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Greetings from
Hong Kong & Quebec

Parents of the Board
Wouter & Job

The Teacher
Jan de Leeuw

ASSET

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Nekst Up: Me Again!

The great honor of being Editor-in-Chief is bestowed upon me once again this year. What I gained in experience last year has not diminished my enthusiasm, so be prepared for some fun new editions.

As we are publishing three issues this year, we can shift our attention to filling each edition with even more pages of incredibly well-written articles. Our team consists of eight editors and two designers, helping to lighten the workload. You get to meet everyone in our Meet the Crew section!

The moment this Nekst finds itself on your doorstep, it is wintersport season. Maybe you have already been—or are still—going down the slopes, but I can assure you that this edition's special on the influence of ski resort design, as well as Nekst advice on finding the motivation to pick up your skis one more time, will interest you.

This edition includes an interview with our very own Jan (the custodian of the rooms), stories about the experience of living abroad from two of our exchange students, and much more. There is something for everyone!

We are excited to bring you some new articles, so please take some time to read the special, do the puzzle, or at the very least open the page of the Quatsch section.

So pick your poison, and happy reading!

Kind regards,

Hedser van der Wel
Editor-in-Chief

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Special

Teacher: Jan de Leeuw

COLOPHON
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Dear Members,

Summer is over, the beach beds have been put away, and the school desks are back as if we have taken the lift to a new season. I hope you all had a smooth landing into the new academic year. A new academic year also means new committees and a new board. I am proud to announce that together with Wouter, Anouk, Gijs, Sanne, and Job, I will be taking the reins, or rather, the ski poles to lead our wonderful association this year. To be honest, writing my first "Dear Members" feels a bit like taking that first run of the season: exciting, but above all, fun. And thereby I am following in the tracks of previous chairs.

They say time flies when you are having fun or, more accurately, that the slopes seem to pass by in a blur, and I could not agree more. After being active within Asset | Econometrics for two years, I have already had the pleasure of organizing some fantastic events. Moreover, about half a year ago, the handover of the board began, and since then, my life has been moving at full speed. During the first few months, we still received guidance from the previous board to help us stay on our skis, and I personally received a lot of support from my predecessor, Emma. However, for the past few months, we have officially taken over the tasks and responsibilities of the previous board, allowing us to stay on our skis independently and to steer the association in the right direction.

This year, I expect to learn a lot in my role as chairman, especially when it comes to reasoning and argumentation. As chairman, your opinion is often asked, and it needs to be solid, just like a skier maintaining perfect balance. Particularly in conversations with companies or the university, it is important to present yourself professionally, even when the slope gets steep. This board year is the perfect opportunity for me to further develop these skills, and I am confident they will benefit me in the future, both personally and professionally.

Looking back at the first two months, we already hit the slopes with momentum. We kicked off with the Midsummer BBQ, a cozy warm-up after the summer break. The Freshmen BBQ was equally successful, as if the first-years immediately put on their ski goggles, eager to tackle the slopes with enthusiasm. At the Monthly Afternoon, we enjoyed delicious poké bowls and fun games together. The classics like the Cycling Dinner and VVV'tjes Day were once again huge successes. Our formal events, such as the EOR Business Dinner, the Lunch Lecture, and the BAOR Inhouse Afternoon, were also well attended.

I am proud to serve as your chairman, and I am confident that together we will reach great heights this year. Let us make it a season full of fun that we will not soon forget. So, strap on your skis, find your balance, and enjoy the ride together. We will make it an unforgettable run!
On behalf of the board,

Luke de Laat
Chairman Asset | Econometrics 2025 - 2026

Meet the Crew!

Nekst committee 2025-2026

Hedser van der Wel

Hey! My name is Hedser. I am 22 years old and a Master's Business Analytics and Operations Research student. This is already my fourth year of being part of this beautiful committee, this year I have the honor of returning as the Editor-in-Chief. Besides being part of the Nekst, the Olden goldies and the europe trip committee, I enjoy having a drink with my friends, and you will find me at most of Asset | Econometrics' events. During the weekend, I like to spend time with my family and play some board games.

Dylan Koenders

Hello! I am Dylan and I am one of the designers for the Nekst this year! I am originally from Duiven, a small village near Arnhem but moved to Tilburg when I started the Bachelor's degree 4 years ago. Last year I was part of the board of this beautiful association and now I will continue being active in the Nekst and International Business Tour 2026 committees. Besides all of that I like to hangout with friends and occasionally go to a football match of Ajax.

Sander Schout

Hi all! I am Sander Schout, originally from Middelburg in the beautiful coastal province of Zeeland. For my studies I have been living in Tilburg for over 7 years now. I graduated a few years ago from the Bachelor's Economics and Business Economics, after which I started the Master Finance, and currently I am doing the Master Accountancy as well. Next to my studies, I have been part of the board of another association within Asset in the past year, and the year before that I have done an internship at a large bank in the Netherlands.

In my free time, I enjoy cooking, which I loved ever since working in a restaurant kitchen up until a year ago. Next to that, I very much like to go to the gym and throw some weights around. And of course, I love spending time with friends at some nice café or sing-along concert.

Anouk Wets

Hi! My name is Anouk and I am 21 years old. This year, I will be the coordinator of the Nekst committee. I have been active at Asset | Econometrics for three years now, although I have not been part of the Nekst committee before. I originally planned to join it this upcoming year, but after deciding to do a board year, I now have the wonderful opportunity to coordinate it instead. After my board year, I still plan to stay involved with the Nekst after being warmed up by this year, but then more on the designer side.

Besides coordinating the Nekst, I am also the coordinator of the Active Members Weekend, the KOALA committee, and the Yearbook committee. I am very excited to be part of such a variety of committees and to work with so many enthusiastic committee members.

Outside of Asset | Econometrics, I love spending time with friends, whether we have planned a fun day trip, cook dinner together, or play some games. I also have many creative hobbies, such as photography and making photo books. I hope you enjoy reading this edition of the Nekst!

Luuk van der Meer

Hi everyone, I am Luuk, originally from the beautiful Eindhoven but living in Tilburg for quite some time now. Currently, I am finishing my Bachelor's in econometrics during my exchange in Hong Kong, more on that during the greetings from, but I will start with the Business Analytics and Operations Research Master's in February so then I will be back in Tilburg!

Apart from studies, I used to have a lot of things that kept me busy during the week. I play volleyball at the student volleyball association, go to the gym sometimes and sometimes even find myself in a rowing boat. The last thing is often the result of losing a bet. Furthermore, I like to spend time with my friends, where you can often find me during a "Dobbel Dinsdag". On the weekends I work back home in the most beautiful Albert Heijn of Eindhoven.

This year I will be part of the Nekst committee. As a writer I am looking forward to contribute as a writer with some good articles!

Lucas Mejic

Hello everyone! I am Lucas. I am 22 years old and currently doing the Master's Business Analytics and Operations Research research. I am part of the committee organizing the Connection Day and this is my second time participating in the Nekst committee. Last year I was part of the committee for half a year while finishing my Bachelor's, after which I took a six month break for some travelling and other fun stuff, but now I am back and happy to again be an active member and participate in this committee.

Outside of studying and working, I enjoy hanging out with my friends back home and I spend quite some time travelling, but when possible I always try to come to the Asset | Econometrics events.

Matthijs Vernooij

My name is Mattijs, I am 25 years old, and this is my second year writing for Nekst. That is not just a coincidence, coming up with creative ideas and putting them on paper is something I genuinely enjoy! Two years ago, I did a board year at Asset | Econometrics, and I am currently studying hard for the QFAS Master's.

Nekst is not my only committee I am doing this year. I am also part of the Europe Trip committee, which keeps me busy and excited as we prepare for our trip in April to a city that will be revealed later. Outside of studying, I spend my time working, exercising, hanging out with friends, and keeping up with the latest gadgets to satisfy my curiosity.

Niels Hultermans

Hello! My name is Niels Hultermans, born and raised in the beautiful city of Tilburg. I recently graduated from the joint Bachelor's program in Data Science and am now pursuing the BAOR Master's. Some of you might have already seen me around campus, as I spent most of my Bachelor's years studying at TiU. Since the beginning of this semester, I have been working behind the desk at the university library, so feel free to stop by for a chat when I am around!

This year, I will be part of the Next committee, where I will be writing a few articles that I hope you will enjoy reading.

Outside of studying, I like to keep busy with different activities. I play the guitar and love to read. I also enjoy going to the gym, though honestly, I am happy doing almost any kind of sport. Besides that, I love spending time with friends, often at Café Buitenbeentje, working my way through their beer menu, usually accompanied by a "worstenbroodje" or a tosti.

I am looking forward to contributing to Next and sharing some fun reads with you all!

Theo Janssen

Hello everyone, I am Theo and I am the only first-year student in the Nekst committee! I am 19 years old, I am originally from Hilvarenbeek, I attended the St. Odulphus Lyceum Highschool in Tilburg and I am also currently living in Tilburg. Although I am a first-year student here, this is not the first year that I am a student; Last year I studied theoretical mathematics at Leiden University.

Aside from my studies, I spend a lot of my time doomscrolling. I am also a former national champion in table tennis and now play tennis on the weekends, but I enjoy all sports. I enjoy spending time with my friends, whether we are playing sports, studying together or going out for drinks.

I also love to travel, provided I can stay at a quality hotel and get my own room.

This year is going to be the first year that I am a member of the Nekst committee, and I am very much looking forward to seeing what I will be able to contribute!

Tobias Smits

My name is Tobias Smits, and I grew up in the beautiful city of Trondheim, Norway. With a Norwegian mother and a Dutch father, my household was bilingual so I grew up learning both languages simultaneously. I am 24 years old, of which the first 19 I lived with my family in Trondheim, until I moved south to Oslo to pursue a Bachelor's degree at BI Norwegian Business School.
I have always valued new experiences and the opportunity to get to know new people, so in addition to moving south I decided to do a semester abroad in Prague. Not yet satisfied, I embarked on my most successful journey so far: Tilburg, where I am currently following the MSc Finance.

In addition to studying I enjoy having some drinks with friends, when possible in Amsterdam, watching my favorite team Ajax. Sometimes, I also enjoy doing things by myself, in these cases I usually pick up a book or my running shoes.

This year I will be writing articles for the Nekst Committee and hope you all will enjoy reading them!

Oddtown

In linear algebra, you learn to compute with vectors and matrices, usually to solve systems of linear equations. However, it also helps to solve surprisingly odd mathematical puzzles.

Consider the problem of a town called Oddtown. The town has N residents, who have a peculiar hobby: forming clubs, and as many as possible. Each resident can be a member of as many clubs as he or she wants, and no two clubs have exactly the same members. There are two main rules:

1. Each club has an odd number of members,
2. Any two clubs have an even number of members in common.

The Mayor of Oddtown wants to know: how many clubs can possibly be formed?

