2 FINANCIAL AND ECONOMIC REVIEW

June 2023
Vol. 22 Issue 2

Financial and Economic Review

Scientific journal of the Magyar Nemzeti Bank

Publisher: Magyar Nemzeti Bank
Publisher-in-Charge: ESZTER HERGÁR
H-1013 Budapest, Krisztina körút 55.
https://en-hitelintezetiszemle.mnb.hu/
ISSN 2415–9271 (Print)
ISSN 2415–928X (Online)

Cover design: MARIANNA IZSÓNÉ BIGAI

2 FINANCIAL AND ECONOMIC REVIEW

June 2023
Vol. 22 Issue 2

FINANCIAL AND ECONOMIC REVIEW

The address of the Editorial Office: H-1013 Budapest, Krisztina körút 55.

Phone: +36-1-428-2600

Fax: +36-1-429-8000

Homepage: https://en-hitelintezetiszemle.mnb.hu/

Editorial Staff:

Dániel Palotai Editor-in-Chief: szemle@hitelintezetiszemle.hu

Endre Morvay Editor-in-Charge: morvaye@mnb.hu

Published regularly every three months.
HU ISSN 2415–9271 (Print)
HU ISSN 2415–928X (Online)

Page setting and printing:
Prospektus Kft.
H-8200 Veszprém, Tartu u. 6.

Contents

Vol. 22 Issue 2, June 2023

OUR VISION

STUDIES

ESSAY

FEATURE ARTICLES

BOOK REVIEW

CONFERENCE REPORTS

Globalisation versus Deglobalisation*

Péter Halmai

One of the biggest questions in recent years concerns the future of globalisation. Some argue that the rivalry between the USA and China, certain trade policy restrictions and the repercussions of the coronavirus pandemic that threatened global production and supply chains could mean the end of globalisation. In fact, however, we are witnessing a fundamental transformation of the globalised world economy. Identifying the main directions of change is a crucial task for economists as well as a precondition for prudent economic policy action.

Journal of Economic Literature (JEL) codes: F02, F10, F15, F20, F42, F51, F60, F62, F68

Keywords: global and regional integration, deglobalisation, protectionism, outsourcing, global value chains (GVC), fragmentation, productivity spillover, intangible assets, "elephant curve"

1. The essence of globalisation: global and regional integration

Globalisation is a far-reaching process that affects the whole world. It is driven by the emergence of the global economy. It is also a long, complex historical process, the dominant dimension of which is global integration. The latter aspect has primarily come to the fore over the more than seven decades that have passed since the Second World War and became a dominant trend in the second half of the 20th century.

The key features of globalisation are as follows:

• a rising share of international trade in GDP;

• increasing international financial flows;

• a rising share of FDI; growth in outsourcing and global value chains; migration;

• global flows of information, intangible assets and knowledge;

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Péter Halmai: Hungarian Academy of Sciences, ordinary member; Budapest University of Technology and Economics (BME), Professor of Economics; University of Public Service, Professor of Economics.
Email: halmai.peter@gtk.bme.hu; Halmai.Peter@uni-nke.hu

The essay was carried out within the framework of the program for research on the Post-Covid phenomena.

The first version of the Hungarian manuscript was received on 18 April 2023.

DOI: https://doi.org/10.33893/FER.22.2.5

- the elimination of political and administrative barriers to trade and investments;
- the establishment of international organisations and regulation; calls for global governance;
- political, cultural and environmental factors, effects, correlations and growing interdependence[1] in the world economy.

Globalisation is an all-encompassing process. It involves the integration of national and regional economies, and societies and cultures through the global network of trade, finance, communication, migration and transportation.

With regard to its position and progress, globalisation can be measured and assessed in terms of its main elements. Indicators of internationalisation – such as international trade, FDI, migration, the appearance of international organisations and the development of international communications (e.g. satellite television, submarine cables, intercontinental mobile links) – provide quantifiable evidence of the evolution of these processes. They offer a chance to identify and assess new developments.

The internet and the opportunities it offers have become symbols of globalisation. Liberalisation, involving free trade, privatisation and deregulation, has a similar trajectory and effects. Nevertheless, a heated debate surrounds the so-called neoliberal approaches to globalisation. To a great degree, the assumed and actual consequences of these developments determine the positive or negative opinion of globalisation held by individual players and observers.

Global integration has been a dominant, new phenomenon in the global economy in recent decades (for more information, see *Palánkai et al. 2011*). In today's global economy, *integration processes* can be observed *at both the regional and global level.* In a general sense, integration means *unification* and *incorporation.* However, the individual components do not lose their characteristics in the process of integration.

The concept of globalisation is closely linked to the process of integration and transformation. Globalisation is a process that unifies previously fragmented markets into a broader system of relationships. Geographical and political constraints have less and less bearing on the allocation process. The movement of capital of is driven by returns, whereas the movement of people is driven by material advancement. This is facilitated by the rapid flows of knowledge and information. World-famous economist *Jagdish N. Bhagwati* defines globalisation as integration: globalisation is the integration of national economies into the international economy through the flows of trade, FDI, short-term capital flows, the international movement of people and the flow of technologies in general (*Bhagwati 2007* [*2004*]).

[1] It may, however, cause problems for some countries if these economic and technological interdependecies are structurally one-sided.

Global integration is basically market integration. Nevertheless, integration processes are consciously promoted by governments, international organisations and the business sector. The effects and correlations of integration processes also affect almost all other aspects of social life. One important aspect of globalisation is the elimination of the borders splintering the world. This increasingly allows people to connect to each other, in a physical, legal, linguistic, cultural or emotional sense, wherever they are on the globe.

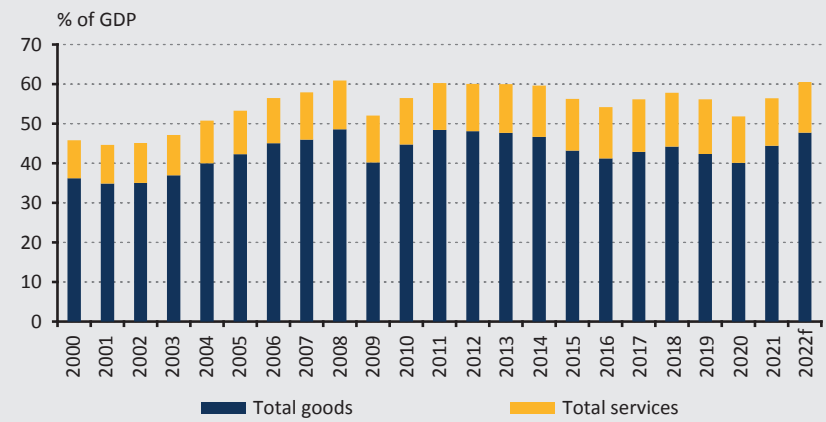
In the course of *regional integration,* nations cluster into supranational, regional-based organisations to improve cooperation and reduce any existing tensions. Although in various ways and to a varying extent, these cooperations aim to ensure the free flow of labour, goods, products and capital. Regionalism is closely tied to globalisation, but they are not identical.

Global and regional integration build upon each other, and they are closely related and correlated (in certain respects, they can supplement each other or even be each other's opposites). The combination of global integration and regional integration between a few states is *international integration.*

2. Is globalisation stagnating?

The steady rise of globalisation has clearly been disrupted in the past 15 years. The 2008–2009 financial and economic crisis resulted in a temporary contraction of global trade of over 10 per cent. While trade did almost return to earlier levels after 2010, its share relative to world GDP stopped increasing (*EC 2017*; see *Figure 1*).

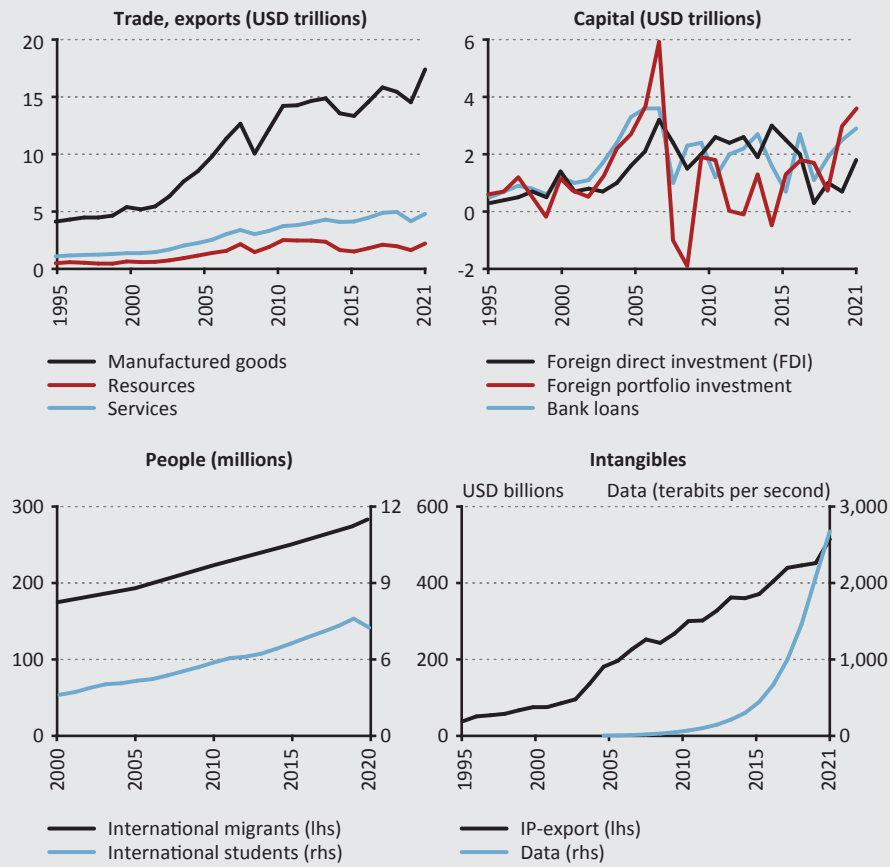
Figure 1
Share of global trade as a percentage of global GDP



Note: f – forecast.
Source: EC (2023)

International capital flows are much more muted than in the early 2000s (see *Figure 2*). While it has become a major political issue, international migration is also practically negligible: since 1990, the global share of the migrant population expanded by merely 0.5 percentage point, from 2.9 per cent to 3.4 per cent.

Figure 2
International flows of the main drivers of globalisation in the past 25 years

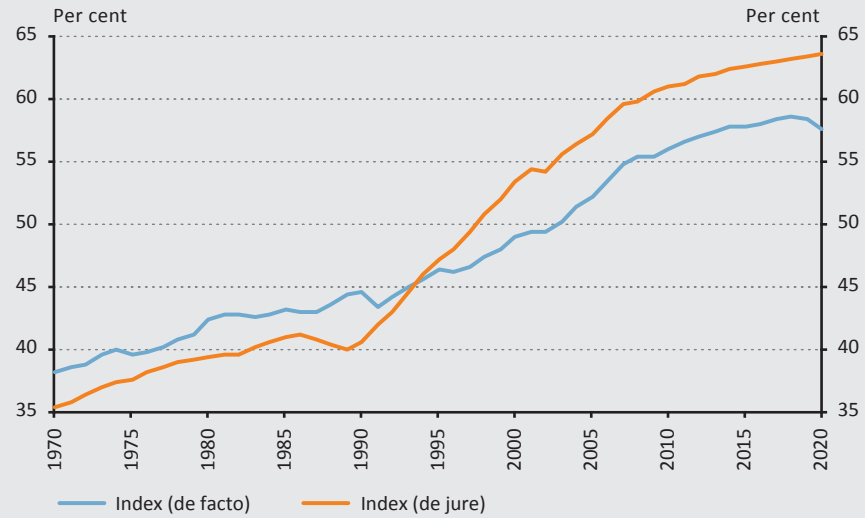


Notes: All growth rates are nominal, IP (intellectual property rights)
Source: Seong et al. (2022)

The *most widely used indicator of globalisation,* the (composite) index of economic globalisation produced by the Economic Institute of ETH Zurich, has barely increased since 2007 and essentially stagnated (*Figure 3*). The financial and economic crisis was preceded by forcibly extended international capital flows, which was partly responsible for the crisis itself. Over the past 15 years, however, cross-border financial speculation and international bank lending in Europe have diminished

considerably. This is not necessarily a negative trend: the pre-2007 situation was unhealthy in several respects. Nowadays, finance is much more balanced and resilient to crises, even if it is less globalised.

Figure 3
Evolution of the Globalisation Index between 1970 and 2020



Source: https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html

Negotiations on the liberalisation of international trade are faltering. Some governments are resorting to traditional, or even less traditional, non-tariff, tools of protectionism. This jeopardises one fundamental dimension of globalisation, the integration of world trade. Another factor pointing towards this is that global trade has lost its earlier dynamism in the past decade, and it remains to be seen whether its growth can return to previous levels. Global trade as a percentage of GDP increased rapidly prior to the Great Recession, rising from 41 per cent in 1986 to over 61 per cent in 2008. Since then, this figure has basically stagnated (see *Figure 1*, *Wozniak – Galar 2018*). With respect to the more complex, and sometimes more hostile global environment of trade relations and the changing economic drivers, the expansion of global trade practically went hand in hand with output growth, or fell somewhat short of that (*WTO 2022*). In view of these developments, the factors supporting the slowdown in global trade should be reviewed.

3. Risks of fragmentation in global trade

To illustrate the above, it is worth reviewing the EU's approaches to international trade. Growth in the EU's external trade, in particular its services trade, has exceeded global trends since the Great Recession. In connection with the deepening integration, the share of the trade in goods in the EU relative to GDP increased by 10 percentage points between 2000 and 2021, from 57 to 67 per cent (supported by the trends in both intra- and extra-EU trade[2]). The proportion of the EU's services trade increased more than the trade in goods, rising from 14 per cent of GDP in 2000 to 26 per cent in 2021. Similarly, the participation of the EU's economy in global value chains rose steeply until 2008 and then remained relatively stable. Foreign value added in the EU's exports ("backward participation in value chains") increased from 12.7 per cent in 2000 to 17.3 per cent in 2012, before falling to 15.8 per cent in 2018. The EU's domestic value added in the exports of partner countries ("forward participation") grew from 14.9 per cent in 2000 to 16.5 per cent in 2008, before returning to 14.9 per cent in 2018.[3] (*EC 2023*)

Several economic and political factors can explain the slowdown in the expansion of global trade in the past decade. First, the drivers of trade seem to have lost momentum. On the other hand, tariff barriers to international trade have been reduced. The world's weighted average tariff on traded manufactured goods contracted from 13.6 per cent in 1986 to 7.5 per cent in 2008 and then to 3.9 per cent in 2019, but the marginal benefits of advancements in communication technologies, which enabled the geographical dispersion of production processes, are yielding diminishing returns (*Antràs 2020*). The share of continued offshoring declined in high income nations as the division of labour in manufacturing stabilised. In the case of emerging countries, the share of intermediary goods in imports fell, as the latter increasingly rely on their own industrial base in acquiring inputs (*Baldwin 2022*). Finally, the structural changes in a few major emerging economies, most notably China, may also contribute to the diminishing openness in trade and the slowdown in global trade (e.g. reflected in more limited integration in global value chains). But services trade has retained its dynamism compared to the trade in goods (except for tourism during the Covid shock), and the digital developments in intermediate services boosted trade[4] (*Baldwin 2022*).

Geopolitical tensions and the Covid-19 pandemic weighed on cross-border trade and global value chains. The vulnerability of certain faraway supplier capacities on account of the lockdowns and other restrictive measures introduced during the Covid-19 crisis led to serious and sustained supply-side issues (*Javorcik et al.*

[2] The share of intra-EU trade in goods was about 60 per cent in the past two decades.
[3] Such detailed data are only available going back several years.
[4] This was particularly true for high income countries and regions, including the EU, as they usually experienced hardly any obstruction in such exports.

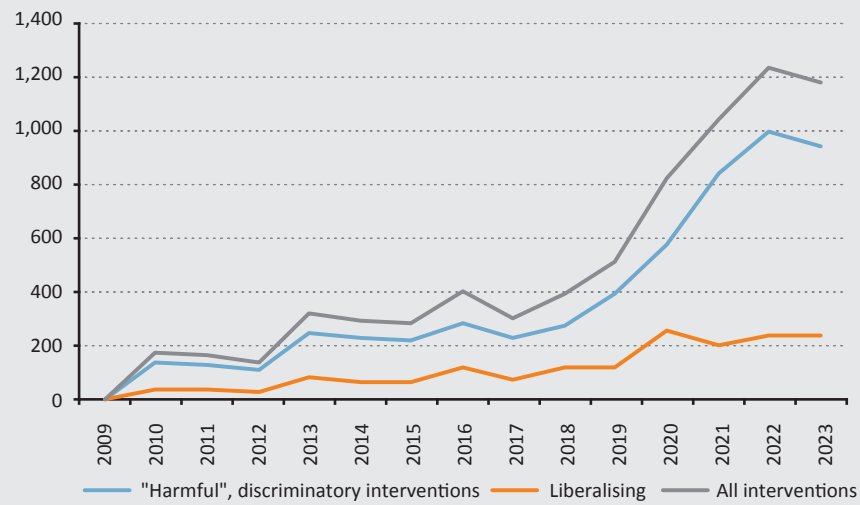
2020; *Meier – Pinto 2020*; *OECD 2020; Hausmann 2020; Halmai 2022a, 2022b*). The drop in the supply of certain intermediary goods (parts, components, materials), coupled with logistics hiccups (shortage of carrier capacities, growing transport costs), resulted in massive disruptions to supply chains. The shortage of chips led to involuntary restrictions, or even the suspension of production in several sectors (e.g. car manufacturing) in certain periods. Due to the contraction in production and the shutdowns, prices increased and unprecedented queuing was experienced, especially after the deepest point in the Covid crisis.

The growing animosity between the US and China led to restrictive measures and to industrial support policies in technology-driven sectors (e.g. semiconductors, green technologies). The lack of healthcare products at the beginning of the Covid-19 pandemic may have strengthened calls for "near-shoring" and the rationalisation of certain segments in the supply chain. The war in Ukraine further heightened geopolitical tensions and risks. Geopolitical considerations became more important in trade dynamics, and economic considerations were sometimes deprioritised. Overall, the efforts at increasing the reliability of the sources of supply, the improvement of demand response and the increasing importance of national security considerations can probably lead to the reorganisation or shortening of some supply chains (*IMF 2022*; *Capital Economics 2022*).

Trade relations may be significantly influenced by the disruptions in the status quo, such as the backtracking on the Trans-Pacific Partnership by the United States in 2017 or the dismantling of the WTO's dispute settlement system. In this context, multilateral institutions' ability to facilitate global trade flows has been weakening (*Dadush 2022*).

The latest trade policy developments continue to signal a difficult environment for cross-border trade and the progression of global value chains. Although tariffs have remained at low levels overall, non-tariff barriers to trade have increased considerably since 2020. First because of the pandemic, and then on the back of the Russian war in Ukraine, and finally on account of the emerging food and energy crisis. Accordingly, the annual average of harmful trade restriction measures applied had risen to 530 by 2022, up from 71 in 2010–2019 (see *Figure 4*). Restrictions affected 9.3 per cent of global imports in 2021 (*WTO 2022*), which increased even more in 2022, due to the EU sanctions imposed after Russia's invasion of Ukraine.

Figure 4
Trade policy interventions



Note: number of new interventions per year.
Source: www.globaltradealert.org

4. Supply chains: deglobalisation versus restructuring

Several basic factors, such as the above geopolitical correlations, the pandemic or the necessity of managing climate goals may shift policy towards restructuring value chains. Several countries are introducing subsidies to foster "reshoring" in strategic sectors and reduce dependence on foreign technologies and inputs. For example, in semiconductor manufacturing, the USA, the EU, Japan and China all use measures and subsidies to build and strengthen domestic industrial capacities. In the USA, for instance, such subsidies could double in the decade ahead (*Economist 2023*). The latest example is the Inflation Reduction Act (IRA) in the USA. Several subsidies are dependent on meeting some condition on domestic output and source of supply, thereby distorting market competition. In green technologies, these measures could probably lead to reshoring of some supply chains (e.g. the manufacturing of electric cars and their components). While other economies are planning or implementing similar subsidy schemes, the recently adopted Green Deal Industrial Plan in the EU underlines the importance of an open rules-based trade regime and the role of trade in the green transition (*EC 2023*).

Companies are likely to adapt their strategies accordingly. According to a survey by the US–China Business Council from June 2022, 87 per cent of respondents (American multinationals operating in China) believe that US–China tensions have

affected their operations and investment decisions; 26 per cent have moved away from China' industrial segments, 29 per cent use separate US- and China-specific value chains, and 24 per cent are disinvesting in China (*EC 2023*). A similar survey by the European Union Chamber of Commerce in China from April 2022 demonstrated the negative impact of geopolitical tensions on European investments in China. Of the companies under review, 7 per cent were considering ending their investments in China after the outbreak of the war in Ukraine and 39 per cent believed that geopolitical tensions reduced China's investment appeal.

