

HOW LOW CAN WE GO?

SUSTAINABLE INSURANCE IN UNCERTAIN WORLD

 **AZN**
Agencija za zavarovalni nadzor
Insurance Supervision Agency

INSURANCE CONFERENCE, Ljubljana, 14. 6. 2021

The sixth annual conference organized by the Insurance Supervision Agency (AZN) has been successfully concluded. This year the conference was held in a hybrid way. Together with participants, we discussed the risks in insurance in a volatile financial climate, characterized by a long period of low interest rates. We explored how the insurance sector copes with the search for returns on high-risk investments and the transfer of imposed risks to policyholders. The issue of global changes in the environment that affect the frequency, magnitude and prevalence of natural disasters, including pandemics, was also addressed. Speakers also highlighted the opportunities and challenges for the insurance sector competing with an unpredictable nature. The event was attended by a number of distinguished speakers, their lecture summaries are presented below.

Za nami je že šesta letna konferenca organizirana s strani Agencije za zavarovalni nadzor (AZN). Konferenca je letos potekala na hibridni način. Na konferenci smo z udeleženci razpravljali o tveganjih v zavarovalništvu v negotovem finančnem ozračju, ki ga zaznamuje dolgotrajno obdobje nizkih obrestnih mer. Odgovorili smo si na vprašanje, kako se zavarovalniški sektor spoprijema z iskanjem donosov iz naložb z visokim tveganjem in prenosom naloženih tveganj na zavarovance. Udeleženci konference so obravnavali globalne spremembe v okolju, ki vplivajo na pogostost, velikost in razširjenost naravnih nesreč, vključno s pandemijami. Govorniki so razpravljali tudi o priložnostih in izzivih za zavarovalniški sektor v tekmi z nepredvidljivo naravo. Na dogodku je sodelovala vrsta uglednih govornikov, njihovi povzetki predavanja so predstavljeni v nadaljevanju.



8:30 Registration and business breakfast / *Registracija in poslovni zajtrk*

9.30 - 9.45 Welcome address / *Pozdravni nagovor*
Gorazd Čibej, MSc, Director of Insurance Supervision Agency, SI

9.45 - 10.00 Inaugural address / *Uvodni nagovor*
Andrej Šircelj, MSc, Minister of Finance of the Republic of Slovenia, SI

10.00 Section 1 / *Sklop 1*

Low Interest Rate Impact on the Sustainability of Pension Systems

Market and economic factors have a dramatic impact on the way in which insurance and pension companies operate. The most prominent factor being the current financial climate, which last year, was marked by a prolonged period of ultra - low interest rates. The overall financial climate has been further affected by the pandemic COVID-19 and all the uncertainties which have accompanied it. The insurance sector has been forced to seek returns from high risk investments and subsequently transfer investment risks to insurance policy holders. In these difficult and unprecedented times, the EIOPA prepared the Opinion on the 2020 Review of Solvency II, which is expected to be put forward by the European Commission as a legal proposal in the third quarter of 2021. The section will also touch on the issue of how some of the proposed changes respond to these new challenges.

Vpliv nizkih obrestnih mer na trajnost (vzdržnost) pokojninskih sistemov

Tržni in gospodarski dejavniki dramatično vplivajo na način delovanja zavarovalnic in pokojninskih družb. Najpomembnejši dejavnik je trenutno finančno ozračje, ki ga zaznamuje daljše obdobje izjemno nizkih obrestnih mer ter v zadnjem letu tudi pandemija COVID-19 in vse negotovosti, ki jo spremljajo. Zavarovalniški sektor zato išče višje donose v bolj tveganih naložbah ter prenaša naložbeno tveganje na imetnike zavarovalnih polic. V teh težkih časih brez primere je EIOPA objavila mnenje o reviziji Direktive Solventnost II, ki naj bi ga Evropska komisija kot pravni predlog predstavila v tretjem četrtletju 2021. Govorniki se bodo dotaknili tudi v mnenju predlaganih rešitev.