For example, suppose Oddtown has 4 residents: Rob, Dilan, Jesse, and Henri. We can find 4 clubs satisfying the rules: *{Rob, Dilan, Jesse}, {Rob, Jesse, Henri}, {Rob, Dilan, Henri}, {Dilan, Jesse, Henri}*. Each club has odd size, and any two clubs have an even number of common members.

How many clubs can Oddtown have at most, if Oddtown has N residents?

This question can be answered with linear algebra. Not over R^N, but over the vector space $V = \{0, 1\}^N$, where we add using the rule 1+1=0, which is called addition modulo 2. For example, 1+1+1 = 1 (modulo 2). For each club, we create a vector of length *N* that has a 1 at position i if resident i is part of the club, and 0 at all other positions. Suppose there are m clubs, then we get *m* such vectors in $\{0, 1\}^N$.

Each club has an odd number of members, so the corresponding vector has an odd number of 1s. The inner product of any club vector with itself is 1 (modulo 2). Meanwhile, any two different clubs intersect in an even number of members, so the vectors corresponding to different clubs have inner product 0 (modulo 2). In other words:

1. Each club vector has a nonzero self inner-product,
2. Any two different club vectors are orthogonal.

A key fact from linear algebra is that orthogonal vectors with nonzero self inner-product are automatically linearly independent, since no such vector can be a linear combination of the others. Therefore, the m club vectors are linearly independent.

But the vector space $V = \{0, 1\}^N$ has dimension *N*, and hence cannot have more than *N* linearly independent vectors. So *m* is at most *N*, i.e., Oddtown can have at most *N* clubs. Even if the Mayor wanted more clubs, linear algebra won't allow it.

By contrast, let us visit the neighboring town Eventown. Here, each club has an even number of members, and any two clubs share an even number of residents. In Eventown, the mayor can form $2^{\lfloor \frac{N}{2} \rfloor}$ clubs. To see the difference, consider for instance *N=100.* Oddtown allows at most *N=100* clubs. Eventown? With almost the same rules, the mayor can form up to $2^{50} \approx 10^{15}$ clubs, more than a thousand trillion!

As we can see, a small change in the rules can have enormous consequences: thanks to linear algebra ●

Sven Polak

Dr. Sven Polak is an Assistant Professor at Tilburg University in the field of Econometrics and Operations Research. His research focuses on mathematical optimization, particularly convex and combinatorial optimization techniques. He is interested in developing theoretical methods to solve complex optimization problems more efficiently.

A Board Year Beyond the Parties

On a drizzly November evening we sit down with Ingrid van Heertum and Menno de Vroomen, the parents of Wouter. They no longer live under the same roof, but they speak openly about their son, his path to Tilburg, and the student life they mostly see from a distance.

Ingrid (56) was born and raised in Schijndel and teaches Dutch at the Elde College in Sint-Michielsgestel, a job she has done for over three decades. Menno (60) also lives in Schijndel and has run his own business since 1994, working between European clients and Chinese suppliers. From home he handles production and quality control; sometimes he has to travel to China.

They did not really experience the "classic" student life themselves. Ingrid studied in Tilburg but kept living at home, the train back still ran after a night out. Menno studied in 's-Hertogenbosch and did live on his own, but not in a student house therefore he did not have a lot of pub nights and did not join a fraternity. "All that hazing stuff… that is not for me," he says. The fact that their own experiences are so different from Wouter's world only heightens their curiosity.

When Wouter announced he wanted to do a board year, their first reactions were mixed. "My very first thought was: oh dear, he does not feel like studying for a year," Menno says. But after some explanation and a tip from a cousin who studied econometrics, their view shifted: a board year is a year that teaches organizing, networking, and taking responsibility. Ingrid saw it the same way: "An excellent 'internship' for a study where an internship is not mandatory." By now they can see the concrete results: full weeks, serious budgets, and even LinkedIn seemed to take notice.
Was econometrics always the obvious choice? "Math and arithmetic suited him," says Menno. Ingrid adds: "In bilingual high school he chose the science track and managed it without extreme cramming." The start was not perfectly linear, though: after half a year during COVID, everything online, not yet living in student housing, Wouter quit and then went all in on applying to the Dutch Army, including tough screenings and training. Afterwards he returned to econometrics. The pull of the military is still there: being of service, doing something 'useful.' It shows how seriously he considered different paths.
Looking back, they sketch a picture of a quiet introvert who gradually opened up.

As a child Wouter was slender; around sixteen he started going to the gym, alongside football. It brought more self-confidence and a job at Albert Heijn, and, as Menno puts it, "where he first started getting some attention from girls." Music was part of home life too: on car rides to France they sang loudly to BLØF and Counting Crows, with Wouter invariably making up his own lyrics.

Friends play a leading role. From secondary school there is a tight-knit group with its own very lewd name and traditions; they go on a friends' weekend and recently took a trip to Ireland. Wouter no longer lives at home, but when he's in Schijndel he looks them up. That network has broadened through his dispuut, association, and board, exactly the social layer where, according to his parents, he clearly thrives. "You can work for forty more years," Menno says. This, he adds, is exactly the phase where you try out a lot of things.

A recurring theme is responsibility. For years Wouter and his brother Teun joined one-parent holidays; the past two summers Wouter even went as a staff member, organizing activities for young people. According to his parents, that's where he really developed. As for the bond with Teun: it is good, different characters (Wouter a bit more deliberate, Teun more outspoken), but they find each other effortlessly.

And winter sports? Ingrid and Menno laugh: "We are not really into it." Wouter once planned a ski trip with friends, but COVID put a stop to it. He is athletic enough that they don't expect him to be clumsy on the slopes; the right moment just has not presented itself yet. Until then: study, board work, friends, music, and maybe one day the Army. A full schedule, backed by parents who now understand well what a board year really means. "Partying is part of it," they conclude, "but there is also a lot of hard work"

Moving with Direction

written by **Dylan Koenders** and **Niels Hultermans**

On a weekday evening we call in with Thijs Sanders and Wendy Raaijmakers, the parents of Job. They live separately, Thijs in Boekel, Wendy in Gemert, but speak together about their son and the winter-sports moments that have become part of his story.

Thijs (53) studied in Amsterdam, worked there for two years, and then joined the family firm with his brother. After selling that company, they built an e-commerce wholesale business in logistics consumables, which they eventually sold as well. In 2019 Thijs founded BINQER, an e-commerce company for bins, waste-separation solutions and cleaning supplies. He is an Ajax supporter who lived in Amsterdam through the club's 1990s glory years. In his spare time, he runs and skis.

Wendy (50) studied psychology in Nijmegen, specializing in the psychology of aging, and is now a health-care psychologist working in primary care for older adults and people with chronic conditions. She is happiest on long walks with a podcast in her ears and when all the kids are home together for dinner. These days, two of the three children live elsewhere, so family dinners have become less frequent.
Job is the eldest of three. His sister Pien studies in Nijmegen; his brother Teun studies in Helmond and still lives at home. According to both parents, Job has always taken school seriously without needing to be pushed. Primary school went smoothly; in secondary school he earned high marks through a mix of ability and effort. "Intelligence alone does not cut it," says Thijs. "He combines it with discipline." That discipline showed up early at his supermarket job: within no time he was leading a small team and trusted to open the shop on Sunday mornings at six. Those early Sundays were never an issue for Job, he did not go out very often, and the double pay helped too.

When Job told them he was considering a board position, the mood was positive straightaway. He had finished his Bachelor's without delays; going directly into a master felt possible but maybe early. "Stepping out of the study rhythm for a moment to contribute to the association, and to taste a bit of working life, made sense," Thijs says. For Wendy the half-year board term also offered breathing room: space to explore what's next, and where. Rotterdam has been on Job's mind for a master, though Tilburg is not out of his system yet —"he has not 'finished' Tilburg," he often jokes.

Abroad was on his list early. Job spent a semester in Stockholm, very much his style: structured, but still an adventure. He likes discovering cities and cultures; months of open-ended backpacking might not be him, but studying abroad with weekend trips and a plan certainly is. "He is goal-oriented," Wendy says. "He thinks through the next step and then challenges himself to take it."

Socially, he is warm and easy-going, but also selective with his time. Both parents recognize the trait of needing to recharge alone after busy days. He started going out a bit later than some, around seventeen, and has since found a balance that suits him: active in the association, committed to friends, yet mindful of his own pace.
A formative moment, they agree, was the separation of his parents in 2012/2013. It was tough, but Job describes the upside as learning to stand up for himself sooner, becoming more assertive and independent. The caring side never left, he is present for his grandparents, runs errands, checks in. "He has a strong sense of responsibility and values," Wendy says.

Winter sports run through Job's childhood. He is been on skis from a young age; there were early trips with all three kids, and later a memorable trip to Austria. Thijs laughs as he recalls arriving at a packed mountainside terrace around three in the afternoon, the sun out and the music up. The slope pitched just before the crowd; everyone in the group slowed down — everyone except Job, who hit a small bump and performed an unplanned dismount in full view of the terrace. No harm done, just a red face and a quick recovery drink.

If there is one constant, it is intentionality. Job does not go for the loudest option; he tends to choose the one that makes sense to him. Whether it is opening a supermarket at dawn, spending a semester in Stockholm with a clear plan, or taking a board term between Bachelor's and Master's he keeps moving, but with direction. "You can hear it in how he talks about next steps," Wendy says. "He enjoys the moment, yet he is always thinking one move ahead" ●

How Ski Resort Design Shapes Your Day

written by **Niels Hultermans**

Most of us are looking forward to the upcoming Christmas break and the winter season. As the weather turns colder, the streets in "het dwaalgebied" in Tilburg light up with decorations, and wooden stalls appear selling roasted sausages and hot chocolate with Schrobbelèr.

Many of us are also preparing for our winter holidays, a chance to escape the increasingly mild Dutch winters and find the snowy mountains we know from old movies or the stories our parents told us. Once you arrive, the feeling is amazing, with crisp air, white slopes, and that first view from the chairlift.

Now skiing has changed. What once was a luxury for the upper class has, over the past few decades, become a tradition for many working-class families. Ask around, and it seems everyone has gone skiing at least once, and it shows on the mountains.

Some are fanatics who queue up for the first lift to catch fresh snow and enjoy emptier slopes; others take their time after a long après-ski night. But sooner or later, everyone meets again in the queue around eleven o'clock, waiting for the gondola that will take them back to the top. Few things are more frustrating than standing in line while, just a few slopes away, another lift seems almost empty. Why does that happen? Why do crowds form in some places while others stay quiet?

It turns out this is not just bad luck; economists and engineers have actually studied how skiers move through ski resorts, and what design choices can make the difference between long queues and smooth flow.

Skiers' BehaviourThe Brain's Reaction to Music

Skiers move through a mountain much like commuters move through a city. Each chooses a route that balances three things: enjoyment, effort and waiting time. Experienced skiers know the thrill of finding an almost-empty slope, yet their decisions are rarely random. Some look for a challenge, others plan their run toward a lunch spot or a meeting point, and many simply follow the paths that seem most doable for their skill level. Together, these individual choices create the familiar traffic-like bottlenecks that form around certain lifts.