Political pressure to relocate supply chains does not immediately produce significant changes in standard aggregate trade indicators. This is because the restructuring of supply chains requires time, and implementation is difficult due to high costs and technological challenges (*IMF 2022*). Nonetheless, political efforts could change trade patterns (in the case of automated jobs, the most advanced countries may even relocate certain stages back home).

The share of the USA declined in China's exports, while that of ASEAN countries increased. Meanwhile, India is a potential new engine in the development of global value chains (*Banga 2022*). Until now, political changes have diversified trade relations rather than destroying them. One important element of the new trade patterns is the restructuring of supply chains in Asia, in response to the deteriorating trade and geopolitical relations between the USA and China. A similar realignment can be expected in other regions, too. Central and Eastern Europe may increase its participation in value chains. At the same time, certain Latin American countries (e.g. Mexico) may step up their participation in American value chains (*AMRO 2021*).

The restructuring of value chains could raise the issue of *technological sovereignty,* which has become the means rather than the end in the 21st century. It refers to the ability of a state or integration (e.g. the EU) to develop or acquire the technologies that are considered crucial for social welfare, economic competitiveness and the state's ability to act without one-sided structural dependence on other economic areas (*Edler et al. 2023*). In other words, technological sovereignty based on economic welfare is the ability of a nation to enable its companies to compete in the global technological framework freely and successfully, and ensure the long-term adequate welfare of the population (*Inzelt 2023*).

At the same time, the restructuring of global value chains may lead one to wonder about deglobalisation. However, building shorter and less vulnerable value chains than before, in other words restructuring, can hardly be considered deglobalisation.

5. Risks of trade fragmentation

Changing trade patterns do not necessarily have a negative effect on aggregate trade indicators, but they can entail significant economic costs. The restructuring of supply chains requires time, and it entails huge costs and technological challenges (*IMF 2022*). The international barriers increasingly hampering international trade, the declining share of FDI and technological change can make resource allocation less efficient and may have a negative impact on productivity growth and productivity spillovers. Stronger barriers to trade and/or higher uncertainties regarding trade policy lead to increased global fragmentation. According to the analysis of the IMF, the relatively significant fragmentation of the global economy, depending on its extent, could lead to a permanent global output loss. Model estimates suggest that this would range from 0.2 per cent of GDP to 7 per cent of GDP. The scenarios combining trade fragmentation with a technological decoupling could lead to output losses between 8 and 12 per cent of GDP in some countries (*IMF 2023*).

Overall, several factors can hamper the global trade outlook, with risks weighing on economic growth. Some structural factors that hindered trade growth in the past decade, such as the limited impact of large technological breakthroughs in transportation and IT, are expected to remain broadly unchanged. Besides the above, the latest exogenous shocks and trade policy developments indicate that the effects negatively affecting global trade could strengthen at both the country level and the multilateral level. Taking all factors into account and identifying a causal link between trade and potential growth (*Singh 2010*), fragmentation entails significant potential economic costs and poses a downside risk to global trade for the global economy (*IMF 2023*).

6. Changing globalisation

The main driver of globalisation is the growth in connections between people, economies and cultures. The latest phase of globalisation focuses on the flow of digital services, information and knowledge. *The process of globalisation progresses in various forms.*

Global trade is currently experiencing a revolution in communication and technology. The adoption of new technological innovations (blockchain, 5G, electric cars) has had far-reaching effects. Nevertheless, the global middle class may grow in parallel with this. The standard of living is on the rise, especially in emerging markets. This could have a major impact on global trade in the decades to come. According to McKinsey's forecast (*Lund et al. 2019*), the volume of global consumption could double from its 2017 figure by 2030. Of this increase, 60 per cent could come from emerging economies, which will likely consume two thirds of the world's manufactured goods in 2030. In the context of rising consumption in

the emerging economies, the share of cross-border trade in goods declined relative to total output in the past decade. Many countries are increasingly able to satisfy consumers' demands through domestic supply chains.

Globalisation is not dying, it has merely changed (*Wolf 2022*). In the past, globalisation was about the movement of goods, capital and people, but nowadays its more about the flow of services, information and data. Globalisation no longer requires that people or goods cross borders or that factories be built. People are working for global corporations while sitting at a computer. Most of the highest-valued companies on the globe do not produce physical products (Microsoft, Amazon, Alphabet, Facebook, Tencent, Alibaba).

Coupled with the increasing popularity of artificial intelligence (AI), robotisation and more and more automation, this creates much more complex social, political and economic challenges than globalisation based on physical products. This can affect both blue-collar workers and white-collar workers, all over the world, even though the latter have mostly benefitted from globalisation until now.

The process of globalisation is undergoing a fundamental transformation. The trade in goods and the offshoring of physical jobs (from advanced countries to emerging ones) may be blocked by politics, but the globalisation of services may replace them.

World trade has expanded in three waves since the Industrial Revolution (*Baldwin 2016*). The first wave was connected to industrialisation and the transportation of goods. Then, in recent decades, companies started to offshore production to regions offering cheap labour. The third wave is the trade in services, for example the "travelling" offices enabled by IT (e.g. the internet). White-collar workers can perform their duties from anywhere in the world.

The fundamental difference between the first two waves and the third one is that while in the first case objects had to move around, in the second case only information flows between the different regions and countries of the world. Constraining this is much more difficult and costly[5] than in the former case.

At the same time, the trade in services is characterised by dynamic growth. Amidst the changing conditions, the position of service-oriented countries (e.g. the USA, the UK, France, Sweden) may be strengthened. On the other hand, those concentrating on production could face new challenges. Looking for low labour costs is less and less crucial in itself. What is important, however, is research and development and the development of knowledge-driven industries.

[5] Although there are also examples for this in some countries, for example in China.

The share of tangible assets within corporate investments is declining. At the same time, expenditure on intangible assets[6] (software, brand building, planning) relative to GDP is increasing. The latter is often not reflected faithfully in trade statistics. According to the estimates of *McKinsey,* private sector firms have invested more in intangible assets than tangible assets since the early 2000s, and the gap between the two is constantly growing (*Lund et al. 2019*).

Companies' intangible asset purchases amount to USD 770 billion each year, most of which is attributable to the USA, in particular IT firms. The export of IT services can also be seen in other economies. For example, in South Korea almost all intangible asset exports come from IT companies. Another interesting phenomenon is the growth in international data traffic. For instance, between 2007 and 2019 the volume of annual international data traffic increased 148-fold, which means that on average it doubled every 18 months (*Lund et al. 2019*).

The internet/technological/communication revolution reduced transaction costs, changed production processes and may facilitate the market entry of new products (*Levinson 2021*). New technologies may bring further crucial results:

- Digital platforms (e.g. e-commerce) and new technologies open up new markets, improve logistics and reduce coordination costs.
- Artificial intelligence and 3D printing could change production processes, and the volume of the trade in parts may diminish.
- Due to digital innovations, services and data might replace physical products in certain areas (e.g. music, videos, games as physical media are on the backfoot and cloud services are on the rise).
- New services could appear in international trade (e.g. telemedicine, virtual reality, and other things related to 5G).
- The technologies reducing transaction costs (e-commerce, blockchain) lift the volume of the trade in goods, while the technologies that change production processes (AI, robotics) and logistics technologies (electric cars, renewables) could lower it.
- Developing the skills necessary for applying the new technologies is a crucial challenge. The countries that spearhead this and the development of service sectors could benefit handsomely from global value chains.

[6] For more details on the rise of "smart" investments, see *Baksay et al.* (*2022*): pp. 71–80.

The regulation of trade in services mostly pertains to final services rather than intermediary ones.[7] Examples for the latter include the accountants, analysts, administrators, online helpdesk agents, graphic designers, DTP specialists and those working in various IT areas. The trade in services has a bright future ahead of it, but it could also become disruptive: when professionals can work from anywhere in the world, a large number of middle class jobs could be in jeopardy in developed countries.

7. Disputes surrounding globalisation

During the disputes, one basic question is whether the assumed or the actual consequences of globalisation are in the focus. Universalisation ("global" cigarettes, drinks) and Westernisation (Hollywood movies, consumerism) are generally regarded in a negative light, as they are sometimes viewed as threats to local traditions and cultures. At the same time, outsourcing and the cost advantages achieved with international value chains have had a major disinflationary impact for decades. For a large part of the global population, standardised high-quality products have become available at a low price.

Criticism is levelled at the process of trade integration and liberalisation, along with the basic institutions. Less developed countries have called into question the necessity of using strict environmental and occupational safety standards, and they viewed those as an attempt by developed countries at reducing their competitiveness.

The distributional disputes related to globalisation deserve special mention. The widely used narrative goes like this: globalisation only benefitted the wealthy, and outsourcing meant that many Western workers lost their jobs. The decline in industrial employment and the general stagnation of Western real wages in the lower-middle class led to understandable discontent with globalisation. However, the reality is fundamentally different from this. Between the early 19th century and the second half of the 20th century, the share of the income of the largest economies (G7 countries) within total global income did grow dramatically. Innovation remained confined to small regions until the middle of the second half of the 20th century, thereby increasing income inequalities.

However, the information and communication revolution (internet, telephone, ICT) allowed firms to export knowledge to every corner of the world at low costs. Rich countries relocated some of their industrial production into poorer emerging

[7] The activities providing services to service providers.

countries. This resulted in an enormous boom in growth. Hundreds of millions of people were lifted out of extreme poverty.

The loss of Western industrial jobs was influenced much less by liberal economic policies alone than technology. Globalisation creates more jobs than it destroys. But the crux of the problem is that the new jobs require more skills.

The issue is illustrated by the so-called elephant figure created by *Branko Milanovic* (see *Figure 5;* originally published in *Lakner – Milanovic 2013*). It shows the income distribution processes from the past decades, and it can be clearly seen that in the period under review, disregarding the poorest citizens in third world countries, the income growth was the lowest in lower-middle class people from developed countries. In fact, in the 20-year period under review, certain groups experienced a reduction in their standard of living in real terms.

Figure 5
Change in real income in 1988–2008 in the different percentiles of global income distribution (in 2005 USD, PPP)

Note: The vertical axis shows the cumulative change in real income (%), measured in 2005 USD at purchasing power parity in 1988–2008. The horizontal axis shows the percentile positions in global income distribution. The percentile distribution runs from 5 to 95, in increments of 5 percentage points. The top 5 per cent are divided into two groups: the top 1 per cent, and those between the 95th and 99th percentiles.

Source: Corak (2016) based on Milanovic (2016)

According to OECD and World Bank data, inequality (the Gini coefficient measuring it) increased in most developed countries in the past 30 years. In certain countries, inequality indicators show as negative a picture as in the early 20th century. Nevertheless, in the world economy as a whole, when individual countries are

compared, globalisation has definitely reduced inequalities.[8] Poorer countries have joined the global economic system, and they grew faster than developed countries.

These developments are influenced by crucial economic and social changes. The process of globalisation is undergoing a fundamental structural transformation. Knowledge-driven globalisation has technology at its heart. The less skilled lower-middle class workers living in developed countries will no longer compete with East Asian workers who are in a similar situation, but with robotisation instead. Rather than protecting jobs, the focus should be on protecting workers. The above-mentioned third phase of globalisation poses a tremendous challenge.

The anti-globalisation sentiment has produced a political response in many countries, entailing an anti-establishment rebellion and the politics of rage. Important milestones include the Brexit referendum, the election of Donald Trump as the president of the USA and the strengthening of certain anti-globalisation and populist parties. Opposing globalisation is not the only driver behind these trends, but it is definitely an important component. It must be underlined that the main reason for the backlash against globalisation is the growing inequality in developed countries.

Anti-globalisation has become a political tool because the benefits of international trade are difficult to capture. On the other hand, there are clear losers in this process, albeit there are few of them, and they make their voice heard loud and clear. The disruption in globalisation came 6–8 years earlier than the rise of populists. After it became part of the political agenda, it can be argued that "globalisation is under siege".

Actually, globalisation has not reversed. Its main drivers have simply slowed down. At the same time, new dimensions with hardly foreseeable consequences have come into focus.

The biggest threat is posed by anti-globalisation economic policies increasing fragmentation. The rise in protectionism, non-tariff barriers and discrimination in trade all hamper development. Global political measures would be needed to address the extreme offshoots of technology-driven globalisation. However, one of the main messages of the populists advocating the death of globalisation is actually the rejection of international political cooperation.

The establishment and strengthening of multilateral rules and institutions is a precondition for the continued deepening of global integration. Nation states and the regional integrations in which they cluster have several options to influence developments and mitigate risks. Economic policies should focus on increasing productivity and competitiveness. Far-reaching structural reforms facilitating this

[8] This is confirmed in the latest analysis by *Milanovic* (*2022*).

need to be developed and implemented. An important contribution would be increasing the room for fiscal manoeuvre, and ensuring the more targeted and efficient use of resources. Measures that facilitate market competition and freer trade and the reduction of red tape are vital. Labour market reforms, advanced training and active support for finding employment are needed, along with a wider social safety net. The latter could be used to prevent those losing their jobs from falling into a sort of poverty trap.

Potential solutions could include learning from the example of north European welfare states and actively supporting people in retraining, thriving on the labour market and finding housing. The development of education is also vital: students do not need to become one-track specialists but instead workers who can adapt to an increasingly rapidly changing world and consider lifelong learning a part of life. Jobs requiring creativity, interpersonal relationships and personal contact cannot be replaced with remote-controlled robots.

Sustainable and inclusive growth should be targeted, as it could allow wide swathes of society to enjoy the benefits of trade and investment reforms. An important caveat here: the advantages of globalisation should be better articulated to the public, and its obvious losers should be better compensated.

8. Some conclusions

The important features of globalisation include the flows and networks connecting the individual elements of the global economy. In the wake of the Great Recession, the dynamics of the trade in goods and international financial flows were reduced somewhat relative to earlier decades. Yet this stabilised at a high level, while the new driver of globalisation became the flow of *services and intangible assets* (including IP, data and information), *with stronger dynamics.*

Trade remains an important scene for globalisation. Stronger barriers to trade and/or greater uncertainties regarding trade policy could lead to growing *global fragmentation.* The relatively significant fragmentation of the global economy, depending on its extent, could lead to a permanent global output loss.

Several basic factors, such as geopolitical correlations, the pandemic or the necessity of managing climate goals may shift policy towards restructuring *value chains.* However, building shorter and less vulnerable value chains than before can hardly be considered deglobalisation. The restructuring of value chains could raise the issue of *technological sovereignty,* i.e. the ability of a nation to enable its companies to compete in the global technological framework freely and successfully, and ensure the long-term adequate welfare of the population. Amidst the changing conditions, the position of service-oriented countries focusing on

research and development and knowledge-intensive industries could be improved. The economies concentrating on production could face new challenges. Low labour costs are less and less crucial in themselves.

The main driver of globalisation is the growth in connections between people, economies and cultures. The latest phase of globalisation focuses on the *flow of digital services, information and knowledge.* The process of globalisation is progressing in various forms. Actually, globalisation has not reversed. The dynamics of its former main drivers have slowed down, but new dimensions with hardly foreseeable consequences have come into focus.

The biggest threat is posed by anti-globalisation economic policies increasing fragmentation. Global political measures would be needed to address the extreme offshoots of technology-driven globalisation. The establishment and strengthening of multilateral rules and institutions is a precondition for the continued deepening of global integration. Nations states and the regional integrations in which they cluster have several options to influence developments and mitigate risks. Economic policies should focus on increasing productivity and competitiveness. Far-reaching structural reforms facilitating this need to be developed and implemented. Measures that facilitate market competition and freer trade and the reduction of red tape are vital. With sustainable and inclusive growth, wide swathes of society could enjoy the benefits of trade and investment reforms.

References

AMRO (2021): *Global Value Chains in the Post-Pandemic New Normal*. ASEAN+3 Regional Economic Outlook. https://www.amro-asia.org/asean3-regional-economic-outlook-2021-full-report/

Antràs, P. (2020): *De-Globalisation? Global Value Chains in the Post-COVID-19 Age*. National Bureau of Economic Research Working Paper No. 28115. November. https://doi.org/10.3386/w28115

Baksay, G. – Matolcsy, Gy. – Virág, B. (eds.) (2022): *New Sustainable Economics – Global Discussion Paper*. Magyar Nemzeti Bank. https://www.mnb.hu/web/sw/static/file/NEW_SUSTAINABLE_ECONOMICS_-_Global_discussion_paper_2022.pdf

Baldwin, R. (2016): *The Great Convergence. Information Technology and the New Globalization*. Harvard University, Cambridge, Massachusetts.

Baldwin, R. (2022): *The peak globalisation myth*. VoxEU, 31 August. https ://cepr.org/voxeu/columns/peak-globalisation-myth-part-1

Banga, K. (2022): *Opportunities, risks and realities of India's participation in global value chains*. Institute of Development Studies, 23 September. https://www.ids.ac.uk/opinions/opportunities-risks-and-realities-of-indias-participation-in-global-value-chains/

Bhagwati, J. (2007) [2004]: *In Defense of Globalization. With a New Afterword.* New York, Oxford University Press.

Capital Economics (2022): *Global Economic Fracturing*. October.

Corak, M. (2016): *Worlds of Inequality. The winners and losers of globalization. Must it be this way?* The American Prospects – Ideas, Politics & Power, May 18. https://prospect.org/power/worlds-inequality/. Downloaded: 24 May 2023.

Dadush, U. (2022): *Deglobalisation and Protectionism*. Working Paper 18/2022 Bruegel. https://www.bruegel.org/sites/default/files/2022-11/WP%2018.pdf

EC (2017): *Reflection Paper on Harnessing Globalisation*. European Commission COM (2017) 240 of 10 May. https://commission.europa.eu/system/files/2020-07/reflection-paper-globalisation_en.pdf

EC (2023): *European Economic Forecast Winter 2023*. European Economy, Institutional Paper 194, EC DG ECFIN, Brussels. https://economy-finance.ec.europa.eu/system/files/2023-02/ip194_en_1.pdf

The Economist (2023): *The destructive new logic that threatens globalisation*. The Economist, 14 January. https://www.economist.com/leaders/2023/01/12/the-destructive-new-logic-that-threatens-globalisation

Edler, J. – Blind, K. – Kroll, H. – Schubert, T. (2023): *Technology sovereignty as an emerging frame for innovation policy. Defining rationales, ends and means*. Research Policy, 52(6): 104765. https://doi.org/10.1016/j.respol.2023.104765

Halmai, P. (2022a): *Poszt-covid kilábalás: középpontban a kínálati oldal* (*Post-COVID recovery: focus on the supply side*). Külgazdaság (External Economic Bulletin), 66(1–2): 58–71. https://doi.org/10.47630/KULG.2022.66.1-2.58

Halmai, P. (2022b): *COVID-19 Crisis and Supply Side Bottlenecks in the EU. Shorter- and Longer-Term Prospects*. Montenegrin Journal of Economics, 18(4): 19–30. https://doi.org/10.14254/1800-5845/2022.18-4.2

Hausmann, R. (2020): *Transformation of Global Supply Chains in the Manufacturing Industry as a Result of the Coronavirus Pandemic*. Financial and Economic Review, 19(3): 130–153. https://doi.org/10.33893/FER.19.3.130153

IMF (2022): *Global Trade and Value Chains During the Pandemic*. Occasional Paper. In: IMF: World Economic Outlook, April 2022 – War Sets Back the Global Recovery, pp. 87–107. https://www.elibrary.imf.org/display/book/9781616359423/CH004.xml?tabs=fulltext

IMF (2023): *Geoeconomic Fragmentations and the Future of Multilateralism*. Staff Discussion Notes 2023/1. https://doi.org/10.5089/9798400229046.006

Inzelt, A. (2023): *A technológiai szuverenitás felvilágosult koncepciója* (*The enlightened concept of technological sovereignty*). Portfolio, 16 April. https://www.portfolio.hu/gazdasag/20230416/a-technologiai-szuverenitas-felvilagosult-koncepcioja-608248

Javorcik, B. (2020): *Global supply chains will not be the same in the post-COVID-19 world*. In: Baldwin, R.E. – Evenett, S.J. (eds.) *COVID-19 and Trade Policy: Why Turning Inward Won't Work*. CEPR Press, pp. 111–116.

