

TUE 19 MAR **Connection Day**
The Connection Day is a career event for third-year econometrics students and older. ORTEC, TBA, and Willis Towers Watson will provide business cases during which you can get a better idea of the work they do. Join one or more case rounds and the business lunch, and explore your opportunities at these companies!

TUE 19 MAR **Master Experience Day**
Are you not sure yet of which Master program you want to follow after your Bachelor? At the Master Experience Day you can attend several presentations by alumni to learn more about the different programs and the career options these programs offer.

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



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.