Researchers have begun to model this behaviour in surprising detail. In the Dynaski project (Poulhès & Mirial, 2020), GPS and survey data from thousands of skiers were used to simulate how people move through a real resort. The results showed that even small infrastructural changes, such as a new housing area near a base station or the relocation of a lift, can shift skier flows enough to increase average waiting times by more than ten percent. This shows that a minor adjustment on the map can have a major influence on the entire mountain (Poulhès & Mirial, 2020).

A separate study by Heinrich et al (2023) tested what happens when lift capacity is increased in an Austrian resort. Intuitively, one might expect shorter queues. Yet the simulations revealed that simply adding faster or larger lifts often redistributes congestion rather than eliminating it. When one bottleneck disappears,

another may appear farther up the network, depending on how the slopes are connected. The layout and routing of the slopes turned out to be just as important as the size of the lifts themselves (Heinrich, Reibersdorfer-Adelsberger, Grubinger-Preiner, Mündler, & Neuwirth, 2023).

Together, these findings show that a ski resort is a living network of flows and feedback. Every new trail, restaurant, or parking lot subtly reshapes how thousands of skiers move. Understanding that flow, the way people react to convenience, crowding and comfort, is the first step toward designing mountains that feel smooth, not jammed.

When Busy Feels Worse

As winter holidays have become ever more popular, the crowds are impossible to miss. Each season, social media fills with clips of endless lift lines and packed slopes, a reminder that the alpine calm once reserved for a few has become a shared ritual for many. Families plan trips together, groups of friends turn the mountains into a social event, and even university associations, like our own Asset Econometrics, head out to combine skiing with partying. It is all part of the charm: skiing is not only about snow and speed but also about being together.

Yet all this shared joy creates its own kind of friction. Pikkemaat et al (2020) found through empirical research that perceived crowding significantly lowers skier satisfaction, particularly for intermediate skiers, the largest group on the mountain. Beginners often stay in designated areas and experts can escape to steeper, quieter parts of the mountain, but intermediates are in between them, where the conditions and crowd vary the most (Pikkemaat, Bichler, & Peters, 2020).

Except for the crowd and levels of difficulty of a slope into decision comes a psychological element at play. People naturally follow where others go, a behaviour economists recognize as social proof. Seeing a busy run or a long queue can signal that it must be a good one, so more people join it, even when emptier alternatives are nearby. This creates a classic feedback loop familiar in economics: popularity attracts more demand until it begins to erode the very quality that made a place attractive. The result is a paradox of modern skiing: shared enjoyment that, when scaled up, makes the experience less enjoyable for everyone (Cialdini, 2021).

Designing the Mountain

If crowding is the problem, then design is the answer. Long before skiers start their day of hitting the slopes, engineers, architects, and planners have already shaped the route of their day. The way a mountain is mapped, where lifts start and end, how paths connect, and even how steep they are, determines whether the experience feels effortless or congested.

Researchers have shown that small adjustments in layout make a measurable difference. Wu & Wu (2023) examined the design of ski tracks from an engineering perspective. Their work focused on physical features such as slope gradient, curvature, and turning radius, the elements that together create what skiers call “flow”. They found that the most successful slopes strike a balance: keeping gradients within comfortable ranges for the intended users, which provide enough speed without exceeding comfort or safety limits, while excessive curvature or long traverses interrupt momentum. In short, runs that follow the natural terrain, avoiding unnecessary flat stretches or sharp corners, keep people moving more smoothly. When movement is smooth, the time spent standing still, whether on a traverse or in a queue, goes down (Wu & Wu, 2023).

Layout also plays a crucial role in how crowds distribute themselves across the resort. A design report from the University of Maryland (2005) explored this through a simple optimization model. By varying factors such as lift position, lift

capacity, and run length, the researchers measured how each change affected total throughput and waiting time. Their findings were reflected in the real-world simulations done in the research in section 1: the location of the lifts mattered as much as their size. A well-placed lift could draw skiers away from an overloaded area and shorten waits across the network, while adding a new high-capacity chair in the wrong spot could simply shift the congestion elsewhere (Tharnish & Recla, 2005).

Together, these studies show that efficiency on the slopes, depends less on building faster lifts and more on connecting them in a smart way. Every crossing, intersection, or exit point changes the "traffic flow" of skiers in ways that can be predicted and improved. Good design does not necessarily mean expanding infrastructure, it can mean aligning new runs with natural contours or spreading access points so that skiers intuitively spread out across the mountain.

The Bottom Line

From all studies we can see a clear pattern, a ski resort behaves like a connected system. When one part changes, the rest shifts with it. The Dynaski project showed how small adjustments, such as lift relocations or new housing areas, can already reshape skier routes and waiting times (Poulhès & Mirial, 2020). Heinrich et al. (2023) added that increasing lift capacity alone rarely solves congestion, without supportive layout, it simply moves bottlenecks elsewhere (Heinrich et al., 2023).

This matters because, as Pikkemaat et al. (2020) demonstrated, perceived crowding strongly reduces skiers' satisfaction, especially among intermediates who use the busiest areas. And research done by Wu & Wu (2023) and the UMD (2005) team highlights that good design is often about thoughtful alignment, placing lifts strategically and keeping the slopes within comfortable gradients, together with ensuring smooth connections so skiers naturally spread out (Wu & Wu, 2023; Tharnish & Recla, 2005).

In the end, the quality of a ski day depends as much on smart design as on good snow. When resorts use insights from modelling human behaviour, they can turn growing crowds into manageable flows, and keep the mountains operating smoothly, even on the busiest weeks of the winter season.

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"I Go to Work Whistling and Go Home Singing"

written by **Theo Janssen** and **Anouk Wets**

Usually, at the Nekst committee, we interview a teacher; this time, however, we have done something different. This time, we have instead interviewed the concierge of Esplanade, the building where Astrics is based: Jan de Leeuw. Aged 66, he has been the concierge here for the past three and a half years, receiving nothing but praise from both students and colleagues.

How Jan came to be in this position

Jan has been working since he was fifteen and, in his previous job at the municipal council, had a lot of contact with residents in his neighborhood. When he was ready for something new, he considered a position as janitor. Through the council, he got in touch with the university. He was initially going to become a surveillant, but on the very same day he received a call saying they preferred to place him in the Esplanade building. That was 3.5 years ago, and since then he has felt completely at home there. The only downside is that he will have to stop because of his retirement, no matter how much he would like to continue. Therefore, he hopes that later on he can at least continue helping as a volunteer in the building where he feels so at home. Right now, he always says to his boss: "I go to work whistling and go home singing."

A typical day in the life of Jan

So what does a typical day for Jan look like? Well, according to himself, he arrives at Esplanade in the morning whistling with enthusiasm, and starts every day thinking to himself how he can help the students in his building: his door is always open, he says. Other big parts of his day-to-day work are small repairs, maintenance and sorts. He also helps set up and clean up after events in the blackbox, our in-house theater hall. He leaves in the evening singing with joy.

Working in a building full of life

The Esplanade building is known for its liveliness; there is always something happening, often unexpectedly. Of course, it also has to be a pleasant place to study, which is what makes the building unique. To ensure that the rules are still followed, certain qualities are required: empathy, social insight, authority, and intuition. Jan's approach is not to act as a police officer, but to hold up a mirror for the students and engage them in conversation. This again reflects his motto: instead of saying, "you must", he asks, "would you like to?". And it works, as he gains the support of the students through dialogue.

Not every day, however, is sailing with the wind, and not every interaction Jan has with students goes as smoothly as he'd like: Following student activities the Cultuurtuin can be quite the mess, as tidying up lags behind intense use of the room. Another example he gives is when students of another association had punched a hole through a wall.

Despite a few instances, though, Jan says that he enjoys working alongside students, and that although he wants to prevent excesses, he understands that students enjoy partying occasionally. He also takes the time to express that he disagrees with people who say that students do nothing all day; he sees students working very hard and taking the occasional moment to wind down.

Anecdotes

When asked for some anecdotes, Jan could give endless examples. He has seen people come and go in their swimwear or even underwear, but also groups of people having a 'gangborrel' all dressed in suits. Sometimes he even joins in when he comes across people socializing together. For example, together with MAK and the EBT, Asset once organized one of their All Boardies Activities in the Cultuurtuin in Esplanade, which was a cantus/karaoke night. When the students asked if he wanted to sing a song with them, he did so with great enthusiasm, and together they delivered a wonderful version of 'Brabant'.

This is just one of the many examples of how Jan enjoys spending time with students. The Cultuurtuin is therefore one of his favorite spots in the building, as there

Jan de Leeuw

are always game nights or other events happening there, to which the students always welcome him warmly.

Message to students/conclusion

All in all Jan is very content in his position. He sees his relationship with the students as very positive, and he thinks of the building as a place where studying and social life come together. His management style is based on mutual respect, and students have the utmost respect for him. A few years ago this was expressed by presenting him with a portrait of himself on the first floor, and we would also like to thank him for sharing his experiences with us.
Jan has one message for the students: Stay true to yourselves. Respect each other and the building. Always come to him if something comes up. To graduates: he hopes you find work that gives you fulfillment ●

The Dutch Risk Equalisation System: Insights for Insurer Compensation

written by **Anne Verbeek**

The Dutch health insurance system is built on two important principles: solidarity and fair competition. Solidarity ensures that everyone can access healthcare, regardless of age, income, or health. Fair competition ensures that insurers try to improve their service and efficiency, rather than trying to avoid people who are more expensive to insure.

However, combining these two principles is a challenge. People differ widely in their expected medical costs. Some use hardly any care, while others depend heavily on medicines, chronic care, or hospital treatment. If insurers were paid the same amount for all people, they would have a financial incentive to attract the healthy and avoid the sick. This kind of behaviour, called risk selection, would undermine solidarity in the system.

To prevent this, the Netherlands uses a mechanism called Risk Equalisation (RE). This system ensures that insurers receive higher compensation for people who are expected to have higher healthcare costs. The RE model predicts expected costs using characteristics such as age, gender, socioeconomic status, and the presence of chronic illnesses.

Even though the RE system is considered one of the most sophisticated in the world, it is not perfect. Some groups are still systematically undercompensated (often those with chronic or complex needs), and others are overcompensated (often healthy individuals). These predictable patterns can still influence insurer incentives.

In recent years, a new characteristic has played a remarkable role in improving fairness: Multi-Year Pharmacy Costs (MPC). MPC uses historical medicine costs to identify people who have been in relatively poor health over several years. Instead of giving MPC its own coefficient in the RE model, policymakers introduced a constraint: a rule forcing the model to predict the correct total cost for all people with MPC = 1. The constraint has some powerful effects: It redistributed compensation from healthiest to the unhealthiest groups. Which results in serious changes in the compensation patterns for insurers.
However, these changes are not easy to understand. MPC shifts compensation in some complex ways, affecting some insurers much more than others. Why? What hidden patterns in the data caused these shifts? And what can policymakers learn from these patterns to keep the system strong? One of my research questions therefore is:

What are the underlying patterns in policyholder characteristics that cause norm costs in insurers to shift significantly due to the MPC constraint?