Lakner, C. – Milanovic, B. (2013): *Global Income Distribution. From the Fall of the Berlin Wall to the Great Recession*. Policy Research Working Paper 6719, The World Bank Development Research Group Poverty and Inequality Team, December. https://openknowledge.worldbank.org/server/api/core/bitstreams/ed8d4ff4-8768-5c79-8266-1d151eff85b9/content

Lakner, C. – Milanovic, B. (2016): *Global Income Distribution: From the Fall of the Berlin Wall to the Great Recession*. World Bank Economic Review, 30(2): 203–232. https://doi.org/10.1093/wber/lhv039

Levinson, M. (2021): *A fourth globalisation. A new form of trade is reshaping our world, and it's driven by the movement of bits and bytes, not goods, around the globe*. https://aeon.co/essays/the-globalisation-of-ideas-will-be-different-than-that-of-goods

Lund, S. – Manyika, J. – Woetzel, J. – Bughin, J. – Krishnan, M. – Seong, J. – Muir, M. (2019): *Globalization In Transition: The Future Of Trade And Value Chains.* McKinsey Global Institute, January. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/innovation/globalization%20in%20transition%20the%20future%20of%20trade%20and%20value%20chains/mgi-globalization%20in%20transition-the-future-of-trade-and-value-chains-full-report.pdf

Meier, M. – Pinto, E. (2020): *Covid-19 Supply Chain Disruptions*. Covid Economics, 48: 139–170. https://cepr.org/node/390621

Milanovic, B. (2016): *Global Inequality. A New Approach for the Age of Globalization*. Harvard University Press, Cambridge, Massachusetts. https://doi.org/10.4159/9780674969797

Milanovic, B. (2022): *The three eras of global inequality, 1820-2020 with the focus on the past thirty years*. Stone Center on Socio-Economic Inequality Working Paper Series No. 59, Revised December. https://doi.org/10.31235/osf.io/yg2h9

OECD (2020): *COVID-19 and global value chains: Policy options to build more resilient production networks*. OECD Policy Responses to Coronavirus, 3 June. https://www.oecd.org/coronavirus/policy-responses/covid-19-and-global-value-chains-policy-options-to-build-more-resilient-production-networks-04934ef4/

Palánkai, T. – Kengyel, Á. – Kutasi, G. – Benczes, I. – Nagy, S.Gy. (2011): *A globális és regionális integráció gazdaságtana* (*The economics of global and regional integration*). Budapest, Akadémiai Kiadó.

Seong, J. – White, O. – Woetzel, J. – Smit, S. – Devesa, T. – Birshan, M. – Samandari, H. (2022): *Global flows: The ties that bind in an interconnected world*. Discussion Paper McKinsey Global Institute, November 15. https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/global-flows-the-ties-that-bind-in-an-interconnected-world

Singh, T. (2010): *Does International Trade Cause Economic Growth? A Survey*. The World Economy, 33(11): 1517–1564. https://doi.org/10.1111/j.1467-9701.2010.01243.x

Wolf, M. (2022): *Globalisation is not dying, it's changing*. Financial Times, 13 September. https://www.ft.com/content/f6fe91ab-39f9-44b0-bff6-505ff6c665a1

Wozniak, P. – Galar, M. (2018): *Understanding the weakness in global trade*. European Commission, Directorate-General for Economic and Financial Affairs. https://doi.org/10.2765/30756

WTO (2022): *Annual Review*. Geneva. https://www.wto.org/english/res_e/booksp_e/anrep_e/ar22_e.pdf

Improving Access to Credit for First-Time Home Buyers under Borrower-Based Measures*

Gabriella Grosz – Gábor Izsák – Alexandr Maxim Palicz – Katinka Szász

As a result of the dynamic rise in real estate prices in recent years, house prices, and therefore the minimum down payment required to obtain a mortgage, more than tripled by 2022 compared to 2014. This led to a deterioration of access to borrowing opportunities typically for young first-time home buyers aged 35 or younger, especially among clients who are not eligible for family support schemes. In this paper, we provide a detailed overview of the potential side effects of the borrower-based measure framework on first-time home buyers. Relative to their credit risk, these clients may be more severely affected by borrower-based measures, generating negative second-round effects. Therefore, in their case preferential limits may be applied, in line with international practice, notably on the level of down payment. However, when making such a decision, it is important to take into account the development of risks in the housing and credit markets and the macroeconomic environment.

Journal of Economic Literature (JEL) codes: D14, E32, E51, E58, G21, R31

Keywords: financial stability, real estate overheatedness, excessive lending, macroprudential policy, borrower-based measures, loan-to-value ratio, debt-service-to-income ratio, first-time home buyer

1. Introduction and motivation

In the aftermath of the 2008–2009 global economic crisis, so-called borrower-based instruments have become increasingly common at the international level, in order to avoid systemic financial crises. These regulatory instruments limit the debtor's repayments (debt service-to-income, DSTI), the total amount of debt (debt-to-income, DTI) or the current amount of the loan (loan-to-income, LTI) as a proportion of their income (so-called debt-to-income limits) or limit the amount of the loan

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Gabriella Grosz: Magyar Nemzeti Bank, Senior Economic Analyst. Email: groszg@mnb.hu
Gábor Izsák: Magyar Nemzeti Bank, Legal Advisor. Email: izsakg@mnb.hu
Alexandr Maxim Palicz: Magyar Nemzeti Bank, Senior Economic Analyst. Email: palicza@mnb.hu
Katinka Szász: Magyar Nemzeti Bank, Legal Advisor. Email: szaszk@mnb.hu

The first version of the Hungarian manuscript was received on 16 March 2023.

DOI: https://doi.org/10.33893/FER.22.2.25

relative to the value of the collateral (the loan-to-value ratio, LTV),[1] thus hindering the disbursement of loans that are considered too risky. The rules thus protect both debtors and lenders from excessive risk-taking and potential payment difficulties. Experience so far shows that borrower-based measures have substantially increased the resilience of households to shocks and significantly reduced the risk of excessive household indebtedness.

However, the use of borrower-based measures can also have significant unintended side effects for certain groups in society. Because of their lower savings, first-time home buyers, who are typically young,[2] may be affected particularly strongly by such measures. Because of their young age, these clients tend to have lower savings and lower, but faster growing incomes compared to other home buyers. For them, meeting the housing loan market requirements set by the borrower-based measures, in particular the minimum down payment requirement, may be excessively difficult compared to their risk. In Hungary, the rapid increase in housing prices seen in recent years has significantly reduced access to the housing loan market for young clients with low savings, especially for clients not eligible for family support schemes. This may have unintended competitiveness and demographic second-round effects (for a detailed discussion of demographic and housing market developments, see *Lentner et al. 2017*).

To reduce the overvaluation of the housing market and to improve the housing market situation of young first-time home buyers, it is possible to envisage a number of complex economic policy interventions, which target either housing market supply (rental housing programmes, tax incentives, etc.) or demand (housing subsidies, preferential financing, guarantee schemes, tax incentives, etc.). In this paper, we explore the potential negative side effects of the borrower-based measures falling under the competence of the central bank in Hungary on the housing market of first-time home buyers and their macroprudential treatment. In the *second section*, we examine the potential side effects of borrower-based measures, with a focus on first-time home buyers. In the *third section*, we outline the current international and domestic housing and loan market trends affecting the housing situation of first-time home buyers. In the *fourth section*, we outline the general domestic characteristics of this client segment based on the available data sources and discuss in detail the impact of domestic borrower-based measures on first-time home buyers. In the *fifth section*, we explore the macroprudential options for addressing the disadvantaged housing market situation of first-time home buyers and the international practice of their application, and review the possible introduction of such options in Hungary, their preconditions and potential risks. In *sixth section*, we summarise our conclusions.

[1] The content of each ratio is described in detail in the European Systemic Risk Board's (ESRB) 2016 Recommendation on closing real estate data gaps and its 2019 amendment.
[2] In our study, we considered clients aged 35 and under as young.

2. The relationship between borrower-based instruments and first-time home buyers

Although international experience suggests that the borrowing limits set by borrower-based instruments are effective in maintaining a healthy structure of lending (*Claessens et al. 2014; Akinci – Ohmstead-Rumsey 2015; Cerutti et al. 2015; Buch – Goldberg 2016; IMF-FSB-BIS 2016; Martin – Philippon 2017; Hosszú et al. forthcoming*), it is inevitable for certain households with low incomes or low savings that exceed the limits to adapt to the requirement in some way. Such a theoretical adaptation channel could be, in the case of income-based requirements (DSTI, LTI, DTI), on the one hand, reducing repayments by extending the maturity, shortening the length of the interest rate fixation or even taking out a loan denominated in foreign currency, and on the other hand, increasing income mainly by involving co-debtor(s). In the case of collateral-based regulations (LTV), coverage can be increased by including additional collateral, but in its absence, the effectiveness of the limits may encourage the supplementing of the down payment using unsecured loans. However, the use of these adaptation channels may be addressed by the detailed rules of the requirements introduced in the country concerned (e.g. the definition of the income or repayment instalments to be taken into account or the introduction of differentiated limits).

Borrower-based measures can serve as automatic stabilisers during the financial cycle. The restrictive effect of borrower-based measures tends to be stronger during the upturn of the financial cycle, characterised by a low interest rate environment and rapid real estate price increases that exceed income growth. By contrast, in the downturn phase of the cycle, characterised by a financial crisis and house price correction, borrower-based measures are less restrictive on household indebtedness (*McDonald 2015; Claessens et al. 2014*). If the requirement becomes overly strict, i.e. excludes a significant number of clients from the lending market who would otherwise remain performers despite potentially exceeding the lending limits (high second-order error), the regulation could disproportionately increase social inequalities (*Frost – Stralen 2018; Carpantier et al. 2018; Georgescu – Martín 2021*). It should be stressed, however, that overly permissive borrower-based measures can lead to the build-up of financial stability systemic risks and excessive household indebtedness. The regulator should therefore put in place a macroprudential framework that maintains household resilience to shocks and strengthens financial stability while minimising the extent of possible negative side effects.

The rise in house prices seen in recent years and the resulting increase in barriers to entry into the lending market have drawn attention to the steadily deteriorating housing market opportunities of young first-time home buyers, who may be more severely affected than average by the potential negative effects of borrower-based requirements. When establishing their independent existence and housing, young first-time home buyers typically do not yet have the wealth and thus a sufficient down payment to take out a housing loan, due to their young age. In addition to

increasing the amount of the down payment, the loan amount and repayments can also rise rapidly in the event of a rapid increase in real estate prices, which can also exclude young home buyers with still insufficient income due to their stage of life from the housing loan market. The negative impact of borrower-based measures on first-time home buyers could become particularly severe in the event of rapid real estate price increases above the level justified by economic fundamentals (in particular income growth), i.e. in the event of overvaluation in the real estate market. Rents rising in parallel to housing market overheatedness, but at a slower pace than house prices, may further aggravate the situation of young first-time home buyers and extend the saving period needed to raise the amount of down payment required to obtain a mortgage. In extreme cases, this can exclude certain groups of society from the housing market for their entire careers.

In addition to financial stability risks, overvaluation in the housing market and the general deterioration in the affordability of housing may have a number of other unintended second-round economic and social effects, which may be exacerbated by borrower-based measures among first-time home buyers. Rapid increases in housing costs reduce disposable income, to which households can adapt in a number of ways. They can reduce their other consumption and investment expenditure (education, health, food, etc.), move to smaller, technically more obsolete properties or to less expensive locations further away from their workplace. Households may also overburden transport and other infrastructure due to increased commuting (*Gabriel – Painter 2020*). Overvaluation can therefore lead to increased environmental pressures and slower renewal of the real estate stock. High housing costs may reduce labour mobility (*Causa – Pichelmann 2020*), thus reducing macroeconomic performance, while increasing income inequalities between homeowners and renters (*Causa – Woloszko 2020*). The negative effects may particularly affect first-time home buyers due to their low savings and income resulting from their young age, the shrinking of savings opportunities and thus the increased effectiveness of the LTV requirement, which may also increase poverty in old age.

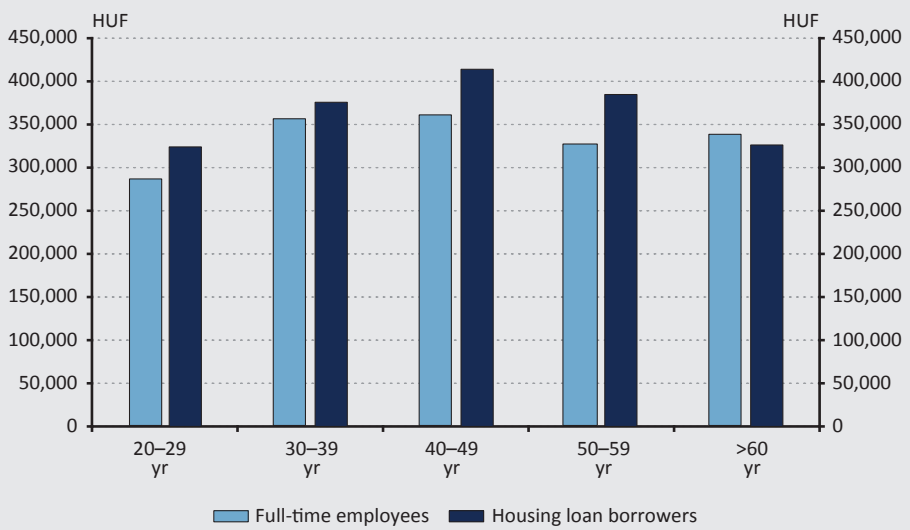
The rapid rise in house prices and persistent overvaluation of the housing market can hit young first-time home buyers particularly hard through a number of potential channels. Young first-time home buyers are more likely than other home buyers to be forced to rent or live with their parents. Their access to the mortgage market is also more limited due to lower income and down payment, shorter credit history and sometimes a disadvantaged labour market situation (*Andrews et al. 2011*), which may be further impacted by borrower-based measures (*Bekkum et al. 2019*). With rising housing market overvaluation and lack of adequate access to mortgage markets, a larger share of young people may be forced into overcrowded properties or properties with a lower comfort level (*Cournède – Plouin 2022*). This may even have negative demographic effects (*Mulder – Billari 2010; Dettling – Kearney 2014*), which could be detrimental to economic growth and competitiveness. Facilitating access to the housing market for first-time home buyers could therefore have a number of positive, second-round economic and social effects: it could support

the renewal of the housing stock and improve the energy efficiency of buildings, as well as help to achieve demographic objectives and reduce income inequalities.

Differentiated, preferential treatment for easier access to the mortgage market may also be justified from a prudential point of view, as the credit risk of these borrowers may even be lower, due to their home-establishing objective and thus presumably higher payment discipline, on the one hand, and the faster-than-average rising incomes of young age groups with relatively little work experience, on the other.

Net earnings data for full-time employees available at 10-year class intervals from the Hungarian Central Statistical Office (HCSO) and data on housing loan borrowers from the MNB's loan register (HITREG data reporting) both suggest that the incomes of young borrowers may be rising faster than average. Based on housing loan disbursements data for the first three quarters of 2022, the incomes of borrowers aged 30–39 are nearly 20 per cent higher than those of borrowers aged 20–29, while the incomes of borrowers aged 40–49 are 10 per cent higher than those of borrowers aged 30–39 (*Figure 1*). In some cases, the rapid increase in the income of young housing loan borrowers with children may also be supported by the subsequent recovery of income temporarily lost at a young age due to raising children. Similarly, using nearly 40 years of individual earnings data on five million US workers, *Guvenen et al.* (*2021*) also found that income growth is highest in the young age groups and most of it occurs until the ages of 35–40.

Figure 1
Average net monthly income by age of full-time employees and housing loan borrowers (2022)



Note: Average net earnings excluding benefits for full-time employees; Average income per borrower for housing loan borrowers taken into account for the DSTI calculation

Source: HCSO, Magyar Nemzeti Bank (MNB)

Few empirical studies are available on the credit risks of first-time home buyers. *Kelly et al.* (*2014*), *Kelly – O'Malley* (*2016*), and *Giuliana* (*2019*) analyse the impact of first-time home buyer status on default risk. Using data on housing loans in Ireland, the authors found a statistically significant negative effect even after controlling for a wide range of control variables on lending and borrowers. Similarly, *Lazarov and Hinterschweiger* (*2018*) found a statistically significant negative correlation between first home purchase loan purpose and loan default risk based on UK loan disbursements data. However, by contrast, analyses by *Gyourko et al.* (*2015*) and *Patrabansh* (*2015*) on US loan data showed a potentially higher risk for first-time home buyers, which the authors explained by the shorter credit history of first-time home buyers and the higher exposure at default and higher expected losses of these borrowers due to the higher loan amount (lower down payment). *Alfonzetti* (*2022*) could not capture different default risk of first-time buyers compared to other home buyers on Australian loan data (*Table 1*).

Table 1
Literature review on credit risk characteristics of first-time home buyers

Author	Sample (Geographical scope, period)	First-time home buyers' credit risk
Kelly et al. (*2014*)	**Ireland** Mortgage data as at December 2013	– **Significantly lower**, even after controlling for control variables for loan and debtors. This may be explained by a stronger commitment of debtors to their place of residence.
Kelly – O'Malley (*2016*)	**Ireland** Mortgage data as at December 2014	
Lazarov – Hinterschweiger (*2018*)	**United Kingdom** Loans granted between 1972 and 2016 at transaction level	
Giuliana (*2019*)	**Ireland** 2013–2017 loans, two-thirds of the mortgage loan portfolio	
Gyourko et al. (*2015*)	**USA** Federal Reserve Bank of New York's Consumer Credit Panel, transaction-level panel data covering 5 per cent of US households for mortgages granted between 2004 and 2008	– The risk for first-time home buyers may be **higher** due to a shorter credit history. – The expected loss given default is **higher** due to the higher LTV.
Patrabansh (*2015*)	**USA** Data on mortgage loans originated between 1996 and 2012	– There is **no difference** in default risk when controlling for credit, collateral and counterparty characteristics. – **First-time home buyers have a lower probability of early repayment.**
Alfonzetti (*2022*)	**Australia** Australian Prudential Regulation Authority, Reserve Bank's Securitisation System, ABS' Surveys (ISA, HILDA) Loans granted in the 3 years preceding 2017/2018 and in 2022	– First-time home buyers **do not have a higher risk**. – There could be essentially two **reasons** for this: **the higher income growth expected in the future and the inherently tighter credit conditions.** – By controlling for age, the effect of first-time home buyer status vanishes, i.e. **age matters most in subsequent delays.**

Based on the studies reviewed, several authors have shown that the credit risk of first-time home buyers is potentially lower or similar to that of other home buyers. An important limitation of impact estimates for first-time home buyer borrowers, however, is that only those clients who have entered the housing credit market under the current regulatory framework can be observed, and the necessary data for first-time home buyer status are often available only when differential regulatory treatment is in place or is introduced. For this reason, relatively little data is available on first-time home buyer status, which means that a risk estimate can only be made with considerable uncertainty, based on data from a few countries and relatively short time series, which may be considerably influenced by the different regulatory environments in the various countries, and therefore it cannot be stated with absolute certainty that the literature is valid in all countries. A more precise assessment of the credit risk of first-time home buyers and of the impact of the regulatory environment on first-time home buyers therefore requires further investigation, which could subsequently inform macroprudential policy decisions for such clients. However, measures to improve the housing situation of first-time home buyers may also be rational on social and economic grounds.

3. Current housing and housing loan market developments

House prices have risen strongly across Europe in recent years, with Central and Eastern European countries typically experiencing house price increases above the EU average. In comparison, house prices in Hungary have also risen sharply, especially in the last two years. By 2022 Q3, house prices in Hungary had risen to more than 250 per cent of their 2015 average, a level only approached by the Czech Republic, where house prices rose to 220 per cent of their 2015 average over the same period *(Table 2)*. The unprecedented price rise is explained by the favourable macroeconomic performance of recent years, a wide range of home purchase subsidies, rising construction costs, labour shortages and the rigidity of housing market supply, while market feedback suggests that inflation fears and early demand related to interest rate hikes may have also affected house prices.

The rapid rise in house prices in recent years has led to a substantial deterioration in the affordability of housing in Hungary, and the overvaluation of the housing market has reached historically high levels. The ratio of house prices to incomes has been rising since 2014, so that by 2022 H1, an average 75-square metre dwelling in most cities required more than 10 years of average net income to buy. As a result of the sustained house price increases, the estimated level of overvaluation in the housing market rose to a historically high level of around 20 per cent by 2022 Q2, which is also outstanding by international standards (*MNB 2022a*), and has not declined significantly since then (*Table 2*). However, the deteriorating macroeconomic environment in the wake of the Russia-Ukraine war, rising interest rates and

potentially tightening lending conditions may have led the housing market to the peak of its multi-year upward cycle, and looking ahead, a considerable slowdown in the housing market is expected. The importance of dynamic house price growth is enhanced by the fact that the proportion of home-owners in Hungary is also outstanding by European standards, the 3rd highest in Europe, and has remained stable in recent years.