Karel Van Hulle, Prof. em. KU Leuven and Hon., Prof. Goethe University Frankfurt, Member of the PIOB, Member of the Board of the Bermuda Monetary Authority, BE

Andraž Rangus, PhD, Devison Director, Pension and Disability Insurance Institute of Slovenia, SI

Frank Genheimer, Managing Director, New insurance business GmbH, CH

Daniel Kempchen, Member of the board, SIGNAL IDUNA Insurance Ltd, DEZ

Cooperation of the academia with the insurance industry - An Example of Good Practice

The Faculty of Mathematics and Physics of the University of Ljubljana offers high quality study programs in mathematics and physics. Graduates of several programs in mathematics are on high demand in the financial sector. We will focus on these program and on master level. To ease the transition from the academia to the industry we introduced several forms of cooperation with industry, professional associations and regulators. I will present some of the concrete examples of cooperation.

Sodelovanje fakultete z zavarovalniško industrijo - Primer dobre prakse

Fakulteta za matematiko in fiziko Univerze v Ljubljani nudi kvalitetne študijske programe iz matematike in fizike. Poudarek bo na predstavitvi magistrskih študijskih programov in programih, ki izobražujejo kadre za finančni sektor gospodarstva. Za lažjo tranzicijo diplomantov v delovna okolja smo vpeljali več oblik sodelovanja z gospodarstvom, panožnimi združenji in regulatorji. V prispevku bom predstavil tudi nekatere od konkretnih oblik sodelovanja.

PhD **Tomaž Košir**, Faculty of Mathematics and Physics (FMF), University of Ljubljana, SI

12:00 Break / *Odmor*: 45 min

12:45 Panel discussion / *Panelna razprava*

Trends and Challenges / *Trendi in izzivi*

Moderator: Prof. **Karel van Hulle**

Marko Jazbec, Chairman of the Management Board, SAVA RE, d.d., SI

Boris Bajić, Chief Executive Officer, Adacta Fintech d.o.o., SI

Ante Žigman, PhD, President of the Board of Hanfa, HR

Dr **Manuela Zweimueller**, Head of Supervisory Practices, International Association of Insurance Supervisors, IAIS

14.00 Section 2 / *Sklop 2*

Can the Insurance Sector Compete with Nature?

The second part of the conference will address global changes in the environment and climate which will affect the frequency, size and distribution of natural disasters including pandemics. These changes require the insurance sector to take urgent action, other than just raising the premium. The speakers will discuss the opportunities and challenges for the insurance sector in their race against nature.

Ali lahko zavarovalniški sektor tekmuje z naravo?

Globalne spremembe v okolju vplivajo na pogostost, velikost in razširjenost naravnih nesreč, vključno s pandemijami. Te spremembe zahtevajo takojšnje ukrepanje zavarovalniškega sektorja, ki ni omejeno zgolj na dvig premije. Govorniki bodo razpravljali o možnostih in priložnostih za zavarovalniški sektor v tekmi z nepredvidljivo naravo.

Marko Jazbec, Chairman of the Management Board, SAVA RE, d.d., SI

Klime Poposki, PhD, Professor at the University of St. Kliment Ohridski, MK

Andrea M. Corcoran, Founder Align International, LLC, US

Rom Aviv, PhD, Managing Director and Head of Insurance, Agritask, IL

15:30 End of the Conference / *Konec konference*

The Organisers of the event can modify and improve this program without prior notice. Any changes to the programme will be published on the event website. The conference is free of charge. The conference will take into account and ensure all the necessary measures to prevent infections and safeguard your health.

Organizatorji dogodka si pridržujejo pravico do sprememb in izboljšav v programu brez predhodnega obvestila. Kakršnekoli spremembe programa bodo objavljene na spletni strani. Konferenca je brezplačna. Konferenca bo potekala ob upoštevanju vseh potrebnih ukrepov za preprečevanje okužb, za vašo varnost bo ustrezno poskrbljeno.