Multiple Correspondence Analysis

MPC (multi-year pharmacy cost) is not strongly correlated with most variables individually. However, looking only at pairwise correlations cannot reveal combinations that frequently co-occur, or subgroups of people defined by interacting characteristics. Given that our dataset is extremely high-dimensional and only consists of binary variables, a suitable method to detect these deeper structures is Multiple Correspondence Analysis (MCA). MCA is a dimensionality-reduction method specifically designed for categorical data.

MCA allows us to detect these clusters and to understand why some insurers are more affected by the MPC constraint: different insurers enroll different types of policyholders, and those policyholders align with certain dimensions.

Intuitive interpretation

MCA uses singular value decomposition (SVD) to rotate the indicator matrix into new axes that best capture co-occurrence patterns. These axes, latent dimensions, are ordered by their eigenvalues, which reflect the amount of structure (or inertia) each captures. Think of MCA as mapping categorical data into a kind of "cloud" in space. Rotation is like turning that cloud around so that the most important patterns (the directions where the data points vary the most) line up with the axes. After rotating, we scale the axes so that each dimension reflects its relative importance: how much of the total variation it explains.

MCA yields as many dimensions as there are active variables in the dataset. Each dimension reflects a particular contrast or pattern of categorical cooccurrence. To interpret a given dimension, we examine two elements: The contribution and position of each category within that dimensional space.

The contribution indicates how much a category helps define a given dimension. A high contribution means the category is an important driver of that dimension. To interpret a dimension, it is common

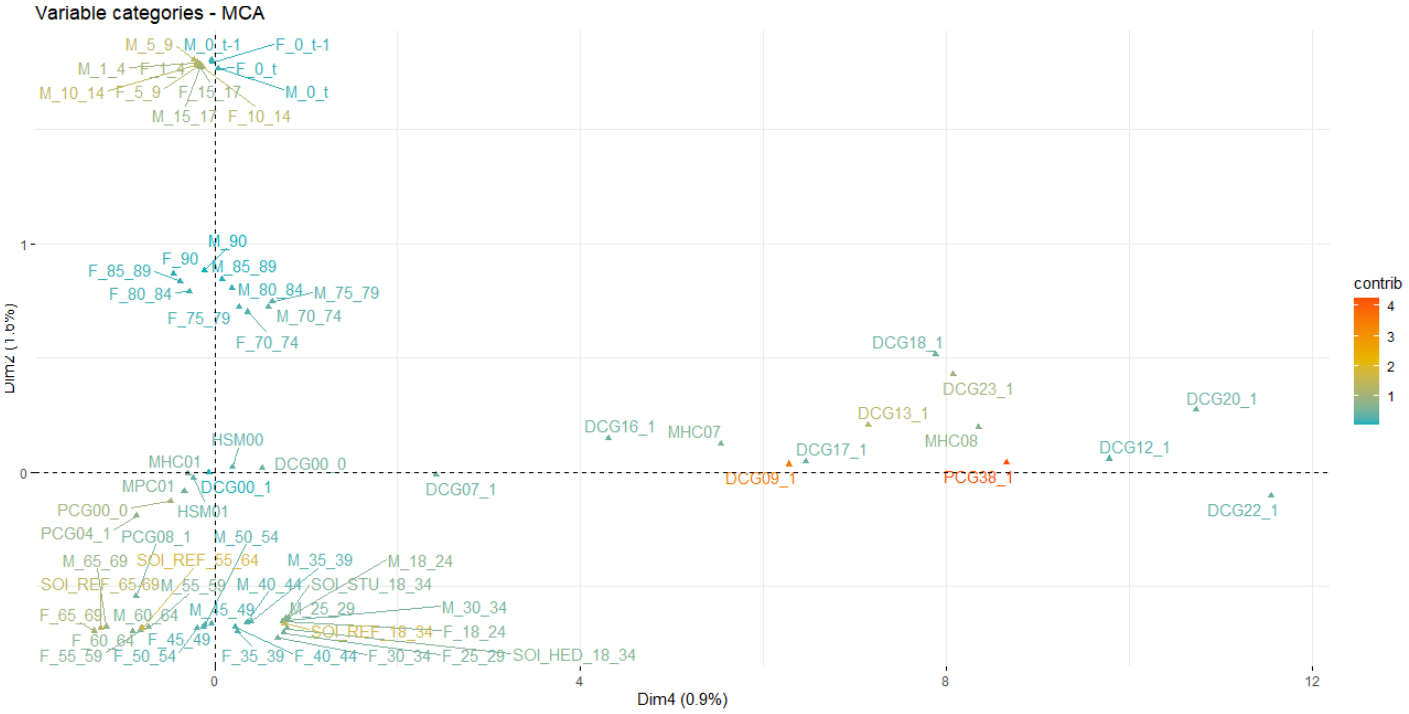


Figure 1: Variable plot of dimension 2 (reference dimension) and 4, containing variables that account for 70% of the variance in the fourth dimension.

practice to focus on the top contributing categories, those that together account for roughly 70–80% of the dimension's total contribution.

The position of a category reflects how strongly and in what direction it is associated with a particular dimension. Categories located far from the origin (0) on a given axis are more strongly related to that dimension. By assessing their positions, especially which lie at opposite ends of a dimension, we can infer the latent contrasts it represents. These are typically visualised in variable plots.

We focus on the dimensions in which either MPC category (0/1) emerges as a principal contributor. These are dimensions 1, 4, and 17. To demonstrate how we arrive at what a dimension represents, we will discuss dimension 4 in more detail.

Fourth dimension

As visible Figure 1, the strongest contributors in this dimension lie on the positive axes include:

- PCG38 (Cancer)
- DCG09 (a high diagnostic cost group strongly associated with cancer treatment)
- MHC07 and MHC08 (top multi-year cost groups)
- PCG categories indicating early or moderate chronic conditions (e.g., PCG04 cardiovascular prevention meds, PCG08 depression)

These suggest a pattern of recent emergence of severe conditions or early treatment phases of chronic disease. Interestingly, this dimension separates age into two subsets of the working-age population: 18-34 on the positive side of the dimension, 55-69 on the negative side. This pattern may represent individuals in the early stages of diagnosis and treatment for genetic, chronic, or severe illnesses. Older individuals (55-69) are more likely to have already been diagnosed and are actively undergoing treatment. In contrast, those aged 18- 34, particularly if the illness has a genetic component, are more likely to be experiencing early symptoms and undergoing diagnostic assessments.

MPC contributes to this dimension by identifying: people recently entering high-cost trajectories and individuals showing increasing medication patterns before diagnosis or hospital treatment. These are not yet reflected in diagnostic cost groups or long-term cost groups alone. Therefore, we conclude this dimension represents:
Early stages of diagnosing and treating severe or chronic illness

Removing MPC severely weakens this dimension's ability to reflect early illness stages, forcing the model to rely on less precise, sometimes delayed indicators like PCGs or DCGs (pharmacy and diagnostic indicators).

First and Seventeenth dimension

The first dimension likely captures long-term healthcare expenditures and chronic illness associated with the elderly. This pattern aligns with expectations, as ageing increases susceptibility to chronic illnesses and higher medical costs, whereas younger individuals typically face different health concerns, such as childhood illnesses and fractures. Thus, we conclude:
First dimension: Long-Term Healthcare expenditure and Chronic Illness in the Elderly.

The seventeenth dimension identifies individuals who are not yet in very high-cost categories, but do exhibit persistent conditions suggesting eligibility for long-term or mental health care. MPC helps distinguish between individuals with long-term stable needs and those with episodic or severe incidents.

Seventeenth dimension: Eligibility for Mental Health or Long Term Care

Answering the Research Question

Using the insights from the MCA dimensions to explain why insurers experience different shifts in norm costs when MPC is included as a constraint. To do this, we look at the change in average residual per insurer, with and without the MPC constraint. This difference serves as a measure of how much the model's performance changes for each insurer. This is then compared to the dimension score.

Each individual receives a score in each dimension, based on linear combinations of the original variables. For each insurer, we calculate the average score across all

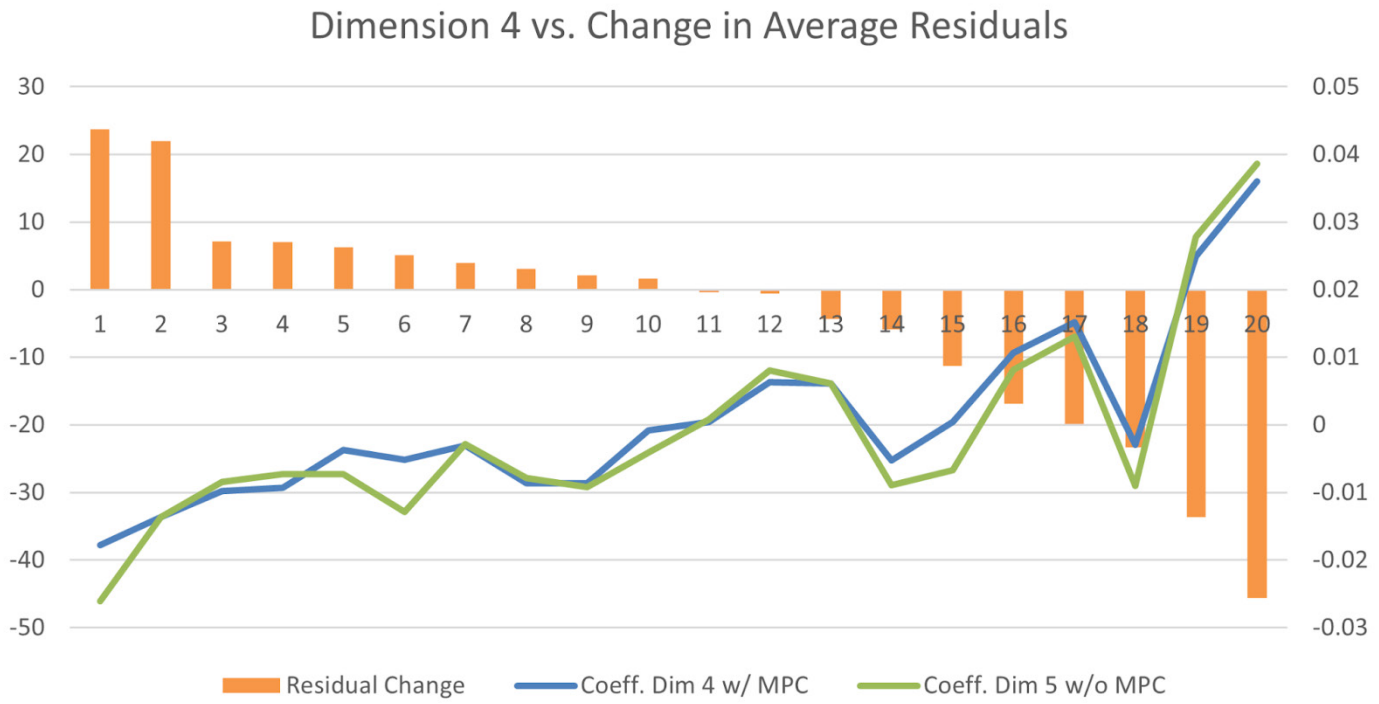


Figure 2: Average insurer position in dimension 4 vs. change in residuals.

insured individuals within these dimensions, yielding an aggregate profile of that insurer's population in MCA space. By comparing these averages to the changes in residuals, we can assess whether insurers with specific dimensional profiles are more affected by exclusion of MPC.