In many cases, the rental market, with its limited development, is not a real housing alternative for households. High prices have also emerged in the rental market, making it even more difficult for young people to find housing. In 2022 Q3, Budapest was one of the 10 most expensive European capitals relative to tenants' incomes (*Table 2*), and annual rental growth is also considered high. In Hungary, the limited size of the municipal rental housing market (less than 1 per cent of the housing stock in 2021[3]) cannot compensate for the market-based rents increasing with housing prices, forcing young people to face high rents in addition to soaring house prices. High rents considerably reduce the savings opportunities of young people and increase income inequalities between groups in society that own their own property and those that do not.

It can also be observed that young people are living longer with their parents. According to the OECD 2020 survey, nearly half of 20–29 year olds in OECD countries live with their parents, while the same proportion exceeds 60 per cent in Hungary (*Cournède – Plouin 2022*). In 2019, 62 per cent of 18–34 year olds lived with their parents in Hungary, 12 percentage points more than in 2005, according to the HCSO survey.[4]

[3] https://www.ksh.hu/stadat_files/lak/hu/lak0004.html, downloaded: 12 March 2023.
[4] https://www.ksh.hu/docs/hun/xftp/idoszaki/fiatalok/atlagosan_27_evesen_koltozunk/index.html, downloaded: 3 March 2023.

Table 2
Trends in housing and credit risks in EU countries (2022 Q3)

	Housing market overvaluation (%)	Changes in house prices (2015 = 100)	Share of households living in owner-occupied housing (%)	Rent/income ratio (%)
LU	61	192	71	39
SK	41	181	92	55
SE	36	138	65	37
CZ	36	221	78	55
AT	32	176	54	24
DE	24	166	49	33
PT	22	194	78	63
NL	21	189	70	43
HU	**20**	**256**	**92**	**47**
FR	20	134	65	40
DK	16	137	59	36
LV	14	188	83	34
BE	14	136	71	30
EE	11	191	82	37
ES	9	144	76	45
BG	4	174	85	54
HR	4	162	91	45
GR	–1	NA	73	36
LT	–1	200	89	51
PL	–1	167	87	63
MT	–1	146	82	NA
SI	–2	177	76	44
FI	–2	112	70	29
IE	–6	167	70	53
IT	–8	107	74	35
CY	–11	113	70	28
RO	–18	143	95	48

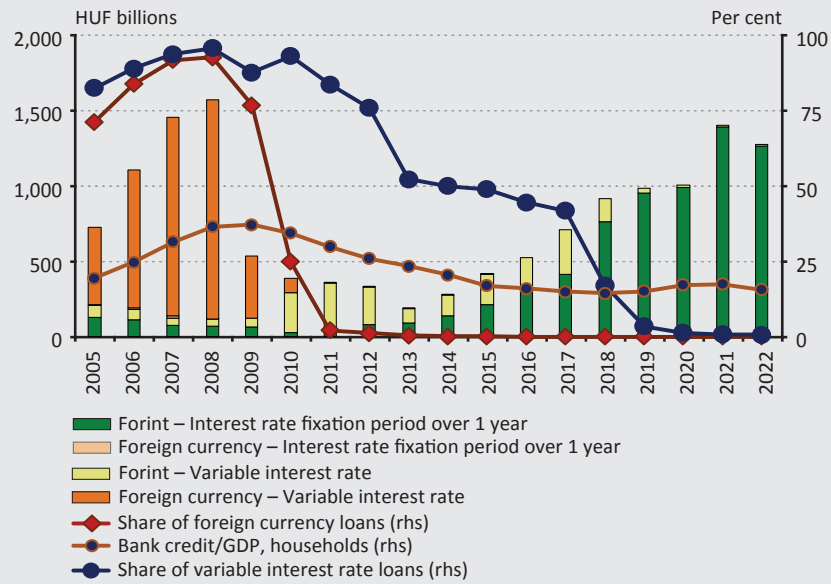
Note: Data on housing market overvaluation[5] for Slovakia, France, Lithuania and Cyprus for 2022 Q2. No data on house price changes are available for Greece. Share of owner-occupied housing for 2021; for Slovakia for 2020. The rent/income is for one-bedroom apartments. The data are not available for Malta. The red-green scale is used to indicate risk, while regarding the proportion of owner-occupied properties, high/low ratios do not indicate risk per se, thus a different scale was used.

Source: European Central Bank (ECB), Eurostat (download date: 10 January 2023), MNB

[5] Estimates of the overvaluation/ undervaluation of residential property in each EU country are based on several different valuation methods. For details, see *Jarmulska et al.* (*2022*).

Persistent overvaluation in the housing market may also lead to loan market overheatedness, which, despite the dynamic expansion of the housing loan market in recent years, cannot be identified at present. Although the amount of domestic housing loan disbursements has shown dynamic double-digit annual growth since 2014, the total amount of housing loan originations only approached the pre-2008-2009 crisis nominal level by the end of 2021, and remained below it in real terms (*Figure 2*). Despite a rapid and sustained increase in housing loan disbursements, the ratio of household indebtedness to GDP has not changed significantly in recent years, totalling to around 15–20 per cent of GDP, which is among the lowest in the EU. With a low level of retail loan portfolio to GDP, the share of home purchases financed by loans in Hungary has remained stable at between 40–50 per cent (*MNB 2022a*).

Figure 2
Trends in domestic housing loan disbursements



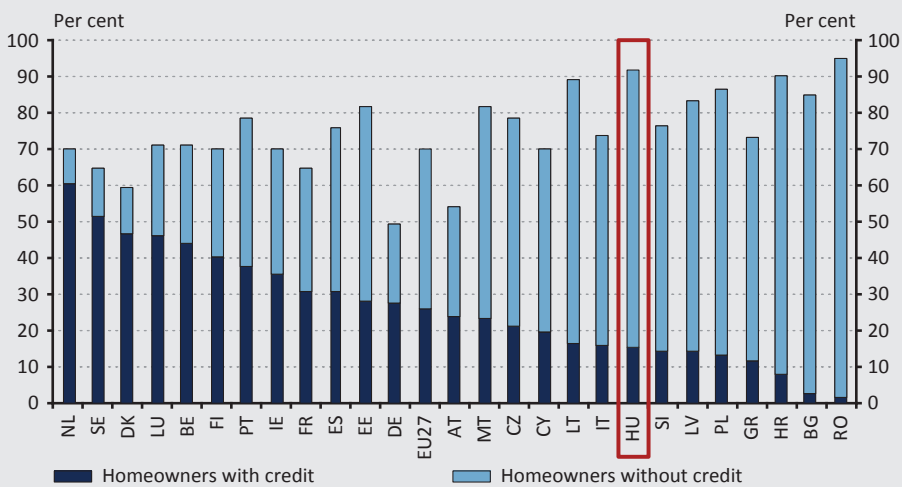
Note: Household bank loan/GDP exchange rate adjusted data based on household financial accounts.
Source: MNB

In Hungary, the share of homeowners with a housing loan is below the EU average, which may be explained by high entry barriers to the housing market.[6] In Hungary, the share of homeowners with housing loans in the total population reached 15 per cent in 2021, compared to 26 per cent in the EU27 on average, according to Eurostat

[6] The housing market entry barrier was considered to be the housing transaction costs and the minimum amount of down payment required.

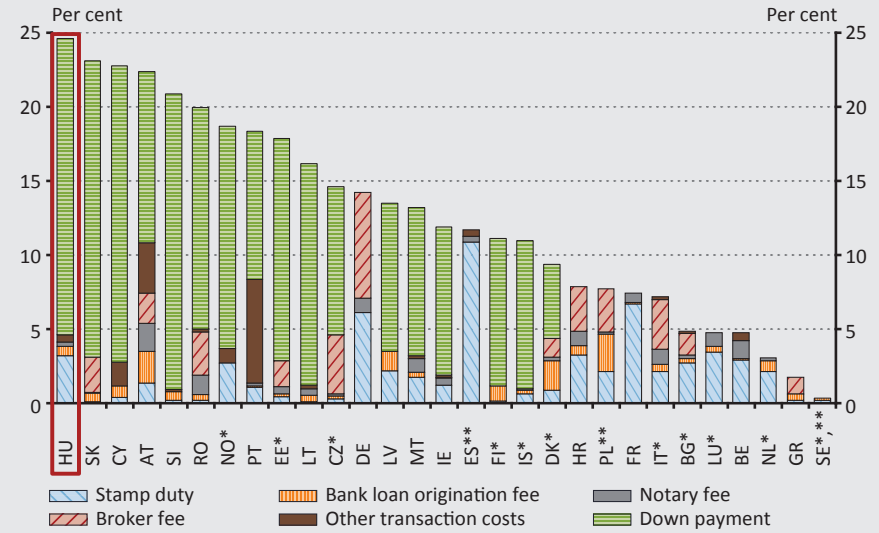
data (*Figure 3*). Low international housing loan penetration may be explained by low levels of public confidence in the financial system, general credit aversion, past adverse mortgage market experiences (e.g. foreign currency lending) and high levels of required down payments, which are also considered high internationally. Hungary ranks in the middle of European countries in terms of real estate transaction costs (*ESRB 2020*). However, the minimum down payment required is among the higher ones. Considering the required down payment and the related transaction costs together, the barriers to entry into the housing market in Hungary are among the highest in the EU, amounting to around 25 per cent of the total purchase price paid by the buyer (*Figure 4*), which may be further increased by the higher down payment requirement due to the possible shortfall in the market value of the property as determined at the loan assessment.

Figure 3
Proportion of homeowners in the EU with and without a loan in the total population (2021)



Source: Eurostat

Figure 4
Entry barriers to the housing loan market as a share of the value of an average dwelling in the EU (2019)



*Note: MNB collection with regard to the minimum required down payment. The minimum down payment required may be further increased by the difference between the purchase price paid by the buyer and the market value as determined by the loan assessment. In countries marked with *, repayments are tax deductible, depending on the marital status. For countries marked with **, no data are available on the minimum down payment required.*

Source: ESRB (2020) and MNB collection

4. The potential impact of domestic borrower-based measures on the access of young first-time home buyers to housing loans

4.1. The development of domestic borrower-based measures and their effectiveness

From 1 January 2015, the MNB became one of the first central banks in Europe to introduce binding borrower-based measures. For mortgage loans, as a general rule, the loan amount cannot exceed 80 per cent of the market value of the collateralised real estate at the time of the loan assessment[7] (LTV) and the repayment burden of the borrowers' outstanding loans cannot exceed 50 per cent of their regular and certified monthly net income (DSTI). The borrower-based limits are differentiated in terms of different dimensions based on the various risks of the exposures (*Table 3; Fáykiss et al. 2018*).

[7] Term within the meaning of Section 2(10) of MNB Decree No 32/2014. (IX. 10.) on regulation of the Debt Service-to-Income Ratios Instalment Payment and the Loan-to-Value Ratios

Table 3
Domestic borrower-based limits for mortgage loans as a general rule

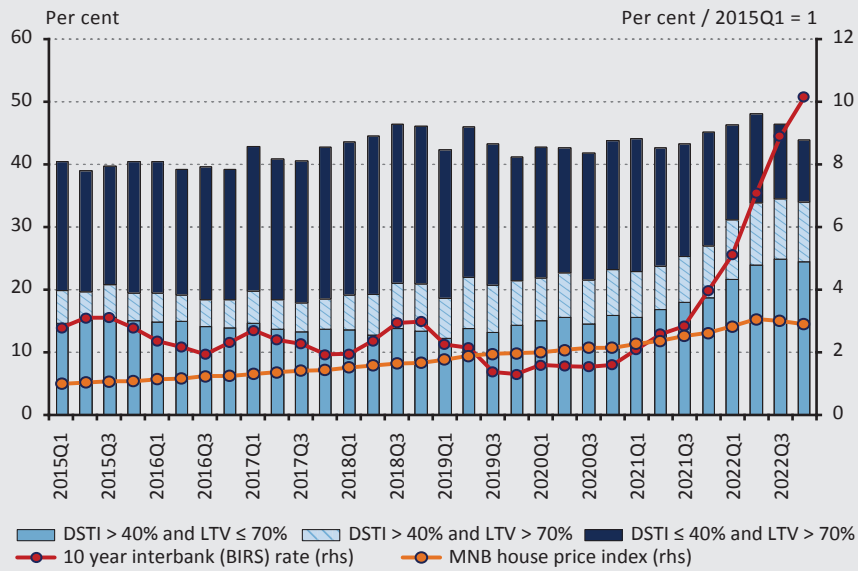
	Borrower-based measures in Hungary				European practice
	Category	HUF	EUR	Other FX	Differentiation in several dimensions
DSTI (%)	Monthly net income below HUF 600,000	50	25	10	~50 (min. 40, max. 50)*
	Monthly net income at least HUF 600,000	60	30	15	
LTV (%)	For mortgage loan	80	50	35	~85 (min. 60, max. 100)

*Note: DSTI limits effective from 1 July 2023. Regarding financial leases, 5 percentage points higher LTV limits can be applied. Lower DSTI and LTV limits apply to foreign currency loans, and lower DSTI limits apply to loans with a maturity of over 5 years and an interest period of less than 10 years. * Regulatory constraints of a net regular income-based ratios similar to the domestic ones as a general rule*

Source: MNB

Changes in the availability of loans to buy a home are well illustrated by the clustering of home loan disbursements near borrower-based limits. The clustering of housing loan disbursements around the DSTI and LTV limits (the share of loans with DSTI above 40 per cent or LTV above 70 per cent), i.e. the stretch of borrowers according to DSTI and LTV requirements, remained essentially unchanged until the end of 2021. However, from the end of 2021, the effectiveness of the DSTI requirement has become more pronounced as interest rates have risen (*MNB 2022b*). While between 2015 and 2021, around 20 per cent of new home loan disbursements were granted at a DSTI above 40 per cent, by the end of 2022 this share had reached close to 35 per cent (*Figure 5*). By contrast, there has been a gradual decline in LTV stretch, mainly explained by a reduction in loan amounts as a result of the rising interest rate environment. Thus, in recent years almost one half of new housing loan disbursements have been granted by banks to borrowers considered to be stretched in terms of DSTI or LTV requirements.

Figure 5
Share of housing loans granted near borrower-based limits



Note: By volume. 10 year interbank (BIRS) rate (%), MNB house price index (2015Q1 = 1)
Source: MNB

Typically young, first-time home buyers may be in a disadvantaged position compared to other home buyers when buying a home with a loan, as their life situation (lower current income) makes it difficult for them to raise the down payment needed to take out a housing loan. In 2015, when the borrower-based rules came into force, assuming a savings rate of 25 per cent, it was necessary to save around HUF 2.7 million for the down payment and nearly HUF 330,000 for related transaction costs (tax levied on the transfer of property, lawyer's fees, notary fees, etc.) for an average 45-square-metre, HUF 10.9 million home. To take into account the potential discrepancy between the purchase price paid by the buyer and the market value established in the loan assessment, for the minimum down payment required, we performed the calculation using a minimum down payment of 25 per cent of the purchase price of the property. The minimum total savings required to buy a home could therefore be around 28 per cent of the value of the property in 2015, which would take an average of 7.1 years to achieve, based on the average income of workers under 40.[8] By 2022, the required down payment has risen to HUF 7.3 million, the associated transaction costs to HUF 1.5 million and the required savings period to more than 10 years. In addition, due to the increase in interest rates, indebtedness with a 75 per cent LTV would already result in an

[8] The HCSO publishes the age of workers in 10-year class intervals, therefore we have calculated the earnings of those under 40.

income burden above 50 per cent, which would require other negative adaptations, for example, affecting the quality of property or further postponement of home purchase. Although the family support schemes available may improve young people's home buying chances, in the absence of external help, the opportunities for first-time home buyers, especially single people, who are not eligible for family support schemes, are severely limited (*Table 4*). The social group affected by the problem is also increasing with marriages being delayed until a later age.

Table 4
Possible financing structure for first-time home buyers buying their own home

	2015	2022
Average house price* (45 m^2; HUF)	10,900,000	29,200,000
Minimum down payment required (25 per cent of the purchase price;** HUF)	2,725,000	7,300,000
Transaction costs related to the purchase of real estate (3–5%;*** HUF)	327,000	1,460,000
Total savings needed to buy a home (HUF)	3,270,000	8,760,000
Average monthly net income for those under 40**** (without tax deductions; HUF)	142,939	287,614
Housing price/income per year (%)	6.4	8.5
Years needed to buy a home (savings rate = 25%;***** year)	7.1	10.2
Loan amount borrowed (LTV = 75%; HUF)	8,175,000	21,900,000
Average interest (10-year fixation; %)	6.4	6.9
Repayment instalment (maturity: 25 years; HUF)	54,669	152,946
DSTI (%)	38	53

*Note: * Average house prices are estimated based on the National Tax and Customs Administration (NAV) housing transaction data for urban home purchases. ** To take account of any difference between the purchase price paid by the buyer and the market value established at the loan assessment, a minimum down payment of 25 per cent was assumed. *** Property purchase tax, lawyers' fees and other transaction costs related to the purchase of real estate. For the tax levied on the transfer of property, we calculated using a 2 per cent levy for 2015 and a 4 per cent levy for 2022, due to the decreasing availability of the tax relief due to the increase in property prices. Tax relief on state-subsidised loans was not taken into account. **** The average income of potential borrowers under the age of 40 was estimated on the basis of data from the HCSO. ***** For the time required to save the down payment, a savings rate of 25 per cent was assumed.*

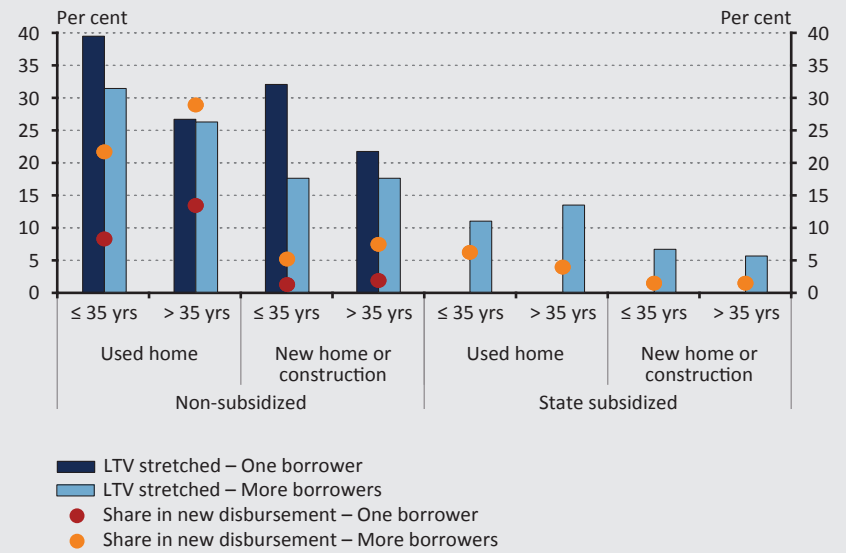
The example illustrates the impact of house price and interest rate rises in a hypothetical home purchase, but the actual effects may differ significantly depending on the characteristics of the home purchase and the borrowing.

Source: NTCA, MNB, HCSO

The asymmetric impact of the increasing need for the down payment on first-time home buyers is also indicated by the high LTV stretch of these home buyers. Looking at the distribution of housing loans with an LTV compliance above 70 per cent, which can be considered as stretched from an LTV perspective, across different client segments, we see that the share of housing loans with a low down payment in 2022 is the highest among young, under-35, single (without a co-borrower), not claiming state subsidies, presumably first-time home buyer borrowers buying used homes: while the share of LTV stretched loans is close to 20 per cent for loans with

no state subsidy and multiple borrowers with a new home purchase loan purpose, and around 30 per cent among used home buyers, the same share was close to 30–40 per cent among young borrowers borrowing alone. For state subsidised housing loans, a lower stretch of loans according to the LTV can be identified due to the loan crowding-out effect of housing subsidies, i.e. access to state subsidies can considerably reduce the amount of the down payment required. In addition, despite the lower real estate values, there is also a higher LTV stretch of used home buyers relative to new home buyers, especially among young borrowers who could potentially qualify as first-time home buyers, which may suggest that borrowers who are stretched in terms of LTV may also be forced to adapt in terms of quality, which may also slow down the renewal of the housing stock (*Figure 6*).

Figure 6
Proportion of housing loans with low down payments (LTV > 70%) by volume compared to disbursements within different client segments (2022)



Note: We considered loans granted with an LTV of over 70 per cent to be loans taken out with low down payments. Excluding loans under the Green Home Programme, without renovation and extension loan purposes. First-time home buyers tend to be in the younger age groups; therefore, we approximated this segment with the age below 35. The share in new disbursements indicates the share in total 2022 disbursements of each client category shown (e.g. clients aged 35 or less, buying a used home, with unsubsidised loans).