Karel Van Hulle, Prof. em. KU Leuven and Hon., Prof. Goethe University Frankfurt, Member of the PIOB, Member of the Board of the Bermuda Monetary Authority, BE

PENSION CHALLENGE IN A LOW INTEREST RATE ENVIRONMENT

Providing an adequate and sustainable pension after retirement is a huge challenge. It requires a multi-pillar approach, whereby the different pillars mutually reinforce each other. Low interest rates affect each of the three pillars. They make long-term pension products less attractive for consumers. Many insurers therefore no longer offer long-term pension products. The Solvency II review should be used to make the solvency regime more fit for purpose by incentivising insurers to offer more long-term pension products. This should help to reduce the pension protection gap.

Andrea M. Corcoran, Founder Align International, LLC, US

CAN US P&C INSURERS BE PART OF A PROACTIVE PROGRAM TO COMBAT INFRA-STRUCTURE DECAY AND INCREASINGLY ADVERSE CLIMATE SYMPTOMS IF US POLICY MAKERS HELP THEM?

This presentation, from a US capital market's specialist's perspective, will set forth information on the complex US system. It will also pose questions to ask and proposals to consider on how to reinforce the virtuous circle of public-private partnership between insurers and governments. Can a more central strategy be designed whereby the public sector (i) reinforces the viability and accessibility of private insurance (ii) leverages private insurers' capacity to finance risk mitigating infra-structure reducing social consequences to communities; and (iii) strengthens resilience by reinsuring the reinsurers.

Boris Bajič, Chief Executive Officer, Adacta Fintech d.o.o., SI

THERE IS NO CHALLENGE INSURANCE INDUSTRY CANNOT OVERCOME!

Insurance business, in one form or the other, has been present among us for hundreds of years. There have been numerous trends and challenges over that period and some of those very trends shaped the insurance industry and shaped it to its current form. Products we have and concepts we follow are nothing but a reflection of the trends and challenges the industry faced in the previous years.

Low-interest rates have been here for some time and could have material implications for the profitability and the solvency of many insurers. While the impact of low-interest rates is likely to differ across insurance companies depending on their business model, the entire industry must find a way to soften the blow.

The first thing that comes to mind is a set of new, innovative products without too many strings attached to traditional investments. The second is asset allocation towards higher-yielding but often much riskier assets. On the other hand, the industry also needs to recalibrate their risk appetite and get proper support from the regulators especially when it comes to various investment-related constraints.

To help the decision-makers determine the need for and profitability of a certain product or if a certain asset will make a good addition to their investment portfolio, insurers need a lot of data and strong analytics. Unfortunately, many insurers are known to struggle with data management in relation to their risk management and investment portfolios. Whether they decide to restructure their offering or to rethink their investment strategy, insurers need strong technology to steer them towards the right direction.

And while modern insurance platforms can't turn the curve, they can help insurers make strategic decisions and give them the power and flexibility to act on them. Accessible data is only one of the benefits of modern platforms. Insurers across the world are starting to recognize the real value of standard insurance platforms: swift and simple legacy migration, faster time to market for new products, and even building their own ecosystems to support new, bold strategies for the 21st century.

The truth and perhaps the main takeaway is — there is no challenge the insurance industry can't overcome, especially if it relies on the right technology stack.

Frank Genheimer, Managing Director, New insurance business GmbH, CH

«#plaintext on life insurance»

Frank will speak in his talk «#plaintext on life insurance» about the major hurdles in the inevitable transformation of the industry and about (his) hope that this transformation will take place, and that it will happen for good. In his anthem on life insurance, he talks about innovative products, new services and a fundamentally different approach to customer engagement. At the end, he answers the question «How long can we go?» in his very own way.

Marko Jazbec, Chairman of the Management Board, SAVA RE, d.d., SI

CAN THE INSURANCE SECTOR COMPETE WITH NATURE?