The fourth dimension, associated with the early stages of diagnosis and treatment, shows a negative correlation with the shift in residuals (Figure 2). However, this relationship is weaker and less consistent. Risk-bearers 19 and 20 stand out: they are the only ones with a positive average in this dimension and also experience a strong negative shift in residuals. The relatively low explanatory power of this dimension (0.9% of total variation) likely contributes to the instability of this trend. Correlation weakens slightly after MPC removal, dropping from –0.899 to –0.849. Still, this suggests that these insurers may serve populations flagged as 'healthy' by MPC, even though they incur substantial costs due to the early stages of illness. Under the constraint, this results in severe undercompensation. This is particularly concerning, as early-stage treatments, such as those for cancer, can be highly cost-intensive, despite not yet being classified as chronic or severe within the MPC framework.

The *first dimension* is consistent with expectations: individuals who are generally less healthy, and thus more likely to be elderly, play a key role in how model performance shifts.

The *seventeenth dimension* has a very weak correlation. This may indicate that niche subpopulations, such as individuals in transition to alternative care systems, are correctly flagged as 'unhealthy' within the constraint system just before their costs shift away from somatic care. As a result, these groups may receive mild overcompensation under the current model ●

你好 from Hong Kong everyone!

written by **Luuk van der Meer**

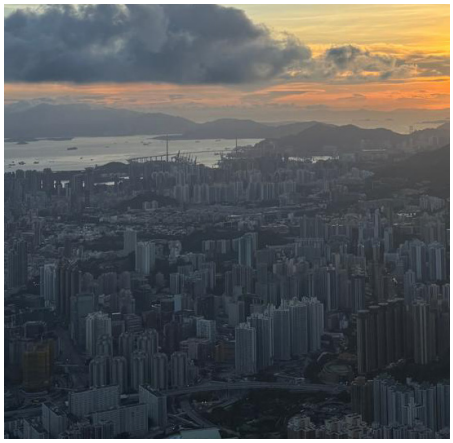
Like you could already have read in my short introduction, I am Luuk, a fourth year Bachelor's student in Econometrics currently on exchange in Hong Kong! After being drafted out last year, I postponed my studies for half a year for this experience. Possibly the best decision I could have made.

I arrived in Hong Kong on August 24 and arrived in my dorms a day later. I was very nervous about it because I would be living with a random guy in the same room for the upcoming 4 months. Fortunately, I have a great roommate! From my first week I remembered feeling really overwhelmed with everything. Hong Kong felt like one big maze, so my first trip to IKEA took 1 hour instead of the 15 minutes Google Maps showed. Furthermore, living in a complex with over 2500 other students is something to get used to, especially sharing 4 toilets and 3 showers with 24 other boys. Lets say that I am really happy that the bathroom gets cleaned every day.

In the first weeks I started exploring Hong Kong, which was quite challenging since it was still 35 degrees and very humid. My most memorable experience was seeing the skyline for the first time. It is so huge and so different from what I am used to in Tilburg. Since Hong Kong is the city with the most skyscrapers in the world, 9000 high-rise buildings with 1000 over 100 meters, the difference could not be any bigger. The more I discovered about Hong Kong, the more I found out it is way more than meets the eye. Hong Kong actually is a very vibrant place with a lot of nature and beaches. My favourite activities here are hiking through the mountains or chilling at the beach, which can be done the whole year because even during the christmas season Hong Kong still has days with 25 degrees.

There are 8 different universities in Hong Kong. This results in a very active student life here. I am studying at the City University of Hong Kong, which is essentially the most international university of the world. Therefore, it was easy for me to get a lot of contacts very fast. The university can arrange everything, they even have their own doctor where you can go for consultation. So everything really is amazingly managed by the university. Furthermore, every wednesday the horse races take place, which is a meetingpoint for all the exchange students in Hong Kong, so it is easy to keep in contact with a lot of different exchange students.

During my time in Hong Kong, I learned a lot about Cantonese and Chinese culture. For example, people love to queue here. For nearly none restaurant you can make reservations so you are expected to queue before getting a table or queue before taking the elevator. Furthermore, in Chinese and Cantonese culture most people only want to drink hot water and wash their chopsticks in their tea before eating. Moreover, I learned what to do during a typhoon. During my stay, Hong Kong



was hit by super typhoon Ragasa, which was the strongest typhoon since 2015. So we all went into a complete lockdown. Fortunately, everyone was fine.

Finally, Hong Kong is an amazing place to go from for trips. You can find really cheap flights to a lot of different locations in mainland China, Japan and south east Asia. I visited Beijing, Bangkok, Seoul and Macao and I am currently visiting the north of Vietnam! I especially enjoyed my trip to Beijing where I saw the Great Wall and the forbidden city! Many students are also planning to travel after their studies here since you are already so close to amazing backpacking countries like the Philippines and Indonesia.

I am very happy that I made the choice to participate in my exchange since I really do enjoy every part of it, nonetheless I still miss my friends and family at home sometimes but since time is moving so quickly, I do not have problems with that. To anyone hesitating about going on an exchange or going to Hong Kong (or any other country outside of Europe), I could only encourage you to just go since it is amazing!


ASSET Econometrics

Meet the Board

Summer board of Asset | Econometrics 2025-2026

Chairman

My name is Luke de Laat. I was born and raised in Tilburg, and in 2023, I began my Bachelor's in Econometrics and Operations Research at Tilburg University. This year, I am the chairman of Asset | Econometrics, Asset | Tilburg, LOES (National Organization of Econometrics Study Associations), and the treasurer of TiGeAk (Tilburg Joint Activities). As chairman, I am responsible for maintaining an overview of the association, ensuring that everything runs smoothly as planned. In my free time, I play football, regularly go squash with friends, hang out, and enjoy a few beers with them. I am looking forward to seeing you at the rooms or at one of our events!

Vice-Chairman

Hi, my name is Wouter, I am 23 years old and I am originally from a village called Schijndel. About 1.5 years ago, I moved to Tilburg to live in the fraternity house of 'Onafhankelijk Heerendispuut Excessive'. This fraternity keeps me quite busy, and I thoroughly enjoy all the drinks, student festivals, and other parties it offers. I found some of my closest friends here, so I do my best to balance it with the responsibilities that come with being a board member. Currently, I am in the third year of my Bachelor and plan on finishing it in 4.5 years. I very much look forward to seeing everyone the remaining of this year at the activities or at the rooms!

Secretary

Hi! My name is Anouk, and I am 21 years old. I grew up in Huizen, but I have been living in Tilburg for three years now and I am really enjoying the 'Brabantse gezelligheid'! I have now finished my bachelor's, but became active in my first year, and have since joined multiple fun committees. These range from creative committees to ones focused on organizing an event. Now I get to coordinate the Active Members Weekend, Yearbook, KOALA, and Nekst committee, which feels like the perfect mix. Outside of Asset | Econometrics, I love planning fun day trips with friends or simply spending cozy evenings cooking together, playing games, or doing something creative. See you soon!

Treasurer

Hello everyone, my name is Gijs. I am 23 years old. Originally, I am from Den Bosch, but since three years I have been living in Tilburg. I started my studies in 2020, and next to my studies in Econometrics, I have also been pursuing a degree in Bestuurskunde. I am planning to finish my Master's Business Analytics and Operations Research and my Bachelor's Bestuurskunde next year.

Most of you had probably not seen me last year, as I only participated in the IBT and Board Information Session. I have been active at Astrics since 2021 in the EfS, Education, ECT and Nekst committees, but last year I was not active in a committee. Besides this, I am also a member of Heerendispuut Vatos. In my free time, I enjoy playing tennis.

External Affairs Officer

Hi! My name is Sanne van Duren, 21 years old and originally from Best. I've played hockey there for as long as I can remember, and I still enjoy playing every Sunday. Besides hockey, I like running and spending time with friends and family. I recently finished my Bachelor's in Econometrics and will start my Master's in Quantitative Finance and Actuarial Science next year. After joining several committees and meeting many new people, I decided to do a board year as External Affairs Officer.

External Affairs Officer

Hi everyone, my name is Job Sanders and I am 21 years old. Originally, I am from Gemert, but I have been living in Tilburg for two and a half years now in my beautiful student house on the Schouwburgring. Becoming active at Asset | Econometrics was one of the best choices I have ever made. My first committee was the Freshmen Night committee, and I made some of my best friends there. Besides the committee work, I always enjoyed all the activities, trips and drinks that the association organizes. In my third year, I did an exchange to Stockholm, which was great. In my free time, I enjoy doing activities with my friends, reading, travelling and I have just started playing the guitar. The thing I love most about Asset | Econometrics is the mentality of everyone. The average econometrician can be described as a social nerd, which I think is one of the best combinations one can have.

Semidefinite programming and the stable set problem

My name is Lennart, and I am a PhD student at the TiU EOR department. My supervisors are professors Sotirov and Vera. I have also followed the TiU EOR bachelor, and the BAOR master. During my PhD, I have assisted students in tutorials of EOR courses, such as linear algebra, analysis 1 and 2, and operations research methods.

For my PhD research, I have studied semidefinite programming (SDP), which can be considered as an extension of linear programming. In this article, I show how SDP can be used to solve the stable set problem from graph theory. I have written this article without assuming prior knowledge of these topics, although familiarity with linear algebra will be useful. If you wish to know more about SDP, feel free to contact me via email. Lastly, although TiU does not offer SDP courses, you can write your thesis on it, since the TiU EOR department hosts many SDP experts!

A semidefinite program

A semidefinite program (SDP) is a generalization of a linear program (LP). Such LPs are usually stated in the following standard form:

$$\max_{x\in\mathbb{R}^n} c^\top x \text{ subject to } x \geq 0,\ Ax = b, \quad (1)$$

for some given $n \in \mathbb{N}$, $c \in \mathbb{R}^n$, $A \in \mathbb{R}^{m\times n}$ and $b \in \mathbb{R}^m$. In other words, the LP (1) concerns the maximization of a linear function (i.e., $c^\top x$), over the nonnegative orthant (the set $x \geq 0$) subject to linear constraints (i.e., $Ax = b$). An SDP is defined similarly as an LP: In SDPs, we again look to maximize a linear function subject to linear constraints, but the nonnegativity condition in SDPs is different than in LPs. In SDPs, our variable is not a vector in $\mathbb{R}^n$, but instead a symmetric matrix $X \in \mathbb{S}^n$, where $\mathbb{S}^n$ denotes the set of symmetric matrices in $\mathbb{R}^{n\times n}$. In SDPs, it is not required that each entry of the symmetric matrix is nonnegative. Rather, we constrain that X is positive semidefinite (PSD), written as $X \succeq 0$. As you may recall from Analysis 2, a symmetric matrix $X \in \mathbb{S}^n$ is PSD if and only if $w^\top Xw \geq 0$ for all vectors $w \in \mathbb{R}^n$. If you have followed advanced linear algebra, you may also recall that X is PSD if and only if its eigenvalues are nonnegative.