Source: MNB

4.2. Number and characteristics of the domestic first-time home buyer client segment

Determining the number of first-time home buyers and their share in the housing loan market is only possible with significant uncertainty. Based on the ESRB's *recommendation* on closing real estate data gaps,[9] the MNB has been collecting data on the first-time home buyer status of housing loan borrowers based on the optional self-declaration in the framework of the central bank's loan register data service since July 2021. In addition to the information available in the central bank's loan register, data on the potential share of first-time home buyers are also available from market real estate agents for all home buyers, regardless of whether or not they financed their purchase with a loan. According to the central bank's loan register, borrowers declared their first-time home buyer status[10] for around 35 per cent of bank housing loans granted in 2022, representing nearly 25,000 contracts. However, among the clients who made a declaration, construction and state-subsidised loans represent a negligible share; therefore, the data available for these types of loans cannot be considered representative, and these transactions were eliminated from the loans examined. After data cleansing, the resulting sample database covers 22 per cent of bank housing loans granted in 2022, representing around 16,000 transactions.

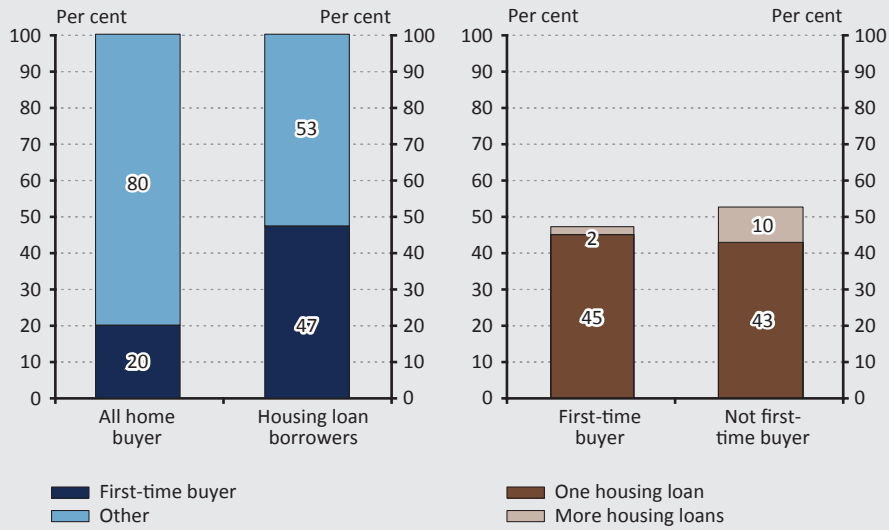
Based on the data of borrowers who made a declaration, the share of first-time buyers among new borrowers is estimated to be around 47 per cent. This is more than double the proportion of first-time home buyers among all home buyers, estimated at around 20 per cent according to real estate agents.[11] The over-representation of first-time home buyers in the central bank's loan register data may be explained by the higher loan market participation of first-time home buyers due to their lower down payment and the higher willingness of first-time home buyers to declare compared to other home buyers.

To check the data quality of declarations of first-time home buyer status, we also examined the proportion of those taking out their first housing loan as a function of their declaration of first-time home buyer status. Around 95 per cent of clients declaring themselves as first-time home buyers actually had only one or same-day housing loans, confirming the reliability of client declarations of first-time home buyer status. However, 43 per cent of new housing loans clients who also had a single housing loan did not identify themselves as first-time home buyers. These clients are likely to have already bought a home on their own without taking out a loan, or to have already repaid a loan on their previous home purchase. Overall,

[9] Based on the ESRB's 2016 Recommendation on closing real estate data gaps and its 2019 amendment.
[10] Excluding bank loans collateralised by residential property, excluding loans from building societies.
[11] Based on DunaHouse Barometer data: https://dh.hu/en/barometer

however, the identification of first-time home buyers based on currently available lending data is only possible with significant uncertainty (*Figure 7*).

Figure 7
Hypothetical share of first-time home buyers among all home buyers and housing loan borrowers (left panel) and distribution of housing loan borrowers* by the number of their housing loans (right panel) (2022)



*Note: *For housing borrowers, based on a sample covering 22 per cent of new bank housing loan disbursements. First-time housing loan borrowers were defined as those with a single housing loan or a housing loan taken out on the same day. Individual and data quality factors may explain first-time home buyers with multiple housing loans.*

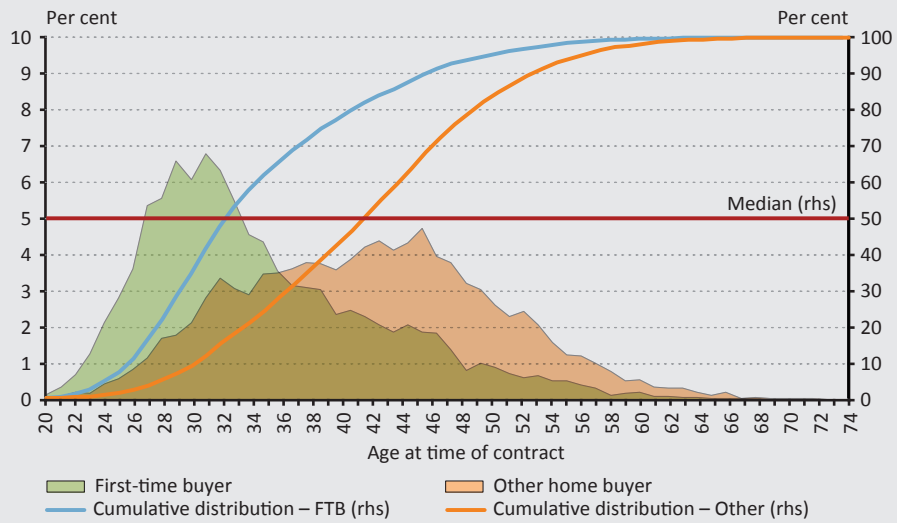
Source: MNB, Duna House Barometer

Although the share of first-time home buyer clients in new housing loan disbursements can only be estimated with significant uncertainty, the characteristics of each client segment (first-time home buyer or other) can be considered representative. This is supported by the fact that the average values of the main characteristics (loan amount, maturity, APRC, DSTI, LTV, etc.) calculated on the basis of the available sample database data typically differ from the average values of total disbursements by less than 5 per cent, with loans with low APRs being slightly over-represented among respondents, but this does not considerably affect the conclusions of our analysis.

Based on available data, we expect that the vast majority of first-time home buyers will be in the under-35 age group. The median age of these clients is 32 years, about 10 years less than the median age of other clients. However, the age distribution of first-time home buyers is more skewed to the right, with a significant weight of older

people among those claiming to be first-time home buyers, which may suggest that a proportion of borrowers are able to buy their first home only with a significant time lag compared to the average (*Figure 8*). Identifying young first-time home buyers – also bearing this in mind – solely on the basis of the age of the borrowers is also only possible with significant uncertainty and type II error.

Figure 8
Age distribution of housing loan disbursements among first-time home buyers and other clients (2022)



Note: By number of contracats, based on a sample covering 22 per cent of new bank housing loan disbursements.

Source: MNB

Self-reported first-time home buyers are, on average, younger than non-first-time home buyers, borrow smaller and longer-term loans at slightly higher average APRCs, have lower earnings, higher LTV stretch but similar DSTI compliance, buy used homes at a slightly higher rate, and are more likely to be single borrowers without a co-borrower. The DSTI value of first-time home buyers' housing loans at the time of loan assessment is similar to the value of housing loans of non-first-time home buyers, but the aggregate monthly net income of these borrowers for the DSTI calculation is HUF 596,000 on average, HUF 142,000 lower than that of other non-first-time home buyers. In line with preliminary expectations, first-time home buyers borrow more than the value of their collateral, resulting in an average LTV that is 7 percentage points higher than for non-first-time home buyers. Overall, despite the lower earnings, first-time home buyers provide an average of HUF 13 million down payment for their home purchases, while non-first-time home

buyers provide an average of HUF 21 million. Clients who identify themselves as first-time home buyers are buying properties of similar size compared to other buyers on average, meaning that no significant negative adaptation in terms of floor area can be identified for the time being.

For first-time home buyers aged 35 and over who are likely to be particularly affected by the borrower-based measures, the share of single borrowers without a co-borrower is considerably higher, by 7 percentage points, than for first-time home buyers aged under 35. This draws attention to the less favourable access to housing loans for single clients (*Table 5*). The same may be confirmed by the fact that the average per capita income of single first-time home buyers without a co-borrower is about one and a half times the per capita income of first-time home buyers with a co-borrower, which means that only borrowers with above-average income may be able to borrow on their own, which may further delay the ability of first-time home buyers to purchase a home.

Table 5
Main characteristics of first-time home buyer and non-first-time home buyer clients (2022)

	First-time home buyer (≤ 35 years)	First-time home buyer (>35 years)	First-time home buyer (total)	Not a first-time home buyer
Median age (year)	29	42	32	42
Share of buyers without co-borrower (%)	34	41	37	37
Share of second-hand home buyers (%)	94	94	94	92
Average loan volume (HUF million)	16	18	17	19
Average maturity (year)	19	19	19	18
Average APR (%)	7.4	7.1	7.3	7.1
Average PTI (%)	33	32	33	33
Ratio of loans granted with a DSTI above 40 per cent (%)	25	25	25	26
Average DSTI-income (HUF thousand)	574	631	596	738
Average LTV (%)	56	52	54	47
Ratio of loans granted with an LTV above 70 per cent (%)	28	24	27	17
Average dwelling size (m^2)	75	79	77	81
Average market value* (HUF million)	29	34	31	40
Average down payment * (HUF million)	13	16	14	21

*Note: Based on a sample covering 22 per cent of new bank housing loan disbursements. *Estimated value based on the LTV value reported by credit institutions.*

Source: MNB

However, when analysing the situation of first-time home buyers, it should be underlined that only clients who are creditworthy in the current credit and economic environment and presumably have above average income and savings opportunities can be tracked in the central bank's loan register. That said, there may also be an increasing number of clients who, as a result of inflation, rising interest rates and overvaluation in the housing market, no longer have the minimum savings or income to borrow a housing loan and are therefore being priced out of the housing loan market.

5. International regulatory trends supporting housing opportunities for first-time home buyers

5.1. International practice on preferential terms for first-time home buyers

The impact of borrower-based measures on first-time home buyers is being mitigated in many countries through the introduction of preferential rules. There are different ways of defining debtors who are eligible for preferential treatment as first-time home buyers: most countries typically link first-time buyer status to a home ownership condition (Finland, Iceland, Romania, Malta) or to the absence of prior borrowing (Belgium, Ireland, Luxembourg, Malta). In Portugal and Slovenia, first-time home buyers are considered buyers who take out a loan to buy a property as their primary residence, while in the Czech Republic and Estonia the preferential treatment is linked to the age limit of 36 and 35, respectively.

Supporting first-time home buyers' access to housing by setting higher LTV limits within the borrower-based requirements is the most common. Preferential treatment of the target group concerned means applying LTV limits 5–10 percentage points higher, typically in the 85–95 per cent range (Finland, Iceland, Romania, Ireland, Portugal, Malta, Czech Republic, Estonia). In Luxembourg, first-time home buyers have access to loans with a 100 per cent LTV limit, while in Slovenia they must comply with a more restrictive preferential limit of 80 per cent, compared to the general limit of 70 per cent. In Belgium, a general LTV limit of 90 per cent is recommended for mortgage lending, with 20 per cent speed limit up to a maximum LTV of 100 per cent; however, as regards first-time home buyers, the macroprudential authority allows a higher limit of 35 per cent within the maximum lending compared to the general 20 per cent "speed limit" for home purchases for own use, and considers loans above 100 per cent LTV up to 5 per cent of the lending to be acceptable.

The higher loan amount available can increase the income stretch of first-time home buyers, which is why several countries (Ireland, Slovakia) tolerate exceeding the income limits required to take out a loan, allow higher limits (Iceland, Ireland, Czech Republic, Slovakia) or exempt them (Malta) from the rules (*Table 6*).

Table 6

International practice of preferential borrower-based limits for first-time home buyers

	Prerequisite for a first-time home buyer preferential treatment				NORMAL LIMIT	PREFERENTIAL LIMIT
	Real estate ownership	Housing loans	Residence	Age and family status		
FI	None	–	–	–	• **LTV: 85%**	• **LTV: 95%**
IS	None	–	–	–	• **LTV: 80%** • **DSTI: 35%**	• **LTV: 85%** • **DSTI: 40%**
RO	None	–	–	–	• **LTV: 85%**	• **LTV: 95%** (in the case of "Noua Casa" guarantee)
MT*	None	–	–	–	• **LTV: 75%** (regardless of value limit) • **DSTI: 40%** • **maturity limit of 25 years or up to retirement age**	• **LTV: Above EUR 175,000 loan amount 90 per cent** (which may be exceeded for 10 per cent of disbursement) **/no LTV below this amount** • **DSTI: No limit below EUR 175,000 loan amount**/ 40 per cent limit above this amount • **Maturity limit of 40 years or up to retirement age**
BE	None and never was	–	–	–	• **LTV: 90%** (max. 20 per cent of disbursements may exceed 100 per cent LTV)	• **35 per cent of disbursements may exceed 90 per cent LTV up to 100 per cent, 5 per cent may exceed 100 per cent LTV**
IE	None and never was	–	–	–	• **LTV: 90 per cent** for second and subsequent home purchases; **70 per cent** for buy-to-let home purchases • **LTI: 3.5** for second and subsequent purchases, and for buy-to-let purchases	• **LTV: 90%** • **LTI: 4** (which may be exceeded for 15 per cent of disbursements)
LU	None and never was	–	–	–	• **LTV: 90%** for owner-occupied; **80%** for buy-to-let	• **LTV: 100%**
PT	–	–	Permanent	–	• **LTV: 80%**	• **LTV: 90%**
SI	–	–	Permanent	–	• **LTV: 70%**	• **LTV: 80%**
CZ	–	–	Permanent	Under 36 years	• **LTV: 80%** • **DSTI: 45%** • **DTI: 8.5**	• **LTV: 90%** • **DSTI: 50%** • **DTI: 9.5**
SK	–	–	–	Under 41 years	• **DTI:** over 41 years **7.75 to 5.25 tightening**	• **DTI: 8, under 41 years** (which may be exceeded for 5 per cent of disbursements up to 9)
EE	–	–	–	Parents under 35 (or 40) raising one (or more) child(ren) under 16 or a specified worker under 35*	• **LTV: 85%**	• **LTV: 90%** (if guaranteed by KredEx)

*Note: *In the case of Malta, the LTV limit is 90 per cent even if the borrower is not a first-time home buyer, but the property is used as a primary residence and there is no outstanding housing loan.*

Source: ESRB, MNB, national websites – based on February 2023 data

The potentially higher loss given default due to the higher credit exposure as a result of the preferential requirements for first-time home buyers can be mitigated by setting up mortgage insurance or public guarantee funds. Mortgage insurance products, known internationally but currently unavailable in the Hungarian market, provide lenders with insurance cover in the event of default on their mortgage loans. The scheme could be a way to reduce the risk of default, but would require significant capital from insurers, making it difficult to ensure the maintenance of such products on a market basis. Public engagement may therefore be necessary to ensure the viability of the concept, which could take the form of a guarantee or assumption of premium payments by the state.

In addition to mortgage insurance, guarantee funds for housing loans can also be set up to ensure that home buyers can obtain loans with lower down payments and interest rates. A guarantee usually provides security for the amount of the loan not covered by the collateral, and thus the level of down payment required can be reduced for guaranteed loans, as fewer client funds do not increase the bank's expected losses. There are examples of housing loans with a state guarantee in several countries, such as the Netherlands, Finland and France. In addition, Estonia, Latvia and Romania have 5–10 percentage points higher LTV limits for loans that are guaranteed.

5.2. Possible applications in Hungary

In line with international practice, a differentiated increase in the LTV limits may be the most appropriate way to provide preferential treatment for typically young first-time home buyers in the domestic borrower-based framework. For first-time home buyer borrowers, the LTV requirement is typically the effective limit. However, due to the potentially lower probability of default of young first-time home buyers, a differentiation of the DSTI requirement could also be considered. However, to date, the higher income burden of young housing loan borrowers compared to other borrowers has not been identified.

An LTV limit that is 5 to 10 percentage points higher could reduce the down payment needed to buy a home and thus the savings period needed to buy a home by three quarters or even half. This would greatly improve young people's chances of obtaining a home, while the higher loan amounts that would become available would not lead to excessive indebtedness or a significant increase in the probability of default due to the already limited income stretch under the DSTI rules. Similar to international examples, Hungary may also consider linking the use of preferential LTV limits to state guarantees or mortgage insurance in order to mitigate the potential increase in loss given default.

The situation of first-time home buyers could also be improved by less targeted, but also internationally applied, exemption rules exempting a specific part of the disbursement from the borrower-based measures. These allow a certain proportion of new loans to exceed the general regulatory limits, giving lenders more flexibility in their lending. Although such portfolio-limit-type speed-limit regulation is typically not directly aimed at preferential treatment of first-time home buyers, but rather at improving the flexibility of the borrower-based framework in general, it can also be a suitable tool to improve access to the loan market for first-time home buyers.

The preferential treatment of first-time home buyers in the context of borrower-based requirements poses significant operational challenges. While a wide range of international practices can be identified in relation to the potential target group, when identifying first-time home buyers, age, previous home ownership and an existing housing loan may be the main factors to consider. The introduction of potential regulatory preferential terms could achieve the desired effect if they could be incorporated into the housing lending process in a way that minimises the scope for circumvention, but is flexible and does not considerably complicate the borrowing process. In particular, this requires rapid, automated, electronic access to the data needed to determine first-time home buyer status. This could be best facilitated by the digitisation of land registers, the early completion of the e-land registry project and the development of easier, automated banking access to detailed, expanded land registry data. There are currently a number of barriers to obtaining data on the fact of first-time home buying, as land registry data is currently difficult to search and query as to whether a particular owner has previously owned a home; therefore, borrowers can only be identified on the basis of their declaration, age or outstanding housing loans with considerable uncertainty and significantly slowing the loan approval process.

However, the preferential treatment of first-time home buyers may also have the potential to increase risks in the real estate market. Therefore, the timing of its possible introduction justifies particular attention. A preferential LTV limit for first-time home buyers could potentially increase credit risks via higher loan amounts available to creditworthy new home buyers and already creditworthy home buyers, and could lead to increased housing market demand. In the absence of a similar adjustment in housing market supply (for a detailed analysis of the reasons for low housing market supply, see the MNB's housing market reports[12]), stronger housing market demand could further increase house prices and the already high level of housing market overvaluation. However, borrowers exiting the rental market may reduce rental yields and thus demand in the investor housing market (*Hosszú et al. forthcoming*).

[12] https://www.mnb.hu/en/publications/reports/housing-market-report

Because of these factors, the preferential treatment of first-time home buyers under the borrower-based framework requires particular attention to housing and loan market risks and the cyclical situation of the loan market. Further research is needed to more accurately identify and quantify the potential benefits and risks of preferential treatment for first-time home buyers, which could be facilitated by the gradually expanding data set of the central bank's loan register. However, in the current risk environment, the potential risks of regulatory changes to boost housing market demand may outweigh their benefits.

6. Conclusion

Experience in recent years shows that borrower-based instruments have proven effective in preventing excessive household indebtedness, but can significantly limit access to loans and housing for first-time home buyers, who are typically young clients. These clients find it more difficult to meet the minimum income and down payment requirements set by the borrower-based measures, mainly because of their low savings due to their age, especially if they are single and not eligible for family support schemes. In Hungary, around 30–40 per cent of non-state-subsidised loans to borrowers under 35 years of age were granted by banks close to the LTV limits, which is around twice the share for the over-35 age group and almost four times the share of state-subsidised lending. The risk of first-time home buyer clients may be lower than other home buyers due to their higher willingness to pay as a result of their home-buying objective and their faster income growth compared to other borrowers, and their exclusion from the housing market may have considerable negative social and economic consequences. This may be mitigated by their preferential treatment under the borrower-based measures, of which there are many international examples.

We estimate that in 2022, the share of young, first-time home buyers in the housing loan market in Hungary could be around 50 per cent. This share may be around twice their share of total home purchases financed by loans and not by loans, indicating the low possibilities of these clients to buy a home with own funds. Our analysis shows that borrowers who identify themselves as first-time home buyers are younger, borrow smaller amounts for longer terms, have lower incomes, higher LTV stretch, but similar DSTI compliance compared to non-first-time home buyers. For first-time home buyers aged 35 and over, who are presumably particularly affected by the borrower-based measures, the share of single borrowers without a co-borrower is considerably higher, by 7 percentage points, than for first-time home buyers aged 35 and under, which may indicate less favourable access to housing loans for single clients.