The humanity is currently still on a path towards „too little, too late“ on global warming issues. Climate change is a major threat to the global economy and society as a whole, much threatening than pandemic risks. Insurability is a key topic in a warming world with a chance of some risks or regions becoming uninsurable where premiums become unaffordable.

Insurance industry responses should go towards resilience, mitigation and adaptation. Sava Insurance Group is exposed to natural disasters, mainly floods and earthquakes. Sustainability agenda in Sava Insurance Group is becoming a key strategic pillar for the future.



Tomaž Košir, PhD, Faculty of Mathematics and Physics (FMF), University of Ljubljana, SI

COOPERATION OF THE ACADEMIA WITH THE INSURANCE INDUSTRY - AN EXAMPLE OF GOOD PRACTICE

The Faculty of Mathematics and Physics of the University of Ljubljana offers high quality study programs in mathematics and physics. Graduates of several programs in mathematics are on high demand in the financial sector. We will focus on these program and on master level. To ease the transition from the academia to the industry we introduced several forms of cooperation with industry, professional associations and regulators. I will present some of the concrete examples of cooperation.

Andraž Rangus, PhD, Devison Director, Pension and Disability Insurance Institute of Slovenia, SI

INTER-GENERATIONAL (IN) EQUALITY

Pension insurance is one of the basic social sub-systems that should provide adequate income to all individuals who, due to age or inability to work in the labour market, can no longer perform gainful activities. An efficient pension system in its function thus represents a fundamental precondition for ensuring social peace in society as well as a condition for intergenerational coexistence of all generations. Each socio - economic and demographic situation dictates the constant adaptation of the system to the new realities. These adaptations require also an effective intergenerational dialogue in the society. The basic precondition for an effective intergenerational dialogue, which ultimately leads to the conclusion of an intergenerational agreement, is that the changes to be made to the system in the end guarantee a fair, transparent and financially balanced pension system. Such a system should treat each generation equally from the point of view of rights and should not financially overburden only one of the generations.

Ante Žigman, PhD, President of the Board of Hanfa, HR

TRENDS AND CHALLENGES

The current low and negative interest rate environment poses a significant risk for the long-term financial viability of pension funds, as they will barely be able of generating positive returns with simple and conservative strategies which imply generating sufficient returns to meet obligations to policy holders. This encourages pension funds to become involved in the "search for yield" in order to match the level of returns promised to their policy holders when interest rates were higher; this poses a risk, including insolvency, even during the pre-COVID-19 time.

In addition to confronting the challenge of aging populations, pension funds should strengthen the ability of the pension system to absorb shocks, and to avoid the potential outbreak of on-going COVID-19 crisis.

If interest rates remain low into the future, pension funds may find their assets insufficient to meet their commitments, unless they adjust their pension or payment obligations.

To reduce insolvency risks, pension plan sponsors could adjust or terminate the existing plans and offer less attractive terms to new clients, whereas the defined benefit pension plan, sponsors could increase contributions to the funds. Accordingly, supervisory authorities and pension policy makers should pay special attention to preventing excessive "search for yield" by the pension funds. Therefore, an environment of long-term low returns will necessitate a new appraisal of pension goals, as well as the saving levels and contributions to match those goals.

It is important to emphasise that policy holders can increase their pension income either by saving more or by investing. Post-retirement income can also be promoted up by investing more heavily in human capital (education, long-term employability). This might provide the policy holders with additional opportunities for setting aside extra money for retirement; moreover, they could then continue working longer and thus save more retirement income.

Failure to mitigate climate change today is identified as one of the most significant risks in terms of potential worldwide impact. The risks associated with extreme weather, climate change and natural disasters account for three out of the five largest risks by frequency, while the same risks, along with the water crisis risk, account for four out of the five largest risks by damage intensity. If extreme weather conditions continue, the insurers may find it increasingly difficult to find a balance between ensuring affordability and availability of their products and managing financial stability.

Insurance undertakings can influence climate change in two ways - either by complementing their products with measures targeting resilience to climate change risks, or through sustainable (green) investments. In order to enhance resilience to climate change risks, it is important to establish cooperation between public and private sectors.