As stated, the objective function of an SDP is a linear function in the symmetric matrix variable X. This function can be written as $\sum_{1\leq i,j\leq n} C_{ij}X_{ij}$ for some numbers C_{ij}. The linear constraints on X can be written as $\mathcal{A}(X) = b$, $b \in \mathbb{R}^m$, where $\mathcal{A}(\cdot)$ is a linear function that takes as input matrices in $\mathbb{S}^n$, and returns a vector in $\mathbb{R}^m$. For example, if $m = 2$, $\mathcal{A}(x) = b$ could be defined as $\left[X_{11} + 2X_{12},\ 3X_{23} - X_{33}\right]^\top = \left[b_1,\ b_2\right]^\top$. An SDP can then be written as

$$\max_{X\in\mathbb{S}^n} \sum_{1\leq i,j\leq n} C_{ij}X_{ij} \text{ s.t. } X \succeq 0,\ \mathcal{A}(X) = b. \quad (2)$$

Both LPs and SDPs can be solved efficiently by computers[1], although SDPs generally require more time to solve.

Any LP can also be reformulated as an SDP. Indeed, the constraint $x \geq 0$ can be reformulated as follows: Let $M \in \mathbb{S}^n$ be a matrix that is zero everywhere, except for the diagonal entries $M_{ii} = x_i$ for all $i \in \{1, 2, \ldots, n\}$. Then M is PSD if and only if $x \geq 0$.

The stable set problem

We will compare the use of SDPs and LPs for solving the (maximum) stable set problem. The stable set problem is a famous problem from graph theory that is notoriously difficult to solve. It finds applications in many other fields of research as well, such as computer science and operations research.

Graph theory is the study of graphs. A graph is a mathematical object, consisting of a set of vertices V and a set of edges E. The edges are of the form $\{i, j\}$, for vertices $i, j \in V$. If $\{i, j\} \in E$, we say that vertices i and j are connected, or adjacent. An example graph is provided in Figure 1. That graph has vertex set $\{1, 2, 3, 4, 5\}$, and edge set $\{\{1, 2\}, \{1, 3\}, \{2, 3\}, \{2, 4\}, \{3, 5\}\}$. Graphs

[1] The term 'efficient' has a precise meaning, which is taught in the course combinatorial optimization. I omit the meaning here to keep the presentation simple.

can be used to model many phenomena, such as train networks, or family trees.

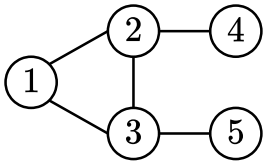


Figure 1: Visual representation of a graph

Given a graph G, a stable set of G is a subset of its vertices, such that any two vertices in the subset are not connected. The graph in Figure 1 has many such stable sets, e.g., $\{1,4\}$, $\{2,5\}$ and $\{1,4,5\}$. The stable set problem is to find a stable set of largest size. The corresponding size is denoted by $\alpha(G)$, and referred to as the stability number of G. Hence, for the graph in Figure 1, its largest stable set is $\{1,4,5\}$ of size 3, so that the stability number $\alpha(G) = 3$.

The problem of computing $\alpha(G)$ can be formulated as an integer LP (ILP). We introduce variables $x_i \in \{0,1\}$ for any vertex i, where $x_i = 1$ represents that we include vertex i in the largest stable set, and $x_i = 0$ means that we do not. The size of the corresponding stable set is given by $\mathbf{1}^\top x$, where $\mathbf{1}$ is the all-ones vector. If vertices i and j are adjacent, then they cannot both be in the stable set, so we must constrain $x_i + x_j \leq 1$ whenever $\{i,j\} \in E$. Indeed, if $x_i, x_j \in \{0,1\}$, then $x_i + x_j \leq 1$ is only satisfied if at least one of the x_i, x_j values equals 0. It follows that $\alpha(G)$ is the optimal value of the following ILP:

$$\max_{x \in \{0,1\}^n} \mathbf{1}^\top x \text{ s.t. } x_i + x_j \leq 1 \ \forall \{i,j\} \in E. \quad (3)$$

Relaxations of the stable set problem

The ILP (3) can be used to compute $\alpha(G)$. However, because computing $\alpha(G)$ is so difficult (unless the graph is small, say ≤ 50 vertices), one cannot expect to solve (3) within reasonable time. Hence, it is useful to investigate relaxations of the stable set problems. Such relaxations should be efficiently solvable, and their optimal values should provide an upper bound on $\alpha(G)$. We present here LP and SDP relaxations of the stable set problem.

An LP relaxation of the stable set problem is obtained by replacing the nonlinear constraint $x \in \{0,1\}^n$ in (3), with the constraints $x \in \mathbb{R}^n$ and $0 \leq x \leq 1$. The resulting LP is given by

$$\max_{0 \leq x \leq 1} \mathbf{1}^\top x \text{ s.t. } x_i + x_j \leq 1 \ \forall \{i,j\} \in E. \quad (4)$$

The optimal value of (4) provides an upper bound on $\alpha(G)$ that can be computed efficiently, but is rather weak in practice, i.e., not very close to $\alpha(G)$. Stronger upper bounds can be obtained by SDP relaxations of the stable set problem.

To construct such an SDP relaxation, consider an $x \in \{0,1\}^n$ that is feasible to (3), and define the matrix $X = xx^\top \in \mathbb{S}^n$. We deduce two properties of X. Firstly, the entries of X satisfy $X_{ij} = x_i x_j$. In particular, if vertices i and j are connected, then at least one of x_i and x_j equals 0 (since they cannot both be in the stable set). Hence, whenever $\{i,j\} \in E$, we have $X_{ij} = x_i x_j = 0$.

Secondly, the diagonal entries of X satisfy $X_{ii} = x_i^2 = x_i$, where the last step follows from the fact that $x_i \in \{0,1\}$.

Now consider the extended matrix

$$Z = \begin{bmatrix} 1 \\ x \end{bmatrix} \begin{bmatrix} 1 \\ x \end{bmatrix}^\top = \begin{bmatrix} 1 & x^\top \\ x & X \end{bmatrix} \in \mathbb{R}^{(1+n)\times(1+n)}.$$

We show that Z is symmetric, and PSD. To this end, define the vector $u = \begin{bmatrix} 1 \\ x \end{bmatrix}$, so that $Z = uu^\top$. Symmetry of Z follows from the fact that

$$Z^\top = (uu^\top)^\top = (u^\top)^\top u^\top = uu^\top = Z.$$

Since $Z \in \mathbb{S}^{1+n}$, also its submatrix $X \in \mathbb{S}^n$. To prove that $Z \succeq 0$, it suffices to show that $w^\top Z w \geq 0$ for all $w \in \mathbb{R}^{1+n}$. Let $w \in \mathbb{R}^{1+n}$. Then

$$w^\top Z w = (w^\top u)(u^\top w) = (w^\top u)^2 \geq 0, \quad (5)$$

where we have used that $w^\top u = u^\top w$.

We can add the properties of X and Z as constraints in a program. This program will then have $\alpha(G)$ as its optimal value. This program is given by

$$\begin{aligned} \max_{x \in \{0,1\}^n, X \in \mathbb{S}^n} \ & \mathbf{1}^\top x \ \text{ s.t.} \\ & X_{ij} = 0 \ \ \forall \{i,j\} \in E \\ & X_{ii} = x_i \ \ \forall i \in \{1,2,\ldots,n\} \\ & X = xx^\top, \ \begin{bmatrix} 1 & x^\top \\ x & X \end{bmatrix} \succeq 0. \end{aligned} \quad (6)$$

Note that program (6) contains redundant constraints: $X_{ii} = x_i$ is implied by $X = xx^\top$ and $x \in \{0,1\}^n$. To obtain an SDP relaxation, we remove the nonlinear constraint $X = xx^\top$, and the integer constraint $x \in \{0,1\}^n$. Then the constraint $X_{ii} = x_i$ is no longer redundant, but it does help to strengthen the relaxation.

Specifically, the SDP relaxation is given by

$$\begin{aligned} \max_{x\in\mathbb{R}^n, Z\in\mathbb{S}^{1+n}, X\in\mathbb{S}^n} & \mathbf{1}^\top x \quad \text{s.t.} \\ & X_{ij} = 0 \quad \forall \{i,j\} \in E \\ & X_{ii} = x_i \quad \forall i \in \{1,2,\ldots,n\} \\ & Z = \begin{bmatrix} 1 & x^\top \\ x & X \end{bmatrix}, \; Z \succeq 0. \end{aligned} \tag{7}$$

Program (7) can be rewritten in the standard SDP form (2). Indeed, the objective function of (7) is a linear function in the PSD matrix variable Z. All the constraints (7) can also be expressed as linear constraints on Z.

The optimal value of (7), corresponding to some graph G, is the celebrated Lovász theta number of G, denoted by $\vartheta(G)$. This number was introduced by Lovász [2] in 1979 to solve a famous open problem, relating to a mathematical model of communication.

The Lovász theta number satisfies $\alpha(G) \leq \vartheta(G)$, i.e., $\vartheta(G)$ is an upper bound on the stability number of G. It can also be shown that $\vartheta(G)$ is at most the optimal value of the LP relaxation (4). Hence, the SDP relaxation (7) provides an upper bound on $\alpha(G)$ that is at most the LP bound.

Strengthening the SDP relaxation

While $\vartheta(G)$, see (7), already provides a stronger upper bound on $\alpha(G)$ than the LP relaxation (4), it may sometimes be useful to compute an even stronger upper bound on $\alpha(G)$.

The famous Lasserre hierarchy [1] presents a method for systematically strengthening any SDP relaxation. Roughly speaking, the idea is to form a relaxation with products of variables, and not only the variables themselves. We present this idea for SDP relaxations of the stable set problem. This presentation is similar to the presentation in the previous section, only more general.

Consider again a graph G, with vertex set $V = \{1,2,\ldots,n\}$ and edge set E. Let $x \in \{0,1\}^n$ be a vector feasible to (3). For any subset $\beta \subseteq \{1,2,\ldots,n\}$, define the product

$$x^\beta = \prod_{i\in\beta} x_i \text{ and } x^\beta = 1 \text{ if } \beta = \emptyset. \tag{8}$$

For example, if $\beta = \{2,3,5\}$, then $x^\beta = x_2x_3x_5$. In particular, if β is not a stable set in G, then not all vertices $i \in \beta$ can be included in the stable set corresponding to x. This means that at least one x_i, $i \in \beta$, equals 0 so that $x^\beta = 0$ whenever β is not a stable set in G.