In the context of domestic regulation, possible preferential treatment of young first-time home buyers could be considered, similar to international practices, primarily through the introduction of higher LTV limits. In terms of domestic borrower-based measures, there has been an increased clustering of young borrowers close to regulatory limits, especially for LTV limits, although DSTI limits have also become increasingly effective over the past year as interest rates have risen. Potentially higher loss given default of larger exposures resulting from preferential LTV limits could be mitigated by the remaining DSTI limits, the provision of state guarantees or the development of loan insurance schemes similar to international examples. However, given the current significant overvaluation in the housing market, the introduction of a preferential LTV limit for first-time home buyers could only be considered if the potential additional risks arising from this are offset in other areas (e.g. through complex public programmes).

Preferential treatment of first-time home buyers in the context of the borrower-based requirements could have the desired effect if it could be incorporated into the housing lending process in a flexible way that does not considerably complicate the borrowing process. In particular, this would require the development of rapid and up-to-date electronic access to the data needed to determine first-time home buyer status. The most obvious solution would be to digitise land registers and improve their accessibility and extend their content.

LTV limits potentially 5–10 percentage points higher would considerably mitigate the housing difficulties of young first-time home buyers in Hungary, but could also have unintended second-round effects, and therefore the timing of their potential introduction is crucial. Higher LTV limits could reduce the down payment requirement for young first-time home buyers by three quarters or even by one half, generating significant additional housing market demand, which, in the absence of a similar adjustment in housing market supply, could lead to further house price increases and a further rise in the already high level of housing market overvaluation.

However, further research is needed to more accurately identify and quantify the potential advantages and disadvantages of potential preferential treatment of young first-time home buyers, which may be supported by the growing data set of the central bank's loan register.

References

Akinci, O. – Olmstead-Rumsey, J. (2015): *How Effective are Macroprudential Policies? An Empirical Investigation*. International Finance Discussion Paper 1136. https://doi.org/10.17016/IFDP.2015.1136

Alfonzetti, M. (2022): *Are First Home Buyer Loans More Risky?* Reserve Bank of Australia Bulletin, March. https://www.rba.gov.au/publications/bulletin/2022/mar/pdf/are-first-home-buyer-loans-more-risky.pdf

Andrews, D. – Sánchez, A.C. – Johansson, Å. (2011): *Housing markets and structural policies in OECD countries.* OECD Economics Department Working Papers No 836. https://doi.org/10.1787/5kgk8t2k9vf3-en

Bekkum, S. – Gabarro, M. – Irani, R. – Peydro, J. (2019): *Take It to the Limit? The Effects of Household Leverage Caps*. Working Papers 1132, Barcelona Graduate School of Economics. https://doi.org/10.2139/ssrn.3284670

Buch, C.M. – Goldberg, L. (2016): *Cross-border prudential policy spillovers: How much? How important? Evidence from the international banking research network.* Working Paper 22874, National Bureau of Economic Research. https://www.doi.org/10.3386/w22874

Carpantier, J. F. – Olivera, J. – Van Kerm, P. (2018): *Macroprudential policy and household wealth inequality.* Journal of International Money and Finance, 85(July): 262–277. https://doi.org/10.1016/j.jimonfin.2017.11.009

Causa, O. – Pichelmann, J. (2020): *Should I stay or should I go? Housing and residential mobility across OECD countries*. OECD Economics Department Working Papers, No. 1626, OECD Publishing, Paris. https://doi.org/10.1787/d91329c2-en

Causa, O. – Woloszko, N. (2020): *Policy Considerations on Housing, Wealth, and Inequality*. Cityscape, 22(3): 339–364. https://www.huduser.gov/portal/periodicals/cityscpe/vol22num3/ch17.pdf

Cerutti, E. – Claessens, S. – Laeven, L. (2015): *The Use and Effectiveness of Macroprudential Policies: New Evidence*. IMF Working Papers, 2015(061). https://doi.org/10.5089/9781498321051.001

Claessens, S. – Ghosh, S.R. – Mihet, R. (2014): *Macro-Prudential Policies to Mitigate Financial System Vulnerabilities*. IMF Working Papers, 2014(155). https://doi.org/10.5089/9781498319546.001

Cournède, B. – Plouin, M. (2022): *No Home for the Young? Stylised Facts and Policy Issues.* OECD Housing. https://www.oecd.org/housing/no-home-for-the-young.pdf. Downloaded: 10 February 2022.

Dettling, L.J. – Kearney, M.S. (2014): *House prices and birth rates: The impact of the real estate market on the decision to have a baby.* Journal of Public Economics, 110(February): 82–110. https://doi.org/10.1016/j.jpubeco.2013.09.009

ESRB (2020): *A Review of Macroprudential Policy in the EU in 2019.* European Systemic Risk Board, April. https://www.esrb.europa.eu/pub/pdf/reports/review_macroprudential_policy/esrb.report200429_reviewofmacroprudentialpolicy_sf~ac314fead6.en.pdf. Downloaded: 23 February 2022.

Fáykiss, P. – Palicz, A. – Szakács, J. – Zsigó, M. (2018): *Experiences of Debt Cap Regulations in Hungarian Retail Lending*. Financial and Economics Review, 17(1): 34–61. http://doi.org/10.25201/FER.17.1.3461

Frost, J. – van Stralen, R. (2018): *Macroprudential policy and income inequality*. DNB Working Paper No. 598, May. https://doi.org/10.2139/ssrn.3191868

Gabriel, S. – Painter, G. (2020): *Why affordability matters.* Regional Science and Urban Economics, 80, 103378. https://doi.org/10.1016/j.regsciurbeco.2018.07.001

Georgescu, O.M. – Martín, D.V. (2021): *Do Macroprudential Measures Increase Inequality? Evidence from the Euro Area Household Survey*. ECB Working Paper No. 2021/2567, June. https://doi.org/10.2139/ssrn.3870018

Giuliana, R. (2019): *Have First-Time Buyers continued to default less?* Central Bank of Ireland, Financial Stability Notes, Vol. 2019, No. 14. https://www.centralbank.ie/docs/default-source/publications/financial-stability-notes/no.-14-have-first-time-buyers-continued-to-default-less.pdf?sfvrsn=7

Gyourko, J. – Lee, D. – Tracy, J. (2015): *First-Time Homebuyers: The Role of Thin Credit Files.* Working paper, Wharton. https://www.frbsf.org/economic-research/wp-content/uploads/sites/4/S01_P1_JoeTracy.pdf. Downloaded: 20 January 2023.

Guvenen, F. – Karahan, F. – Ozkan, S. – Song, J. (2021): *What do data on millions of US workers reveal about lifecycle earnings dynamics?* Econometrica, 89(5): 2303–2339. https://doi.org/10.3982/ECTA14603

Hosszú, Zs. – Borsos, A. – Mérő, B. – Vágó, N. (forthcoming): *Comprehensive evaluation of borrower-based macroprudential policies with a high-resolution agent-based model*. Working Paper, Magyar Nemzeti Bank.

IMF-FSB-BIS (2016): *Elements of Effective Macroprudential Policies – Lessons from International Experience.* 31 August. https://www.bookstore.imf.org/images/IMF_FSB_BIS_2016.pdf. Downloaded: 5 November 2022.

Jarmulska, B. – Bandoni, E. – Lang, J.H. – Duca, M.L. – Perales, C. – Rusnák, M. (2022): *The analytical toolkit for the assessment of residential real estate vulnerabilities.* European Central Bank, Macroprudential Bulletin, No. 19, 10 October. https://www.ecb.europa.eu/pub/financial-stability/macroprudential-bulletin/html/ecb.mpbu202210_2~7f1ad6fa2d.en.html

Kelly, R. – O'Malley, T. – O'Toole, C. (2014): *Do First Time Buyers Default Less? Implications for macro-prudential policy.* Economic Letters, Central Bank of Ireland, Vol. 2014, No 14. https://www.centralbank.ie/docs/default-source/publications/economic-letters/economic-letter---vol-2014-no-14.pdf?sfvrsn=8

Kelly, R. – O'Malley, T. (2016): *The good, the bad and the impaired: A credit risk model of the Irish mortgage market.* Journal of Financial Stability, 22, 1–9. https://doi.org/10.1016/j.jfs.2015.09.005

Martin, P. – Philippon, T. (2017): *Inspecting the Mechanism: Leverage and the Great Recession in the Eurozone*. American Economic Review, 107(7): 1904–1937. https://doi.org/10.1257/aer.20150630

McDonald, C. (2015): *When is macroprudential policy effective?* BIS Working Papers No 496, March. https://www.bis.org/publ/work496.pdf

MNB (2022a): *Housing Market Report – November 2022.* Magyar Nemzeti Bank. https://www.mnb.hu/letoltes/laka-spiaci-jelente-s-2022-november-eng.pdf

MNB (2022b): *Macroprudential report – 2022*. Magyar Nemzeti Bank. https://www.mnb.hu/letoltes/makroprudencialis-jelentes-2022-eng.pdf

Mulder, C.H. – Billari, F.C. (2010): *Homeownership Regimes and Low Fertility.* Housing Studies, 25(4): 527–541. https://doi.org/10.1080/02673031003711469

Lazarov, V.S. – Hinterschweiger, M. (2018): *Determinants of distress in the UK owner-occupier and buy-to-let mortgage markets.* Bank of England Working Papers, No. 760. https://doi.org/10.2139/ssrn.3272837

Lentner, Cs. – Novoszáth, P. – Sága, J. (2017): *A magyar családpolitika és a születésszám alakulásának egyes kiemelt területei demográfiai, szociológiai és állampénzügyi vetületben, nemzetközi kitekintéssel* (*Special aspects of the formation of the Hungarian family policy and the birth rates in demographic, sociological and public finance context, with international perspectives*). Magyar Közigazgatás, 2017(4): 106–133. https://folyoirat.ludovika.hu/index.php/ppbmk/article/view/2885/2140

Patrabansh, S. (2015): *The Marginal Effect of First-Time Homebuyer Status on Mortgage Default and Prepayment*. FHFA Working Paper 15-2. https://doi.org/10.2139/ssrn.2628835

The Concept of Financial Stability in Theory and Law*

János Kálmán

State intervention in the functioning of the economy is necessarily based on some public interests, which may serve as a reason for restrictive state action against the individual, or their freedoms and rights. In legislation, financial stability can be identified as a form of public interest, whereby the need to define the substance of the concept is expressed as an expectation towards the legislator, all the more so because it forms the basis of significant administrative intervention of the public authority type. The study analyses how the concept of financial stability appears in the literature, in legislation and in legal enforcement. Although the concept of financial stability is strongly reflected in the theoretical literature and even in legislation and legal enforcement, its substance is difficult to capture and has evolved constantly. In view of the above, the author offers a definition for the general legal concept of financial stability.

Journal of Economic Literature (JEL) codes: K1, K20

Keywords: state intervention, public interest, macroprudential policy, financial stability

1. Introduction

Economic and financial crises can trigger major social problems, as illustrated by the global financial crisis that erupted in 2007, which set in motion a significant wave of legislation in many states and in the European Union. The focus was on creating the necessary legal instruments to restore and maintain the stability of the financial system, while at the same time broadening the scope of state intervention. As regards the supervisory authorities, i.e. the public authorities exercising public authority control over the financial system, *one of the major achievements of crisis legislation was the expansion of the toolkit for macroprudential regulation and supervision*.

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

János Kálmán: Széchenyi István University, Assistant Lecturer. Email: kalman.janos@sze.hu

The study was carried out in the framework of a grant awarded by the Pallas Athéné Domus Meriti Foundation under its Decision 37/2022 (23.05.).

The first version of the Hungarian manuscript was received on 16 January 2023.

DOI: https://doi.org/10.33893/FER.22.2.54

Macroprudential policy is a sector of the economy and a set of administrative, systemic, comprehensive tools of intervention for the operation of the financial intermediary system; it can be understood *as the enforcement of the public interest* in terms of promoting and maintaining financial stability, averting threats, and, in part, managing any systemic risks that emerge. It follows that macroprudential policy is, first and foremost, a set of *ex ante* instruments, which is also characterised by primary responsibility in that its main focus is to prevent systemic risks from emerging or becoming harmful, in the interest of avoiding financial crises and mitigating losses to the real economy. However, in a period of imbalance in the financial intermediary system, i.e. *ex post*, its instruments are complementary to crisis management tools such as *resolution, lending of last resort, public rescue packages, deposit insurance and investor protection*. Thus, as sets of economic management tools, macroprudential policy and crisis management intervene in the operation of the economy when they "perceive" a threat to financial stability.

However, the decade of strong growth following the global financial crisis is over, and a number of risks can be identified that also are or could be a threat to the stability of the financial system. Such risks include the problems of high inflationary environment, the unforeseen economic consequences of the war in Ukraine, the effects of the COVID-19 pandemic, the risks involved in FinTech companies, or the steady emergence of cryptocurrencies. The mounting risks are already triggering events, such as in the case of the second largest bank failure in US history, that of Silicon Valley Bank. They underline the need for a potent, well-functioning system of administrative instruments to identify and manage the risks surrounding the financial intermediary system.

Striking the delicate balance between public and private interests is the task of the legal system. The most important expectation of a strong administrative system is that is should enforce the rule of law in public administration[1] and ensure that all members of society are protected by law. Describing and defining the substance of public interest that warrants state intervention, including financial stability, the subject of this study, is a means of enforcing the rule of law and ensuring legal protection, and at the same time, an expectation for the legislator (*Kukorelli 2020:27*). However, this expectation for the legislator can only be stated in recognition of the necessarily prominent role of regulatory bodies in the interpretation of the concept.

The aim of this study is to examine the concept of financial stability in theory and law. To this end, in four conceptual units, it provides an analysis of how the concept of financial stability appears, first, in the literature; second, in legislation; and third,

[1] The requirement of lawfully functioning public administration has become increasingly valued since the 19th century, and today it is an absolute prerequisite for the democratic rule of law (*Fábián 2021:51*).

in legal enforcement; finally, in the concluding part, in pursuit of a description of public interest that gives rise to public intervention, seeking to identify the common conceptual aspects appearing in the literature and in legislation as well as in the definitions used by regulatory bodies, a proposal is made for financial stability to be rethought and defined in substance.

2. Efforts to define the concept of financial stability in literature

Financial stability is one of the most "used" concepts in public policy and scientific reasoning, but its substance remains uncertain. The term emerged in the aftermath of the financial crises of the 1990s in technical and scientific discourse – chiefly concerning economics – within specialised financial institutions (*BIS 1986*) and beyond (*Crockett 2000; Das et al. 2004; Horváth et al. 2002; Mérő 2003; Lublóy 2004; Arner 2007*).

In terms of the concept and substance of financial stability, no professional or scientific consensus has been reached, and the concept has evolved constantly as a result of financial crises and also over time. The substance of the concept has also been influenced by the scientific and public policy debate on whether supervisory powers over the financial intermediary system are supposed to be placed in the central bank or in an independent administrative body (*Oosterloo – de Haan 2004:257; Toniolo – White 2015:5*)

However, the global economic crisis also transformed the instruments of state intervention in the financial intermediary system, in view of which, in order to define the concept of financial stability, a research group was set up within the Bank for International Settlements (BIS) in 2011, which provided a summary of the basic issues related to the concept in the Ingves report (*BIS 2011*). The report divides the definitions of financial stability into five groups. The first group includes concepts that define financial stability by describing its preconditions (*Hunter et al. 2006:9*). The second group includes those seeking to define financial stability from a negative perspective by defining financial instability (*Mishkin 1997:62; Mishkin 1999:6; Allen 2005*). The third group includes concepts that already seek to define financial stability in positive terms; in the case of this group, financial stability is basically described in terms of a smoothly functioning financial system (*Duisenberg 2001*). According to the concepts in the fourth group, financial stability can be grasped in terms of the robustness to shocks, the ability of the financial system to perform its main functions, such as intermediation, the execution of payment transactions, and the management of risks, even in times of stress (*Padoa-Schioppa 2002; Phan et al. 2020*). The fifth group is comprised of the concepts that appear in the legal practice of national and EU authorities and central banks as they exercise their powers to maintain financial stability. These concepts define financial stability

in terms of the smooth functioning of the financial system and its robustness to shocks.[2]

In Hungarian literature, almost all of these forms of conceptualisation can be found. According to *Nagy* (*2010:68*), the stability of the financial system is a precondition for the normal functioning of the economy. *Ábel* and *Kóbor* (*2009:33*) argue that price stability is an important element of financial stability. *Mérő* highlights an important aspect among the components of financial stability, namely that if banks start to grow substantially on a massive scale, the role of the *too-big-to-fail* principle supporting financial stability will be reversed. In such cases, rather than supporting the stability of the financial system, it will contribute to its instability by imposing extremely high, sometimes unbearable, burdens on individual countries in the rescue of very large banks (*Mérő 2013:55*). *Székely* (*2012:232*) takes the position that the measurement and monitoring of systemic risks is key for financial stability. *Holló* uses the concept of financial stress to describe financial stability. In this approach, financial stress is understood in broad terms as a situation in which disruptions to the financial system affect the prices and flows of financial products in unexpected ways, which may potentially cause systemically important financial institutions to fail and completely destroy the ability of the financial system to allocate resources, resulting in a major downturn in the real economy (*Holló 2013:256*). A number of authors adopt and use the concept as developed by the Magyar Nemzeti Bank (the central bank of Hungary, MNB) (*Magas 2011:211; Bethlendi – Vértesy 2020:33; Lentner 2018:6*).

There is therefore no general consensus on the definition of financial stability in the literature. Attempts at a definition differ from one another in many ways, approaching conceptualisation from different perspectives, focusing on different elements of financial stability, seeking develop a concept from conceptual elements of unspecified substance. Nevertheless, several common elements can be identified to enable a definition and to develop the concept. *First*, in a significant part of the attempts to define the concept of financial stability, authors refer to the functions of the financial system, in particular the allocation of savings to investors, or the operation of the payment system in the economy. *Second*, a common element is the recognition that in addition to endogenous shocks, instability often develops as a result of unforeseen external shocks to the financial system. *Third*, a number of definitions explicitly acknowledge the potential negative impact of financial instability on the real economy (*Kálmán 2021:276–277*).

[2] For more details on conceptualisation in international literature, see *Kálmán* (*2021*).

3. Is financial stability defined in law?

As a result of the global economic crisis, the concept of financial stability, due to its flexibility and adaptability to specific situations, has become a reason for shaping public policy and introducing state intervention mechanisms. As a result of this process, reaching beyond the confines of science, financial stability *has become a legal concept* incorporated in legislation. As the concept took on a legal character, the need arose to define the exact boundaries of the concept and to explore its substance. Threatening financial stability in itself legitimises the use of official tools and state intervention in the relations of market participants. Determining the substance of the grounds for state intervention, including financial stability, is essential for ensuring that legislation is applied fairly and consistently, that public administration is subject to the rule of law, and that legal protection is guaranteed.

In view of the above, this study provides an analysis of how the concept of financial stability appears in international and EU legislation, as well as in the legislation of Member States and of certain countries that are of particular importance for financial legislation.

3.1. The concept of financial stability in international financial legislation

The most important thematic organisation for the international promotion of financial stability (*Pardavi 2022:171*) is the *Financial Stability Board* (FSB). The FSB continuously updates and monitors *key standards* that are of paramount importance for the sound and stable functioning of financial systems. These key standards are widely accepted as the minimum set of best practices that countries are encouraged to meet or exceed. Through the analysis of key standards, this study examines the definition of financial stability as it appears in the legal regulations.

According to the FSB Charter, the purpose of the FSB is to identify the vulnerabilities that threaten global financial stability, and its members are *committed* to maintaining financial stability (*FSB 2012*). In several provisions, the standard on the key attributes of resolution regimes specifies financial stability as an aspect to be taken into account in resolution (*FSB 2014*). Despite that, *no attempt is made in either the Charter or the standard to define the concept and substance of financial stability*.

The by-laws of the *International Organization of Securities Commissions* (IOSCO) contain no regulations of any kind in relation to financial stability (*IOSCO 1996*), nor does the most important standard developed by IOSCO that summarises the objectives and core principles of securities regulation (*IOSCO 2017a; IOSCO 2017b*).