In addition, some insurers may offer services and products to policyholders who are not directly related to insurance business, but those that may assist in building knowledge and methodologies for climate change risk assessment. For example, through providing advisory services on preventive measures that policyholders can undertake in relation to the risks caused by climate change.

Rom Aviv, PhD, Managing Director and Head of Insurance, Agritask, IL

CAN INSURANCE COMPETE WITH NATURE?

The Insurance Industry was formed to protect individuals, communities, and businesses from nature's devastating implications. However, with Climate Change and population growth the consequences of natural disasters are not what they used to be centuries or even decades ago. The presentation will focus on how the market of Insurance-Linked Securities is utilized by the Insurance Industry to financially cope with natural hazards and close the Protection Gap. We will also outline more generic paradigms including Public and Private Partnerships, embedding insurance into commoditized products, etc.





Daniel Kempchen, Member of the board, SIGNAL IDUNA Insurance Ltd, DE

IMPACT OF LOW INTEREST RATES ON LIFE INSURANCE PRODUCT STRATEGY

Low interest rate guarantees embedded in classic life and pension policies make these products unattractive for the clients. As yield of life insurers are continuing to tumble in this persistently ultra low interest rate environment, insurers are more and more under pressure to meet guarantee obligations from old classic products which imposes cost and solvency burdens.

Therefore, life insurers must adopt their product strategy towards capital market products, preferably without guarantees as well as to products based on biometric risks.

Generating a lot of unit linked business can help to compensate losses in contribution margin from classic life and pension insurance portfolios that are in run-off and where insurers have to build costly reserves to meet guarantee promises made to their clients.

However, when transferring the risk to the policyholder, focus must be put on risk diversification in order to provide the client with sustainable investment solutions, especially in times of uncertain financial climate.

The global portfolio approach of SIGNAL IDUNA Hungary delivers an example of how an insurer is trying to diversify client's investment risk while offering an attractive return potential. The investment fund is constructed is mirroring the composition of the global capital market (equities, bonds). As clients enter Unit Linked policies normally as a long term investment, following the development of the entire global capital market can be a well diversified solution especially in an uncertain environment rather than following currently well performing industries.

Through ETFs the insurer follows a relatively low cost passive investment strategy.

The presentation ends with sharing some information on the impact of COVID-19 on unit linked lapses and new business with the example of SIGNAL IDUNA Hungary. Until May 2021, the insurer has not experienced an increase in lapses or waiver of premium and New Business is flowing in at pre-COVID levels.

Klume Poposki, PhD, University St. Kliment Ohridski, Insurance department, Ohrid, MK

INSURANCE AGAINST EARTHQUAKE RISKS

Earthquakes are one of the most destructive natural perils and can lead to severe economic, social and environmental impacts. Economic losses (both direct and indirect) due to earthquakes since 1900 have occurred in over 154 nations, accounted for 6 of the 10 largest natural catastrophe events since 1980 in terms of overall losses. The average earthquake since 1980 has caused just over 2x more in economic losses than the average climate-related disaster (i.e. USD 9.85 billion vs. USD 4.77 billion). Earthquakes tend to be "tail dependent" due to their potential to trigger secondary perils, such as tsunami and fire (i.e. the low frequency high-impact earthquake "tail" event becomes an even higher-impact tail event as a result of the damages caused by secondary perils). Earthquake risk is also particularly "fat tailed" meaning low probability events have the potential to cause extreme losses. There is also recent evidence that the occurrence of large earthquake events could increase the probability of future events.

The region of the South Eastern Europe is significantly exposed to natural disasters, especially earthquakes and floods. The recent earthquake in Croatia caused economic losses over 16 billion EUR. The cat models for Romania shows in the case of an earthquake with intensity between 7 and 8 degrees, the economic damages to residential buildings might reach up to 8% of Romania's GDP. In the case of a major earthquake with a 250 mean return period the loss to the Macedonian economy will be 11% of the GDP.