Let $\mathcal{B} = \{\beta_1, \ldots, \beta_k\}$ be a collection of subsets of $\{1,\ldots,n\}$. For example,

$$\mathcal{B} = \{\{\emptyset\}, \{1\}, \{2,3\}\}. \tag{9}$$

Given such a $\mathcal{B}$, let $\mathbf{x}^\mathcal{B}$ be the vector with entries x^β, for $\beta \in \mathcal{B}$. For example, if $\mathcal{B}$ is as in (9), then

$$\mathbf{x}^\mathcal{B} = \begin{bmatrix} x^\emptyset \\ x^{\{1\}} \\ x^{\{2,3\}} \end{bmatrix} = \begin{bmatrix} 1 \\ x_1 \\ x_2x_3 \end{bmatrix} \in \{0,1\}^3.$$

Consider the symmetric matrix

$$M = \mathbf{x}^\mathcal{B} \left(\mathbf{x}^\mathcal{B}\right)^\top \in \mathbb{S}^{|\mathcal{B}|}. \tag{10}$$

Matrix M is of the same form as matrix Z in the previous section. Thus, it can be shown in a similar manner, see (5), that also $M \succeq 0$. We index the rows and columns of M with the elements of $\mathcal{B}$. That is, we do not speak of the first and third rows of M, but rather row β, and row γ for $\beta, \gamma \in \mathcal{B}$. The entries of M then satisfy

$$\begin{aligned} M_{\beta,\gamma} = x^\beta x^\gamma &= \prod_{i\in\beta} x_i \prod_{i\in\gamma} x_i \\ &= \prod_{i\in\beta\setminus\gamma} x_i \prod_{i\in\beta\cap\gamma} x_i^2 \prod_{i\in\gamma\setminus\beta} x_i \\ &= \prod_{i\in\beta\cup\gamma} x_i = x^{\beta\cup\gamma}. \end{aligned} \tag{11}$$

For the second equality in (11), we have used (8). For the third equality in (11), we have used that $x_i^2 = x_i$, since $x_i \in \{0,1\}$. Thus, the matrix entries $M_{\beta,\gamma}$ and $M_{\delta,\lambda}$ are equal if $\beta\cup\gamma = \delta\cup\lambda$. Later, we use these linear equalities as constraints in the SDP relaxation.

From here on, we consider only collections $\mathcal{B}$ that satisfy $\{\emptyset\} \in \mathcal{B}$ and $\{i\} \in \mathcal{B}$ for all $i \in \{1,\ldots,n\}$. Then matrix M, see (10), contains the entries $M_{\emptyset,\emptyset} = x^\emptyset x^\emptyset = 1$, and

$$M_{\emptyset,i} = x^\emptyset x^{\{i\}} = x_i,$$

so that $\sum_{1\leq i\leq n} M_{\emptyset,i} = \mathbf{1}^\top x$. Note that $\mathbf{1}^\top x$ equals the size of the stable set corresponding to x, which we would like to maximize.

We collect all previously derived properties of M, and add them as constraints in the following program:

$$\begin{aligned} \max_{x\in\{0,1\}^n,\, M\in\mathbb{S}^{|\mathcal{B}|}} & \sum_{1\leq i\leq n} M_{\emptyset,i} \quad \text{s.t.} \\ & \forall \beta,\, \gamma,\, \delta,\, \lambda \in \mathcal{B}: \\ & M_{\beta,\gamma} = 0 \text{ if } \beta\cup\gamma \text{ is not stable in } G \\ & M_{\beta,\gamma} = M_{\delta,\lambda} \text{ if } \beta\cup\gamma = \delta\cup\lambda \\ & M \succeq 0,\; M_{\emptyset,\emptyset} = 1,\; M = \mathbf{x}^\mathcal{B}(\mathbf{x}^\mathcal{B})^\top, \end{aligned} \tag{12}$$

that has $\alpha(G)$ as its optimal value.

Note that program (12) contains redundant constraints, similar to (6). In particular, $M_{\beta,\gamma} = M_{\delta,\lambda}$ is implied by $M = \mathbf{x}^{\mathcal{B}}(\mathbf{x}^{\mathcal{B}})^\top$. To obtain an SDP relaxation, we remove the nonlinear constraint $M = \mathbf{x}^{\mathcal{B}}(\mathbf{x}^{\mathcal{B}})^\top$, and the integer variables $x \in \{0,1\}^n$ from (12). The constraints on M are then no longer redundant, but they do help to strengthen the relaxation. This relaxation is thus given by

$$\begin{aligned} &\max_{M \in \mathbb{S}^{|\mathcal{B}|}} \sum_{1 \le i \le n} M_{\emptyset,i} \quad \text{s.t.} \\ &\forall \beta,\, \gamma,\, \delta,\, \lambda \in \mathcal{B}: \\ &M_{\beta,\gamma} = 0 \text{ if } \beta \cup \gamma \text{ is not stable in } G \\ &M_{\beta,\gamma} = M_{\delta,\lambda} \text{ if } \beta \cup \gamma = \delta \cup \lambda \\ &M \succeq 0,\, M_{\emptyset,\emptyset} = 1. \end{aligned} \tag{13}$$

If we pick $\mathcal{B} = \{\{\emptyset\}, \{1\}, \ldots, \{n\}\}$, then the relaxation (13) coincides with $\vartheta(G)$, see (7). Generally, larger collections $\mathcal{B}$ correspond to stronger relaxations, that also require more computation time to solve. That is, the size of $\mathcal{B}$ offers a trade-off between relaxation strength and computation time.

Our research

In our paper [4], with professors Sotirov and Vera, we research methods for selecting a 'good' collection $\mathcal{B}$, and methods for solving the SDP (13).

What is a 'good' collection $\mathcal{B}$? If one picks $\mathcal{B}$ as the collection of all subsets of $\{1, \ldots, n\}$, then the relaxation is exact, i.e., always returns the value $\alpha(G)$. This is a desirable property, but due to the large size of $\mathcal{B}$, the relaxation is no longer efficiently solvable. Thus, we would like to select a collection $\mathcal{B}$ that provides the best bound among all collections $\mathcal{B}$ that contain at most, say 2500 subsets. We find that we can use an optimal solution of (7) to guide this selection of $\mathcal{B}$.

Now, given such a $\mathcal{B}$ of size 2500, solving the SDP relaxation (13) is non-trivial due to the large amounts of equality constraints. In fact, even constructing the SDP requires delicate bookkeeping. We show that one particular SDP solution method, known as the alternating direction method of multipliers (ADMM) is well-suited for solving (13). The ADMM involves dividing the feasible set of (13) in two subsets $\mathcal{F}_1$ and $\mathcal{F}_2$, such that the feasible set is given by the union $\mathcal{F}_1 \cup \mathcal{F}_2$. Then, roughly speaking, the ADMM is to start with an initial guess of an optimal SDP solution to (13), and iteratively project this initial guess onto the sets $\mathcal{F}_1$ and $\mathcal{F}_2$. This defines a sequence of matrices, and under some mild assumptions, the sequence converges to an optimal solution of (13).

We implement the ADMM in Matlab, and run the resulting algorithm on many different graphs from the literature to compute strong bounds on $\alpha(G)$. We also compare our approach with another recent SDP based approach to the stable set problem [3]. As is often the case with comparing numerical methods, we are better on some graphs, but [3] is better on others.

Lennart Sinjorgo

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Greetings from Québec City

written by **Ralph Oomen**

Bonjour from the land of poutine, maple syrup, and ice hockey! I am currently on my exchange in Québec City at Université Laval as part of my Master's. It has been an incredible experience so far, filled with many great adventures. At Université Laval, almost 47,000 people study either as full-time students or in graduate programs. It is much more common here to do a Master's when you are already working full-time, so the average age in the classroom is around 30.

With approximately 1.8 km2, the campus is a lot bigger than what I am used to in Tilburg. On campus, we have a gym, two ice skating rinks, a basketball court, an Olympian swimming pool, a stadium for American football, a running track, and much more :) – all these facilities can be used for only €40 for four months! There are four residences for students to stay in; I stay in the largest of the four and share the residence with approximately 1,000 other students. The rooms are about 10 m2 and have their own bathroom sink and fridge. Bathrooms are shared per floor, with about 20 people living on each. We share one big kitchen, where everyone has a locker for stuff such as pans and utensils. You can imagine that it is quite hectic in the evening during dinner hours ;). Next to this, we have many shared areas with TVs, chessboards, and ping pong and pool tables. As you might know, it can become cold here in the winter (like -20 °C). Therefore, we have 5 km of heated underground tunnels connecting all campus buildings, such that we can keep on walking in our shorts and slippers. Luckily, the weather has been great so far with almost no rain.

The city of Québec, with the rest of the province, is French-speaking due to its long history of French colonization. You can really see the European influence in Old Québec (the city centre), although I find the architecture to be more Irish than French (whoops). Château Frontenac, an astonishing hotel in Old Québec, is the most photographed hotel in the world. Outside of the city centre, you can really see the North American influence of wide roads with houses far away from the street and the classic, slightly elevated porch. The Canadians are very proud of their country and heritage, which is noticeable in everyday life such as the abundance of Canadian flags and the frequent playing of the national anthem. It is not an arrogant kind of pride; people are very welcoming and open. People are generally very polite and grateful. In facial expressions and openness, Québec and Tilburg are polar opposites as people just look happy here. As my French is almost non-existent, I sometimes need to use broken sentences to communicate, but luckily most people also speak English.

Remarkably enough, most of my time is not spent studying. The courses are interesting, but definitely require a lot less effort than back at Tilburg, which leaves plenty of time to explore and enjoy my time here. I have made many friends already, but I do most of the fun things with a group of 8 Dutch and Belgian people. We go clubbing each Wednesday to a club called Shaker near the university, and sometimes go to the city centre on weekends. We have done a silent dinner, gone on hikes, attended sports matches like American football and ice hockey and just played board games. Early in September, we went to a cosy Airbnb in a national park close

to Québec, where we did some hikes, barbecued and enjoyed the hot tub. Two weeks later, we went to Toronto for five days, explored the city and took a day trip to the most amazing Niagara Falls. When writing this, I just came back from four days of New York and will leave in ten days for a trip around the West Coast of Canada with two of the Belgian guys. But before that trip will happen, I first need to take some midterm exams and finish some projects. As you can read, I am spending my time here well, maybe a little too well haha.

All in all, my exchange experience so far has been an amazing mix of adventure, trips and a little studying. A perfect balance in my opinion ;). I would highly recommend coming here sometime – making a trip around the East Coast of Canada – to enjoy a great mix of nature, friendly people, beautiful cities, and a relaxed atmosphere in general. ●

The Cost of Cutting Connections

In politics, "funding cuts" often sound neat and rational, a quick fix for a budget shortage. However, as students or faculty members in Econometrics and Operations Research, we know that systems rarely respond so simply. This fall, as the Schoof cabinet is in its last phase, one of its most striking policy moves has been a deep reduction in funding for international cooperation, particularly for NGOs that operate abroad.