The by-laws of the *International Association of Insurance Supervisors* (IAIS) (*IAIS 2018*) state that the purpose of the organisation is to contribute to global

financial stability,[3] and that its task is to draw up recommendations, standards, guidelines and other documents related to financial stability, systemic risks and macroprudential supervision.[4] The most important IAIS standard, which summarises the core principles for the insurance sector (*IAIS 2019*) also contains a number of provisions[5] on official tasks related to the promotion of systemic financial stability. The standard of the *International Association of Deposit Insurers* (IADI) summarising the core principles for effective deposit insurance systems defines the contribution to financial stability as one of the public policy objectives of a deposit insurance system (*IADI 2014*). The *International Auditing and Assurance Standards Board* (IAASB), in its standard on international quality control, auditing, review, other assurance, and related services (*IAASB 2015*) identifies threats to financial stability. In its key standard, the *Islamic Financial Services Board* (IFSB) identifies a well-defined system of financial stability (public) policy-making as a prerequisite for effective banking supervision (*IFSB 2015*). *The concept of financial stability*, however, *is not defined in any of these regulations.*

The *Basel Committee on Banking Supervision* (BCBS) Charter (*BCBS 2018*), similar to that of the FSB, defines the purpose of the organisation as being to increase financial stability by strengthening regulation, supervision and banking operations.[6] The Charter also stipulates that members of the BCBS are committed to promoting financial stability, and in particular, *global financial stability*.[7] That said, the Charter also *fails to specify the substance, meaning and key attributes of financial stability* as the goal set out to be pursued by the BCBS. Developed by the BCBS, the standard on core principles for effective banking supervision (*BCBS 2012*) identifies a well-defined system of financial stability (public) policy-making as a prerequisite for effective banking supervision.[8] An effective banking supervision regime clearly identifies the authorities that are responsible for the identification of systemic risk in the financial system by monitoring and analysing the market-related and other financial and economic factors that lead to its accumulation. The identification of systemic risks, which requires effective cooperation and communication between the authorities concerned, *constitutes the basis for designing and implementing appropriate public policy and official measures*.[9]

However, it is important to point out that the Financial Stability Framework was included in the prerequisites for effective banking supervision only in the 2012 revision of the Principles, driven by the increased prominence of the macroprudential aspect, but even then the standard stopped short of defining

[3] See: *IAIS 2018*, Article 2(1)b).
[4] See: *IAIS 2018*, Article 14(3)b).
[5] See: *IAIS 2019, Sections* 1.2, 1.4.1, 24.0.2, 24.4.2 and 25.7.1
[6] *BCBS 2018,* Section 1.
[7] *BCBS 2018,* Section 5(a) and (g).
[8] *BCBS 2012,* Section 47.
[9] *BCBS 2012,* Section 49.

the concept. Mention should also be made of the standard specifying the basic principles of financial market infrastructure, which contains a number of provisions on the role of the infrastructure in financial stability without defining the latter concept.[10] Developed by the BCBS, the *Basel III Recommendation*, at least indirectly, touches on the substance of the concept of financial stability. According to the Recommendation, the objective of the global reforms on capital and liquidity regulations is to *improve the ability of the banking system to absorb shocks arising from financial and economic stress*, regardless of their source, thus *reducing the risk of the financial sector having a negative impact on the real economy due to the spillover effect.* Despite the fact that the above wording can already serve as a guide in defining the concept of financial stability, as it allows conceptual elements such as increasing resilience to shocks and avoiding negative external effects on the real economy to be identified, it *does not qualify as an explicit and precise definition*. In addition to the above, it is important to point out that in view of its scope, Basel III is a specific recommendation, aimed exclusively at the regulation of the banking sector, and as such it cannot be considered sufficient for defining the concept of financial stability for the entire financial system.

The Articles of Agreement of the *International Monetary Fund* (IMF) state that a principal objective is the continuing development of the orderly underlying conditions that are necessary for financial and economic stability,[11] yet they do so without explaining the meaning of these concepts. Neither is the concept of financial stability defined in the key standards issued by the IMF to ensure the sound functioning of the financial system (*IMF 2017; IMF 2015; IMF 2000; IMF 1998; IMF 199*6). Similarly to the IOSCO, the agreement establishing the *World Bank* (WB) (*WB 1989*) and the standard setting out the principles for insolvency regimes (*WB 2011*), developed by the WB contain no provisions of any kind relating to the concept of financial stability.

Thus, the concept of financial stability appears in international financial regulation and standards, but none of the international documents attempts to define and map its conceptual elements. The regional and national levels of regulation for financial stability therefore need to be further explored.

3.2. The concept of financial stability in EU legislation

The Treaties of the European Union[12] contain only two references to financial stability. First, TFEU Article 127(5) states that the European System of Central Banks (ESCB) shall *contribute to the smooth conduct of policies pursued by the*

[10] *BIS 2012, Sections* 1.15, 1.17 and 3.2.2
[11] *IMF 2016,* Article 4.
[12] The Treaty on European Union (TEU) and the Treaty on the Functioning of the European Union (TFEU). See the consolidated version of the Treaty on European Union and the Treaty on the Functioning of the European Union (2016/C 202/1).

competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system. Second, TFEU Article 136(3) stipulates that *Member States whose currency is the euro may establish a stability mechanism to be activated if indispensable to safeguard the stability of the euro area as a whole.* The Treaties therefore link the financial stability objective to the role of the ESCB in supporting the competent authorities and presume it constitutes the legal basis for the establishment of the European Stability Mechanism, but do so without offering a definition of the concept, which warrants an examination of secondary Union law.[13]

The regulation establishing the *European Systemic Risk Board* (ESRB) as the macroprudential warning system of the European Union[14] does not *explicitly* define the concept of financial stability, but contains a number of references and guidelines regarding the components of its substance. The ESRB Regulation provides that financial stability is a precondition for the creation of jobs, credit and growth in the real economy.[15] It states that the ESRB should contribute to ensuring financial stability and mitigate the negative effects on the internal market and the real economy.[16] In addition, the ESRB should monitor and assess the risks to financial stability arising from the processes, which may have an impact at the sectoral level or at the level of the financial system as a whole, and contribute to the financial stability necessary for further financial integration of the internal market by monitoring systemic risks and issuing warnings and recommendations as necessary.[17] *The normative definition of financial stability in EU law can therefore be approached from the point of view of the concept of systemic risks*. Systemic risk is defined as a risk of disruption in the financial system with the potential to have serious negative consequences for the internal market and the real economy.[18] Similarly to Basel III, CRD IV/CRR[19] contain a number of references to financial stability, setting it as the legal basis for prudential authorities to apply stricter standards compared to the general rules.[20]

---

[13] It is important to point out that the legal bases provided in primary EU law show that the importance of financial stability as a factor in the fulfilment of the central banks' price stability mandate was generally recognised even before the global economic crisis (*Zilioli 2020:143–145*).

[14] Regulation (EU) No 1092/2010 of the European Parliament and of the Council of 24 November 2010 on European Union macro-prudential oversight of the financial system and establishing a European Systemic Risk Board (ESRB Regulation).

[15] *ESRB Regulation*, Recital (1).

[16] *ESRB Regulation*, Recital (10).

[17] *ESRB Regulation*, Recitals (30)–(31). However, Article 2(c) of the ESRB Regulation defines the concept of systemic risk. For the purposes of the Regulation, systemic risk is a risk of disruption in the financial system with the potential to have serious negative consequences for the internal market and the real economy. All types of financial intermediaries, markets and infrastructure may be potentially systemically important to some degree.

[18] *ESRB Regulation*, Article 2(c).

[19] See Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (CRR); Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC (CRD IV).

[20] See: CRR, Articles 124(2) and 164(5)

However, the concept of financial stability is not defined *expressis verbis* in any of these EU legal acts: the ESRB Regulation and CRD IV[21] only define the concept of systemic risk, from which the concept, substance and characteristics of financial stability can be inferred indirectly.

The concept of financial stability is therefore known in EU legislation, but remains undefined. Nevertheless, several possible conceptual elements appear in the normative regulation. In the absence of a definition in EU legislation, it is necessary to examine the concept of financial stability in national legislation.

3.3 The concept of financial stability in national legislation

Given the similarity of the legal systems and the regulatory environment, this study examines only the regulations of the largest financial markets in the European Union, i.e. France, Germany and the Netherlands,[22] touching upon the regulation of the United Kingdom, the largest (post-Brexit, non-EU) financial market in Europe and the fifth largest globally, and also reviewing the regulations of the United States and Hungary.

In *France*, in normative terms,[23] responsibility for the financial stability objective was conferred on the Banque de France (BDF) in 2013. Amended in 2013, the *Code monétaire et financier*[24] provides that BDF shares responsibility for the stability of the financial system with the newly created *Le Haut Conseil de stabilité financière*.[25] The *Le Haut Conseil de stabilité financière* exercises control over the financial system as a whole, in order to preserve the stability of the financial system and ensure its contribution to sustainable economic growth.[26] The financial stability objective was therefore introduced in the French regulation in 2013. However, as pointed out by BDF Governor *Christian Noyer* (*2014:8)*, in terms of its conceptual foundations, financial stability is extremely difficult to define and quantify, and as such it can be interpreted as a complex and multifaceted objective.

In Germany, responsibility for maintaining financial stability was conferred under the *Gesetz zur Überwachung der Finanzstabilität*[27] primarily on the *Deutsche Bundesbank* (DBB), providing that it should not compromise the DBB's

[21] For the purposes of *CRD IV Article 3(1)(10)*, systemic risk is a risk of disruption in the financial system with the potential to have serious negative consequences for the financial system and the real economy.
[22] According to WB statistics, the three Member States with the largest market capitalisations in the European Union are France (9th globally), Germany (10th) and the Netherlands (15th). Data used are available: https://data.worldbank.org/indicator/CM.MKT.LCAP.CD?end=2020&most_recent_value_desc=true&start=1975 (30 November 2022).
[23] It is important to point out the tendency that the financial stability objective became regulated as a central bank or other official responsibility after the global economic crisis, although even previously most central banks also considered the analysis of financial stability to be of interest, in addition to price stability.
[24] See: *Code monétaire et financier 1999*, amended by LOI n° 2013-672 du 26 juillet 2013 de séparation et de régulation des activités bancaires.
[25] See: *Code monétaire et financier 1999*, Art. 141-5-1.
[26] See: *Code monétaire et financier 1999*, Art. 631-2-1.
[27] See: *Finanzstabilitätsgesetz vom 28. November 2012* (BGBl. I S. 2369) 1. §.

accomplishment of price stability, its primary objective.[28] The Banking Act (*Gesetz über das Kreditwesen[29])* requires the federal supervisory authority (*Bundesanstalt für Finanzdienstleistungsaufsicht*) to take into account the impact of its decisions on the stability of the domestic and EU financial system in carrying out its supervisory tasks. In this regard, the effect on financial stability appears as one of the criteria to be considered when taking supervisory decisions.[30] That said, the concept of financial stability is not defined in any of the acts cited.

As opposed to the central banks referred to above, in the Netherlands the promotion of the stability of the financial system is not an objective of the central bank (*De Nederlandsche Bank*), but rather only one of its tasks, the fulfilment of which should not jeopardise the primary objective of maintaining price stability.[31] In addition to appearing in the regulation of the central bank, which also bears responsibility for monetary policy, the financial stability objective is also reflected in the Dutch supervisory regulation. The law on the supervision of the financial intermediary system (*Wet op het financieel toezicht*) provides that prudential supervision, which is carried out by the *Autoriteit Financiële Markten*, is to focus on the reliability of financial institutions and the stability of the financial system.[32] On the other hand, the *Autoriteit Consument & Markt* is responsible for supervising the conduct of business and, partly in order to ensure the stability of the financial system, focuses on orderly and transparent financial market processes, proper relations between market counterparties and the prudent treatment of customers.[33] The concept of financial stability is not defined in any of these acts.

In the *United Kingdom*, which has the largest financial market in Europe, it was in the aftermath of the global economic crisis that financial stability as an objective to be achieved was introduced, in the form of normative regulation, into the set of objectives pursued by the Bank of England (BoE).[34] In 2009, the *Banking Act*[35] was adopted to amend the *Bank of England Act*,[36] providing that the BoE has the objective to contribute to the protection and strengthening of the stability of the financial system of the United Kingdom (UK).[37] This definition of an objective was amended in 2012 by the *Financial Services Act,*[38] whereby the BoE objective of contributing to the protection and strengthening of the stability of the UK's financial

[28] See: *Gesetz über die Deutsche Bundesbank vom 22. Oktober 1992* (BGBI. I, S. 1782) 3. §.
[29] See: *Gesetz über das Kreditwesen*, 1998.
[30] See: *Gesetz über das Kreditwesen*, 1998, Article 6(4).
[31] See: *Bankwet 1998*, Article 4(1)(c).
[32] See: *Wet op het financieel toezicht 2006*. Art. 1:24.
[33] See: *Wet op het financieel toezicht 2006*. Art. 1:25.
[34] Responsibility for financial stability was previously shared between HM Treasury, the *Financial Services Authority* and the Bank of England.
[35] See: *Banking Act 2009*, Part 7.
[36] See: *Bank of England Act 1998.*
[37] In the original language: *Bank of England Act 1998,* Section 2A (1): An objective of the Bank shall be *to contribute to protecting* and enhancing the stability of the financial systems of the United Kingdom (the "Financial Stability Objective").
[38] See: *Financial Services Act 2012,* Part 1.

system was extended to include its *achievement*.[39] The objective of financial stability and at the same time responsibility has therefore been *explicitly* defined in the legislation. However, while providing a precise delineation of responsibilities, the Bank of England Act does not define the concept of financial stability, but, similarly to the ESRB regulation, it contains several references and guidelines regarding the components of its substance. The Bank of England Act provides, by way of a *task*, that the achievement of the financial stability objective primarily involves the identification and monitoring of systemic risks and measures to eliminate or reduce them, in order to protect and increase the resilience of the UK financial system.[40] In addition, the Bank of England Act defines systemic risk by stating that systemic risks include (a) risks arising from the *structural characteristics of the financial market*, such as risks arising from relations between financial institutions, (b) the *sharing* of systemic risks within the financial sector, and (c) *unsustainable* leverage, debt and credit growth.[41]

In the United States, in the aftermath of the global economic crisis, in 2010 the legislature adopted one of the most complete regulations in the history of the United States affecting the financial sector (*Székely 2012:232*), the *Dodd-Frank Act*.[42] In its preamble, the Dodd-Frank Act states its objective as being "to promote the financial stability of the United States by improving accountability and transparency in the financial system, to end '*too big to fail*', to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes." The need for financial stability is therefore already highlighted in the statement of the objective of the Dodd-Frank Act, but, as in the case of European legislation, despite its numerous applications, its normative definition has not been carried out by the legislator.

Hungarian regulation is aligned with the above European legislation in that it does not define the concept of financial stability *expressis verbis*, but it differs in that many elements of the concept of financial stability appear in normative regulation. In particular, Act CXXXIX of 2013 on the Magyar Nemzeti Bank (MNB Act) mandates the MNB to elaborate macroprudential policy for the *stability of financial intermediary system as a whole*.[43] In that regard, the Act attaches a *dual objective to macroprudential policy*: first, to enhance the resilience of the financial intermediary system; and second, to ensure the sustainable contribution of the financial intermediary system to economic growth. To achieve this dual objective,

[39] In the original language: *Bank of England Act 1998*, Section 2A (1): An objective of the Bank shall be *to protect* and enhance the stability of the financial system of the United Kingdom (the "Financial Stability Objective").
[40] See *Bank of England Act 1998*, Section 9C (2): (…) the Financial Stability Objective relates primarily to the identification of, monitoring of, and taking of action to remove or reduce, systemic risks with a view to protecting and enhancing the resilience of the UK financial system.
[41] See *Bank of England Act 1998*, Section 9C (3).
[42] See: *Dodd-Frank Wall Street Reform and Consumer Protection Act*, 2010.
[43] For more details, see: https://www.mnb.hu/en/financial-stability/macroprudential-policy

and within the limits specified in the MNB Act, the MNB identifies the business and economic risks threatening the system of financial intermediation as a whole, promotes the prevention of the development of *systemic risks* and the reduction or elimination of systemic risks which have evolved. Furthermore, in the event of disturbances to the credit market, it contributes to the balanced functioning of the system of intermediation in financing the economy by stimulating lending or – in the event of excessive credit outflow – by restraining lending.[44] *As part of one ex ante pillar of achieving financial stability*, in addition to microprudential policy *the MNB Act requires the pursuit of a macroprudential policy, whose substance is defined as measures to increase the resilience of the financial intermediary system and to ensure the sustainable contribution of the financial intermediary system to economic growth.*[45] The MNB Act does not define the concept of financial stability, but specifies certain substantive elements of the concept and presents them in the regulation as a condition giving grounds for state intervention.[46]

4. The concept of financial stability in the practice of regulatory authorities

On the basis of the above, it can be established that international, European Union and Member State legislation all make use of the concept of financial stability, typically as a cause and purpose of state and administrative intervention in the operation of the financial intermediary system. Although legislation has developed and continues to develop major instruments of administrative intervention in the form of the macroprudential policy toolkit in order to maintain and restore financial stability, it has stopped short of defining the concept of financial stability as grounds for intervention, other than highlighting certain conceptual elements.

The absence of a normative conceptual definition of financial stability is attributable to the fact that financial stability is a complex and multifaceted concept, which may vary according to the objectives a given state is pursuing. The definition of financial stability in a legal instrument may limit its interpretation to a particular context and hamper the flexibility to manage changing financial risks. The financial system and risks are constantly evolving due to technological advances, economic changes and the emergence of new financial instruments. It is difficult for the legislator to develop a concept that, in addition to being subject to the rule of law, also provides the necessary interpretation dynamics for legal enforcement.

---

[44] *MNB Act,* Article 4(7)

[45] With reference to the introduction, it is appropriate to indicate that the *ex-ante* policies of financial stability are not exclusively responsible for the realisation of financial stability; they are necessarily complemented by *ex post* policies.

[46] See: MNB Act, Art. 32. (3)(b), Art. 33. (4), Art. 36, Art. 44. (4); also, on its website the MNB provides information on financial stability and what the concept entails: https://www.mnb.hu/web/en/financial-stability

In the absence of a normative definition of financial stability, the regulatory authorities, i.e. macroprudential authorities and central banks, are free to add substance to the concept, and indeed they do. This study explores the regulatory practices followed by central banks in the same countries as for legislation, as well as by the European Central Bank (ECB).

The *ECB* made its first attempt to define the concept of financial stability in 2004. At the time, financial stability was defined as a condition in which the financial system is able to perform all its general tasks well and is expected to continue to do so for the foreseeable future (*EKB 2004:8*). Following a series of refinements and changes to the concept (*ECB 2006:7; ECB 2015:4; ECB 2016:4*), the ECB currently defines financial stability as *a condition in which the financial system – which comprises financial intermediaries, markets and market infrastructures – is capable of withstanding shocks and unravelling financial imbalances. This mitigates the prospect of disruptions in the financial intermediation process that are severe enough to adversely impact real economic activity* (*EKB 2018:4*).

The *Banque de France* understands the concept of financial stability as a complex term in itself (*Noyer 2014:8*). It is defined as a situation in which the various institutions of the financial system – the financial market, the payment and settlement system, the clearing system and the financial institutions – operate smoothly in such a way that all components of the system are fully resilient to possible shocks (*BDF 2007:3*).

Initially, the *Deutsche Bundesbank* construed financial stability as the smooth operation of the financial system (*DBB 2009:7*) and subsequently defined it in more detail as a property of the financial system whereby it can perform its key economic functions smoothly at all times, such as the effective distribution of financial resources and risks and ensuring the adequate functioning of the financial infrastructure even in times of crisis and in times of structural disruptions (*DBB 2010:7; BB 2011:7*). Also following a series of changes (*DBB 2012:5; DBB 2013:5*; *DBB 2014: 5*; *DBB 2015:5; DBB 2016:5*) in its most recent annual reports, DBB already defines the concept of financial stability simply as *the condition of the financial system in which it is able to perform its functions at all times* (*DBB 2020:5*).

According to *De Nederlandsche Bank*, a stable financial system is capable of allocating resources efficiently and absorbing shocks without damaging the real economy (*DNB 2022:90*).

Following the onset of the global economic crisis, the *Bank of England* construed the concept of financial stability from the perspective of purpose, highlighting the context of the flexibility, functioning and outcomes of the economic system. According to the *BoE*, the objective of financial stability is to ensure the resilience

of the financial system so that financial services (payment services, credit supply, insurance against risks) are permanently and continuously available to the economy as a whole during the credit cycle (*BoE 2009:9*). In other words, a sound financial system exists when it is able to provide basic services to households and businesses under both good and bad economic conditions. However, following the amendment of the Bank of England Act, the BoE no longer defines the concept of financial stability directly, but sets out the actions necessary to achieve the financial stability objective. Thus, in order to achieve the financial stability objective, the BoE identifies and monitors systemic risks and takes measures to eliminate or reduce systemic risks in order to protect and enhance the resilience of the UK financial system (*BoE 2013:3; BoE 2022:3*).

According to the definition provided by the *Federal Reserve System*, acting as the central bank of the United States of America, the financial system can be considered stable if banks, other creditors and financial markets are able to provide households, municipalities and businesses with the financing they need to invest, grow and participate in the functioning of the economy, even when the economy is hit by adverse events or "shocks" (*Fed 2022:V*).