Insurance can make an important contribution to managing the financial impacts of earthquake risk, although the insurability of earthquake losses faces a number of challenges. The aim of the presentation is to give an overview of current insurance systems for earthquake risk that exists. An emphasis will be given to the role of insurance in mitigating financial consequences of catastrophic earthquakes as integrated part of disaster risk reduction. In particular, challenges related to low-probability high-consequence risk characteristics will be discussed. Various insurance and reinsurance models that have been developed and applied in different academic fields will be described.

Earthquake losses (along with flood losses) are the least insured among disaster perils. Since 2000, approximately 85% of reported earthquake losses have been uninsured although there has been some improvement in the level of insurance coverage over time.

Underinsurance of earthquake risks is a global challenge. Closing the gap will require specific measures by insurers and governments to change buying behaviour and market structures. Insurers can better design customised products for the most underinsured groups. Governments play an important role in setting standards for risk mitigation, established government-backed insurance programs or multi-country insurance funds. They can further extend the reach of risk transfer solutions by introducing compulsory insurance schemes to create a sufficiently large risk community or by using insurance principles to prepare disaster recovery plans.



Dr Manuela Zweimueller, Head of Supervisory Practices, International Association of Insurance Supervisors, IAIS

SUPERVISORY PERSPECTIVE: COVID-19 IMPACT ON THE GLOBAL INSURANCE SECTOR

The recent IAIS 2020 Global Insurance Market Report (GIMAR) shows that the global insurance industry has remained both operationally and financially resilient to the shocks triggered by Covid-19, yet uncertainties remain for the future outlook.

The most significant prudential impact on the insurance sector was on solvency and profitability, primarily through losses on the asset side, mainly driven by the decline in value and/or holdings of the equity portfolio. Nevertheless, solvency ratios generally remained well above jurisdictional requirements. On the liability side, the results vary greatly, depending on the business model. In terms of liquidity, the data suggest that the impact has been limited, supported by unprecedented monetary policy, raising no immediate concern on the sector's ability to fulfil obligations at this point.

As mitigating measures regarding profitability, some insurers have temporarily discontinued the underwriting of new life insurance policies due to the low interest rate environment or made adjustments to their pricing (especially for savings products where the crediting rate is based on the current interest rate environment).

Future IAIS monitoring will focus on key vulnerabilities, which may include amongst others the impact of the deepening of the low-yield environment on life insurers, particularly those writing long-term guaranteed products. Further deepening of the interest rates in many jurisdictions as a result of the monetary policy has direct effects on insurers: For instance through profitability strains, however, also has indirect effects from associated management actions, such as potentially reaching for yield and changing business models by altering life insurance product offerings and transferring (parts of) the (re)insurance business.

Furthermore, with the initiating debate on inflation risks, the IAIS is also monitoring any consequences of a reversal of the low-yield environment.

PROTECTION GAPS: MAINTAINING ECONOMIC RESILIENCE

The Swiss Re Sigma Resilience Index for 2020 announced that "COVID-19 set to widen the world's protection gap". Insurance resilience weakened already in 2019, pushing the combined insurance protection gap for mortality, health and natural disaster risks to a new high, reaching USD 1.24 trillion in 2019, with health and mortality exposures accounting for more than 80% of the total.

Economic resilience can only be maintained when protection gaps, including for pandemic risk, are plugged. Finding solutions will be a complex task, requiring leadership and a multi-stakeholder approach, and recognising the importance of achieving social solidarity. The IAIS is actively engaged in how supervisors can contribute to this, in collaboration with industry initiatives.

In addition to our long-standing work with the Access to Insurance Initiative (A2ii) on resilience to natural catastrophes and security in old age, the IAIS has more recently also started to address the protection gap for pandemic risk. The latter is currently focused on a stocktake of initiatives underway in various regions – together with key supervisory considerations in this regard. The IAIS is in a unique position to draw comparisons and identify key issues for supervisors to consider.