Under the new plans, government support for development organizations will fall from around €1.4 billion today to roughly 0.5 billion over the coming years. Some programs, which are long praised for promoting education, healthcare, and climate resilience in low-income countries, will disappear altogether. These changes are framed as pragmatic: tightening the belt, focusing on "Dutch interests first." Yet what looks like saving money on paper may prove a costly simplification of a complex global system.

Dutch NGOs have acted as the connective tissue between policy, research, and practice. They channel not just money, but also knowledge and legitimacy, by linking universities, businesses, and local communities worldwide. Many of the sustainability, agricultural, and health innovations that Dutch firms later commercialized began life in aid-supported partnerships. When that network shrinks, so does the feedback loop that keeps the Netherlands plugged into the global economy.

From an Econometrics perspective, these links have measurable returns. Studies, including an evaluation by the Dutch Policy and Operations Evaluation Department (IOB, 2014), show that every euro spent on well-managed development cooperation tends to boost trade, innovation, and stability. This is mainly due to the fact that aid often opens markets, lowers transaction costs, and builds trust. Cut those ties, and you should expect lower export growth and fewer research collaborations down the line.

From an Operations Research angle, NGOs not only act when responding to crises, they also act as a preparedness network. These organizations are early-warning nodes, spotting droughts, food shortages or health risks long before they appear on government dashboards. They provide the kind of preventive maintenance that keeps the system stable: a relatively small, continuous investment that avoids far larger costs later. When NGOs lose funding, that preparedness layer disappears. Crises that could have been contained early turn into expensive emergencies, demanding far more external resources. Cutting NGO funding may look efficient in the short run, but it removes flexibility, one of main ingredients of robustness in any system.
The current argumentation is that private actors can fill the gap. But even the best-intentioned companies rarely invest where profit margins are uncertain or political risks are high, precisely where NGOs operate.

For students of econometrics and OR, this moment is more than a policy debate; it is a living case of system dynamics. How do incentives shift when intermediary organizations disappear? What feedback loops weaken? What equilibrium does the system move toward?

The next Dutch government, whatever its composition, will soon face the decision of whether to continue down this path. Restoring targeted NGO funding would not just be an act of generosity; it would be an act of strategy. Supporting cooperation abroad strengthens resilience at home, in trade, research, and trust. ●

Joris Wagenaar

Dr. Joris Wagenaar is an Associate Professor at Tilburg University, affiliated with the Tilburg School of Economics and Management. His expertise lies in Operations Research and Business Analytics, with a research focus on logistics, transportation, and optimization models for complex supply chains. His work often addresses real-world challenges in sustainable and humanitarian logistics.

Quatsch!

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Quatsch?

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

Bram (*over Mariokart*)
"Mijn auto sloeg af"

Lina
"Noem eens een bekende Vine dan"

Sanne
"Dat zijn toch gewoon platen"

Sanne
"Mijn broer ging elke ochtend de vaat-wasser uitruimen"

Daan
"Dat doe je toch alleen op moederdag"

Hedser (*over de Nekst*)
"Deadlines zijn meer een streven, geen keiharde streep"

Theo
"Ik ben Theo en ik ben sjaars."

Rein
"Sneeuwwitje werd toch niet gekust door de prins maar door een dwerg?"

Kroesen
"Game theory is gewoon bedacht om phd's over te schrijven."

Puzzle Time

Ski Lift Logic

written by **Niels Hultermans**

A ski resort has six lifts, labelled A to F.
Each lift has:

1. a lift type
2. a slope type it serves
3. a capacity (number of people per chair or cabin)
4. a typical waiting time

In every category, each option is used exactly once. Use the clues to determine the full description of every lift.

Lift types (once each)

- Gondola
- 4-seater chairlift
- 6-seater chairlift
- T-bar
- Cable car
- Drag lift

Slope types (once each)

- Green slope
- Blue slope
- Red slope
- Black slope
- Fun Park
- Off-piste

Capacities (once each)

- 2 people
- 4 people
- 6 people
- 8 people
- 20 people
- 50 people

Waiting times (once each)

- 2 minutes
- 5 minutes
- 10 minutes
- 15 minutes
- 20 minutes
- 30 minutes

Logic clues

- Lift B is the Gondola, and it serves the Green slope.
- Lift E is the Cable car.
- There are exactly two chairlifts: a 4-seater and a 6-seater.
- These two chairlifts serve the Blue slope and the Red slope (one slope each).
- Lift A is one of the chairlifts.
- The Red slope is served by the 6-seater chairlift.
- Lift D does not serve the Green slope or the Blue slope.
- Lift C is the only lift that serves neither a coloured slope
- (Green, Blue, Red, Black) nor the Fun Park.
- Exactly one lift has a capacity of 2 people, and that lift serves the Off-piste route.
- The Off-piste lift has a waiting time of 5 minutes.
- One of the surface lifts (the T-bar or the Drag lift) serves the Off-piste route, and the other surface lift serves the Fun Park.
- Lift F's capacity is four times that of the Off-piste lift,
- and its queue is twice as long.
- The Cable car has both the largest capacity and the shortest waiting time of all the lifts.
- Skiers on the Green slope have the longest waiting time of all.
- The queue for the Blue slope is exactly 5 minutes longer than the queue for the Red slope.
- The T-bar serves the Off-piste route.

Lift	Type	Slope	Capacity	Queue
A				
B				
C				
D				
E				
F				

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

The solution can be found at www.Nekst-Online.nl.

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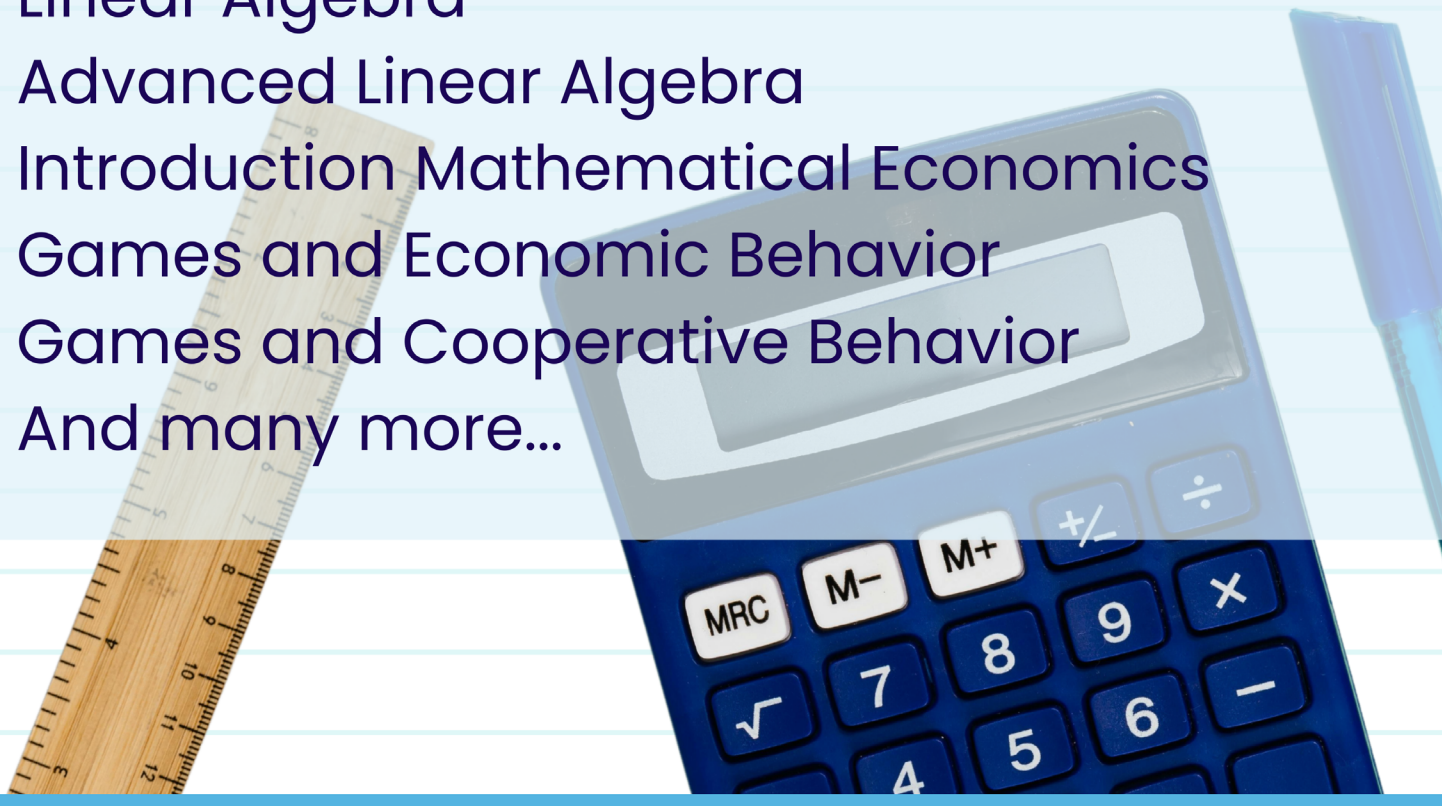

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Agenda

TUE **03** FEB
Constitution Drink
We will thank Wouter and Job for their efforts, through some fun presentations presented by their successors.

WED **04** FEB
Department Members Meeting
On this day, the semi-annual DMM will take place. The board will update you on the ins and outs of the past semester and discuss their plans for the upcoming semester.

THU **05** FEB
National Econometricians Day
On this day, commonly known as the LED (Landelijke Econometristen Dag), all students who study EOR in the Netherlands will come together for the largest annual career event. It is available for third years and higher and takes place in Nieuwegein.

MON **09** FEB
EOR Insights
During this event, some professors and PhD students will tell us more about the research they are currently doing. Join this event and get to see what our professors do besides giving lectures.

TUE **10** FEB
Male Female Activity
Boys and girls will once again be separated to do different activities, only to be reunited again later on during the drink. More information about the program will follow!

THU **12** FEB
Lunch Lecture
While enjoying free lunch, CBS will tell you everything about working at CBS as an econometrician.

TUE **24** FEB
Finance Expedition
On February 24, 25 and 26 the Finance Expedition takes place in cooperation with Asset | Financials. Get to know different companies in the field of finance. Transportation, food, and overnight stay are covered. Participation is based on CV selection.

TUE **03** MAR
Lunch Lecture
During this lunch lecture, Itility will tell you everything about how working as an econometrician looks like at their company.

WED **04** MAR
Econometricians for Society
The EfS committee will organize the second activity of the year to give something back to the society of Tilburg.

THU **05** MAR
Après Ski Drink
Join us in your favorite Après Ski outfit and find out about this year's Europe Trip location.

WED **11** MAR
Inhouse Day
We will visit Picnic and Bearingpoint. At each office, we will get a tour and presentation and learn more about their work field during a case.

TUE **17** MAR
Actuary Business Lunch
Get to know Oliver Wyman, Top Advisory, and De Nederlandsche Bank while enjoying a 2-course lunch.

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