SUSTAINABLE INSURANCE: ROLE OF REGULATORS IN CREATING AN ENABLING ENVIRONMENT

The IAIS is committed to supporting the development of inclusive insurance markets. Regulators and supervisors are key in providing an enabling environment to support this growth. A large part in this respect is about helping to ensure continued financial stability – this is a necessary condition, but it is not sufficient. At the same time, insurance supervisors are essential for a proportionate and appropriate regulatory environment, such that it is supportive of innovation and the societal role that the insurance sector will need to play in steering the broader economy to a more sustainable future.

In addition to addressing critical challenges such as climate, pandemic risk and conduct risk, the IAIS also provides assistance and practical guidance to help with the fundamental building blocks that are essential for effective insurance supervision, such as risk-based solvency regimes. Such regimes are integral for protecting policyholders, maintaining financial stability and supporting market development.

Recently, the IAIS Financial Inclusion Forum (FIF) was established with a particular focus on peer-to-peer exchange to share experiences and provide international guidance on tackling financial inclusion, trends and lessons learnt. Later this year the exchange will target inclusive insurance data, financial education and understanding customers' needs.

The IAIS will also continue to work collaboratively with our colleagues in the other international standard-setting bodies and with our broad range of stakeholders on these important topics.



Fibonacci's golden spiral - the relationship between mathematics and nature

Fibonacci's golden spiral - the relationship between mathematics and nature

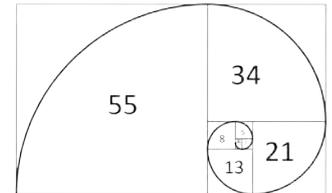
They are found everywhere in the natural world: from leaf arrangements in plants to the pattern of flower petals, the scales of a pine cone, or the double helix of our DNA. The Fibonacci numbers are applicable to the growth of every living thing: a single cell, a grain of wheat, a beehive, all of mankind. From sunflowers to seashells, the same recurrent mathematical pattern can be observed in nature again, and again, and again ...

Najdemo jih povsod v naravi: od razporeditve listov na rastlinah in cvetnih lističev, pa do lusk na storžu in dvojne vijajnice naše DNK. Fibonaccijeva števila so povezana z rastjo vsega življa: posamezne celice, zrna žita, čebelnjaka, celotnega človeštva. Naj gre za sončnice ali školjke, isti vzorec se v naravi ponavlja spet in spet in spet ...



The 13th century Italian mathematician Leonardo Pisano Fibonacci made advancements in business mathematics and expanded the knowledge of Greek mathematicians. The example of rabbit growth in his Liber Abaci (Book of Calculations) was the origin of the Fibonacci sequence, where each following element is the sum of the last two elements. The sequence usually starts with numbers 1 and 1. For the next Fibonacci number, we add up the preceding two, giving us the Fibonacci sequence: 1, 1, 2, 3, 5, 8, 13, 21, ... The Fibonacci spiral is constructed by drawing arcs which connect the opposite corners of squares arranged in a Fibonacci sequence. The ratio between two consecutive numbers converges to the golden ratio (Phi).

Leonardo Pisano Fibonacci, italijanski matematik iz 13. stoletja, je izboljšal metode računanja v poslovni matematiki in razširil obstoječe znanje starogrških matematikov. Iz njegovega dela Knjiga o abaku (Računska knjiga) je preko problema o kuncih znano njegovo Fibonaccijevo zaporedje, pri katerem je vsak naslednji člen vsota zadnjih dveh členov. Zaporedje začnemo z dvema številoma, običajno 1 in 1. Naslednje Fibonaccijevo število dobimo, če seštejemo predhodni, kar nam da Fibonaccijevo zaporedje 1, 1, 2, 3, 5, 8, 13, 21 ... Fibonaccijeva spirala je tvorjena z risanjem lokov, ki povezujejo nasprotni oglišči kvadratov v Fibonaccijevem zaporedju. Količnik dveh zaporednih števil konvergira k zlatemu rezu (F).



Where do we go from here?