The legal environment in Hungary, similarly to those of the countries reviewed previously, has made it necessary for the *Magyar Nemzeti Bank*, in the absence of normative regulation, to develop a concept that sets the framework of its activities in performing its tasks defined by the legislation. Accordingly, the MNB defines financial stability as *a condition in which the financial system, including key financial markets and financial institutions, is resilient to economic shocks and is capable of smoothly performing its key functions in intermediating financial resources, managing financial risks and processing payment transactions*.[47] The above definition was first published in April 2005 (*MNB 2005:3*) and still serves as the MNB's framework for the interpretation of financial stability (*MNB 2022:5*).

At the intersection of the many definitions used in the practice of regulatory authorities, the majority of regulatory bodies apparently seek to define the concept of financial stability and not instability, in pursuit of a positive definition of the concept. In addition, in the definitions an essential element is a reference to the performance of the functions of the financial system and the ability to withstand shocks.

[47] For more details, see the MNB's website at https://www.mnb.hu/web/en/financial-stability

5. The concept of financial stability and specific elements of the concept

This study provided a detailed analysis of the conceptualisation of financial stability, reaching the conclusion that no consensus has emerged in the literature, in the legislation or in legal enforcement with regard to the substance of the concept. Legislation generally refers to financial stability as a reason or purpose for expanding administrative, official, economic instruments of intervention, but does not define the concept itself. It is therefore incumbent on the enforcement authorities to define the concept as a matter of necessity and to define concepts that are constantly changing both over time and in substance.

The definition of a common concept of financial stability is beneficial for a number of reasons. A common definition provides clarity and a common understanding among decision-makers, regulators, financial institutions and market participants. It creates a common language that facilitates communication and coordination in addressing financial stability concerns. A clear and generally accepted definition of financial stability allows the legislator to develop effective public policies for stability. It provides a framework for identifying and assessing risks, establishing appropriate rule-of-law safeguards and implementing measures to safeguard the stability of financial systems. A common definition allows for better coordination and cooperation between countries, international organisations and regulatory bodies. Financial stability is closely linked to investor confidence and market efficiency. If there is consensus on what constitutes financial stability, investors can make informed decisions and market participants can better assess risks and allocate resources efficiently. This promotes confidence and stability in the financial market. A common definition of financial stability helps to identify and prevent systemic risks. It allows authorities to monitor key indicators, detect vulnerabilities and take timely action to mitigate potential threats. In addition, in the event of a financial crisis, a common definition provides the basis for taking the necessary decisions for coordinated crisis management and recovery.

Taking into account the results from the literature, the conceptual elements and conceptual definition attempts in legislation and legal enforcement, the synthesised concept of financial stability, which is also suitable for normative regulation, can be defined as follows:

Financial stability is the condition of the financial system in which:

a) the financial system is able to contribute to economic development in a sustainable manner by fulfilling its functions,

b) there is no systemic risk in the financial system that would cause significant harm to those who are not clients or counterparties to financial institutions by interfering with the performance of the functions of the financial system, and

c) participants in the financial system are resilient to endogenous and exogenous economic shocks.

Before addressing each conceptual element in detail, it is appropriate to point out that the definition of the concept or elements of the concept of financial stability is *not an end in itself*. The necessity and practical benefit of defining financial stability lies in the fact that even the threat of the realisation of a single conceptual element provides the *legal grounds for administrative state intervention via public authorities*.

In alignment with the ESRB Regulation, for the purposes of this study, the concept of the financial system comprises financial institutions, financial markets, products and market infrastructures, which makes the elaboration of this conceptual element unnecessary.

On the basis of the *first conceptual element*, in a state of financial stability the financial system is able to contribute to development in a sustainable manner by fulfilling its functions. That is, the financial system can supply money and liquidity to the economy, adequately meet its credit needs, maintain and operate the economy's payment systems, allocate savings effectively to investors, and manage uncertainties and micro-risks. By carrying out all these functions, the financial system contributes to the sustainable development of the economy, i.e. to cushioning the fluctuation of the economy, to sustainable economic growth, to high employment, to low inflation, to the governmental tasks of ensuring the external and internal financial balance and competitiveness under the supranational coordination of certain governmental tasks.

Based on the *second conceptual element*, there is no systemic risk in the financial system that would cause significant harm to those who are not clients or counterparties to financial institutions by interfering with the performance of the functions of the financial system. On the one hand, this conceptual element emphasises that financial stability as a feature of the whole financial system necessarily requires a macro-level approach, i.e. it responds to systemic or systemic risks rather than to individual institutional risks. The notion of systemic risk, based on the definition of the ESRB Regulation, can be defined as a downturn in financial service provision as a result of the weakening of the financial system as a whole or part of it, in such a way that this downturn may have serious negative impacts on the real economy. Thus, through the conceptual element of systemic risk, a negative impact on the real economy appears as an element of the concept of financial stability, on the one hand, and a significant amount of this negative impact on the real economy on the other hand, since the concept of systemic risk does not include minor fluctuations in asset prices, and the institutional difficulties of certain financial intermediaries, which are part of the normal functioning of competitive markets.

The concept of systemic risks already has a negative impact on the real economy, but it is emphasised in the conceptual element that systemic risks do have and can have a significant negative impact not only on the real economy but also on members of society in general, and that systemic risks also have social costs due to *external impact and procyclicality*. In addition, the specification of systemic risk as a conceptual element provides a time dimension and thus dynamics to the concept, since systemic risks and thus financial stability are not characterised by a given static time state, but have a temporal perspective and at the same time a run-off.

Finally, on the basis of the *third conceptual element*, in a state of financial stability, participants in the financial system are resilient to endogenous and exogenous economic shocks, that is, the financial system is able to manage the emerging risks on its own without external state intervention, regardless of their intrinsic or extrinsic impact on the financial system. The development of resilience serves to avoid and manage the significant negative effects of systemic risks.

In conclusion, the social costs of both financial system and financial system disruption are not limited by state borders, as a result of which the regulation of financial stability can necessarily be considered as an international task or a *global public good*. Despite the fact that it has been shown in detail in the study that the definition of the concept of financial stability can be considered to be highly heterogeneous in the literature, in legislation and in legal enforcement, it is still possible to identify conceptual elements that are capable of creating a concept of a general nature.

References

Ábel, I. – Kóbor, Á. (2009): *Monetáris politika, árfolyam és stabilitás* (*Monetary policy, exchange rate and stability*). Pénzügyi Szemle (Public Finance Quarterly), 54(1): 33–48.

Allen, F. (2005): *Modelling Financial Instability*. National Institute Economic Review, 192(1): 57–67. https://doi.org/10.1177/002795010519200107

Arner, D.W. (2007): *Financial Stability, Economic Growth, and the Role of Law.* Cambridge University Press, New York. https://doi.org/10.1017/CBO9780511511431

BCBS (2012): *Core principles for effective banking supervision*. http://www.bis.org/publ/bcbs230.htm. Downloaded: 30 November 2022.

BCBS (2018): *Basel Committee on Banking Supervision Charter.* https://www.bis.org/bcbs/charter.htm. Downloaded: 30 November 2022.

BDF (2007): *Annual Report 2006.* https://publications.banque-france.fr/sites/default/files/medias/documents/annual-report-banque-de-france_2006.pdf. Downloaded: 30 November 2022.

Bethlendi, A. – Vértesy, L. (2020): *Makrogazdasági pénzügyek* (*Macroeconomic finances*). Budapest University of Technology and Economics Faculty of Economics and Social Sciences, Department of Finance, Budapest.

BIS (1986): *Recent innovations in international banking (Cross Report)*. CGFS Publications. No. 1. https://www.bis.org/publ/ecsc01.htm. Downloaded: 30 November 2022.

BIS (2011): *Central bank governance and financial stability.* http://www.bis.org/publ/othp14.pdf. Downloaded: 30 November 2022.

BIS (2012): *Principles for financial market infrastructures.* http://www.bis.org/cpmi/publ/d101a.pdf. Downloaded: 30 November 2022.

BoE (2009): *The role of macroprudential policy. A Discussion Paper.* https://www.bankofengland.co.uk/-/media/boe/files/paper/2009/the-role-of-macroprudential-policy.pdf. Downloaded: 30 November 2022.

BoE (2013): *Financial Stability Report*. June. https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2013/june-2013.pdf?la=en&hash=B6FF8E6BD760F7184914F622630F65CFC4DF87B5. Downloaded: 30 November 2022.

BoE (2022): *Financial Stability Report*. December. https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2022/financial-stability-report-december-2022.pdf. Downloaded: 30 November 2022.

Crockett, A.D. (2000): *Marrying the micro- and macro-prudential dimensions of financial stability.* BIS Speech, Basel. https://www.bis.org/speeches/sp000921.htm. Downloaded: 16 September 2022.

Das, U.S. – Quintyn, M. – Chenard, K. (2004): *Does Regulatory Governance Matter for Financial System Stability? An Empirical Analysis*. IMF Working Paper, WP/04/89. https://doi.org/10.5089/9781451851311.001

DBB (2009): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/626158/a393b7e5fa94e5f9370487504091b291/mL/2009-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2010): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/665906/f06d0cf1b5414d01073b3ac1bd6cc618/mL/2010-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2011): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/666238/4d12912826e2d1a311f91830db1296f3/mL/2011-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2012): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/666016/8934e4f8558c83e9f8eaef465f6c0811/mL/2012-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2013): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/654260/fe96f1e8092d9438ae5e190c23e20b8e/mL/2013-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2014): *Financial Stability Review.* https://www.bundesbank.de/resource/blob/666664/41825d5b3af86c1a1df703544041d1e7/mL/2014-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2015): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/666964/bac3168b79ef24d514842ee291aa7c6e/mL/2015-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2016): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/667246/5e320b6dc52c2c79994b9a986b1cb05b/mL/2016-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DBB (2020): *Financial Stability Review*. https://www.bundesbank.de/resource/blob/847248/36cb058e4c06d08de803607eeea46ae5/mL/2020-finanzstabilitaetsbericht-data.pdf. Downloaded: 30 November 2022.

DNB (2022): *Striking a new balance. 2021 Annual Report*. De Nederlandsche Bank N.V. https://www.dnb.nl/media/4kobi4vf/dnb-annual-report-2021.pdf. Downloaded: 16 September 2022.

Duisenberg, W.F. (2001): *The contribution of the euro to financial stability*. In: Randzio-Plath, Ch. (ed.): Globalisation of Financial Markets and Financial Stability: Challenges for Europe. Nomos Verlagsgesellschaft, Baden-Baden, pp. 37–51.

ECB (2004): *Financial Stability Review.* December. https://www.ecb.europa.eu/pub/pdf/other/financialstabilityreview200412en.pdf?eec3264a09f1bd7c1299c7c3a94818a1. Downloaded: 30 November 2022.

ECB (2006): *Financial Stability Review.* December. https://www.ecb.europa.eu/pub/pdf/other/financialstabilityreview200612en.pdf?eeb9342332f4cd3127e55b523c51c9ff. Downloaded: 30 November 2022.

ECB (2015): *Financial Stability Review.* November. https://www.ecb.europa.eu/pub/pdf/fsr/financialstabilityreview201511.en.pdf. Downloaded: 30 November 2022.

ECB (2016): *Financial Stability Review.* May. https://www.ecb.europa.eu/pub/pdf/other/financialstabilityreview201605.en.pdf?e1a2bef79ed901d8ceaee004f2fcecdd. Downloaded: 30 November 2022.

ECB (2018): *Financial Stability Review*. November. https://www.ecb.europa.eu/pub/pdf/fsr/ecb.fsr201811.en.pdf. Downloaded: 30 November 2022.

Fed (2022): *Financial Stability Report*. Federal Reserve System, November. https://www.federalreserve.gov/publications/files/financial-stability-report-20221104.pdf. Downloaded: 30 November 2022.

Fábián, A. (2021): *Gondolatok a magyar közigazgatási jogról* (*On Hungarian Administrative Law*). Közigazgatás-Tudomány, 1(1): 50–57. https://doi.org/10.54200/kt.v1i1.5

FSB (2012): *Charter of the Financial Stability Board.* https://www.fsb.org/wp-content/uploads/FSB-Charter-with-revised-Annex-FINAL.pdf. Downloaded: 30 November 2022.

FSB (2014): *Key Attributes of Effective Resolution Regimes for Financial Institutions*. https://www.fsb.org/wp-content/uploads/r_141015.pdf. Downloaded: 30 November 2022.

Holló, D. (2013): *Rendszerszintű stresszindex a magyar pénzügyi rendszerre* (A system-wide financial stress indicator for the Hungarian financial system). Hitelintézeti Szemle (Financial and Economic Review) (12)4: 253–284. https://www.bankszovetseg.hu/Content/Hitelintezeti/253-284-Hollo-Daniel.pdf

Horváth, E. – Mérő, K. – Zsámboki, B. (2002): *Tanulmányok a bankszektor tevékenységének prociklikusságáról* (*Studies on the procyclical behaviour of banks*). MNB Occasional Papers 23, Magyar Nemzeti Bank https://www.mnb.hu/letoltes/mt23.pdf

Hunter, L. – Orr, A. – White, B. (2006): *Towards a framework for promoting financial stability.* Reserve Bank of New Zealand: Bulletin, 69(1): 5–17.

IAASB (2015): *Handbook of International Quality Control, Auditing, Review, Other Assurance, and Related Services Pronouncements Volume I-II.* https://www.iaasb.org/publications/2015-handbook-international-quality-control-auditing-review-other-assurance-and-related-services-0. Downloaded: 30 November 2022.

IADI (2014): *Core Principles for Effective Deposit Insurance Systems*. https://www.iadi.org/en/assets/File/Core%20Principles/cprevised2014nov.pdf. Downloaded: 30 November 2022.

IAIS (2018): *By-laws of International Association of Insurance Supervisors.* https://www.iaisweb.org/uploads/2022/01/181207-2018-By-Law-Amendments-8-November-2018.pdf. Downloaded: 30 November 2022.

IAIS (2019): *Insurance Core Principles and Common Framework for the Supervision of Internationally Active Insurance Groups*. https://www.iaisweb.org/uploads/2022/01/191115-IAIS-ICPs-and-ComFrame-adopted-in-November-2019.pdf. Downloaded: 30 November 2022.

IFSB (2015): *Core Principles for Islamic Finance Regulation (Banking Segment)*. https://www.ifsb.org/download.php?id=4373&lang=English&pg=/index.php. Downloaded: 30 November 2022.

IMF (1996): *The Special Data Dissemination Standard.* https://dsbb.imf.org/content/pdfs/sddsplus15.pdf. Downloaded: 30 November 2022.

IMF (1998): *Key Aspects of a Framework for a Sound Financial System.* http://www.imf.org/external/pubs/ft/wefs/toward/pdf/file03.pdf. Downloaded: 30 November 2022.

IMF (2000): *Code of Good Practices on Transparency in Monetary and Financial Policies: Declaration of Principles*. https://www.imf.org/external/np/mae/mft/code/index.htm. Downloaded: 30 November 2022.

IMF (2015): *Dissemination Standards Bulletin Board.* https://dsbb.imf.org/. Downloaded: 30 November 2022.

IMF (2016): *Articles of Agreement of the International Monetary Fund.* https://www.imf.org/external/pubs/ft/aa/. Downloaded: 30 November 2022.

IMF (2017): *The Fiscal Transparency Code.* https://www.imf.org/external/np/fad/trans/Code2019.pdf. Downloaded: 30 November 2022.

IOSCO (1996): *By-laws of International Organization of Securities Commissions.* https://www.iosco.org/library/by_laws/pdf/IOSCO-By-Laws-Section-1-English.pdf. Downloaded: 30 November 2022.

IOSCO (2017a): *Objectives and Principles of Securities Regulation.* https://www.iosco.org/library/pubdocs/pdf/IOSCOPD561.pdf. Downloaded: 30 November 2022.

IOSCO (2017b): *Methodology for Assessing Implementation of the IOSCO Objectives and Principles of Securities Regulation*. https://www.iosco.org/library/pubdocs/pdf/IOSCOPD562.pdf. Downloaded: 30 November 2022.

Kálmán, J. (2021): *A pénzügyi stabilitás fogalma* (*The concept of financial stability*). Miskolci Jogi Szemle, (14)5: 272–285. https://doi.org/10.32980/MJSz.2021.5.1472

Kukorelli István (2020): *Fejezetek a gazdasági alkotmányosság (gazdasági jogalkotás) témaköréből* (*Chapters on economic constitutionality* (*economic legislation*)). Dialóg Campus, Budapest.

Lentner, Cs. (2018): *A jegybanki szabályozás tanulságai a 2008–2015-ös időszakból – nemzetközi összehasonlító elemzés* (*Lessons from central bank regulation in the period 2008–2015: international comparative analysis*). Gazdaság és Jog, 26(3): 6–11.

Lublóy, Á. (2004): *Systemic Risk Implications of the Hungarian Interbank Market.* MNB Füzetek, 2004/10. Magyar Nemzeti Bank. https://www.mnb.hu/en/publications/studies-publications-statistics/working-papers-1-1/wp-2004-10-agnes-lubloy-systemic-risk-implications-of-the-hungarian-interbank-market

Magas, I. (2011): *Pénzügyi liberalizáció – a nemzeti alkalmazkodás dilemmái* (*Financial liberalisation – The dilemmas of national adaptation*). Pénzügyi Szemle (Public Finance Quarterly), 56(2): 211–237.

Mérő, K. (2003): *A gazdasági növekedés és a pénzügyi közvetítés mélysége* (*Economic growth and the depth of financial mediation*). Közgazdasági Szemle (Economic Review), 50(7): 590–607.

Mérő, K. (2013): *Egy paradigma születése és bukása. A „túl nagy a csődhöz" elv értelmezésének és alkalmazásának változásai* (*The birth and fall of a paradigm. Changes in the interpretation and application of the "too big to fail" principle*). In: Valentiny, P. – Kiss, F.L. – Nagy, Cs.I. (eds.): *Verseny és szabályozás* (Competition and regulation), 2012. MTA KRTK Közgazdaság-tudományi Intézet, Budapest, pp. 32–57.

Mishkin, F.S. (1997): T*he Causes and Propagation of Financial Instability: Lessons for Policymakers*. In: Maintaining Financial Stability in a Global Economy, Symposium Proceedings, Federal Reserve Bank of Kansas City, August 28–30, pp. 55–96. https://www.kansascityfed.org/Jackson%20Hole/documents/3591/pdf-s97Mishk.pdf

Mishkin, F.S. (1999): *Global Financial Instability: Framework, Events, Issues*. Journal of Economic Perspectives 13(4): 3–20. https://doi.org/10.1257/jep.13.4.3

MNB (2005): *Report on Financial Stability.* April. https://www.mnb.hu/letoltes/stab-jel-20050425-hu.pdf. Downloaded: 30 November 2022.

MNB (2022): *Report on Financial Stability.* November. https://www.mnb.hu/letoltes/penzugyi-stabilitasi-jelentes-2022-november.pdf. Downloaded: 30 November 2022.

Nagy, I.Gy. (2010): *A globális pénzügyi válság néhány szabályozórendszerbeli összefüggése* (*The context of the global financial crisis in some regulatory systems*). Külgazdaság, 54(3–4): 63–80.

Noyer, C. (2014): *Macroprudential policy: from theory to implementation.* Financial Stability Review, 18: 7–12.

Oosterloo, S. – de Haan, J. (2004): *Central banks and financial stability: a survey*. Journal of Financial Stability, 1(2): 257–273. https://doi.org/10.1016/j.jfs.2004.09.002

Padoa-Schioppa, T. (2002): *Central Banks and Financial Stability. Exploring a Land in Between*. Policy Panel Introductory Paper, Second ECB Central Banking Conference, "The transformation of the European financial system", 24 and 25 October 2002. http://central.banktunnel.eu/events/pdf/conferences/tps.pdf. Downloaded: 16 September 2022.

Pardavi, L. (2022): *Nemzetközi pénzügyi jog* (*International financial law*). Universitas-Győr, Győr.

Phan, D.H.B. – Iyke, B.N. – Sharma, S.S. – Affandi, Y. (2020): *Economic policy uncertainty and financial stability – Is there a relation?* Economic Modelling, 94(January): 1–12. https://doi.org/10.1016/j.econmod.2020.02.042

Székely, A. (2012): *A válságra tett szabályozói válaszlépések az Egyesült Államokban* (*The Regulatory Responses to the Financial Crisis in the United States*). Hitelintézeti Szemle (Financial and Economic Review), 11(3): 230–253. https://www.bankszovetseg.hu/Content/Hitelintezeti/230-253-szekely1.pdf

Toniolo, G. – White, E.N. (2015): *The evolution of the financial stability mandate: form its origins to the present day*. NBER Working Paper Series, WP 20844. https://doi.org/10.3386/w20844

WB (1989): *International Bank for Reconstruction and Development Articles of Agreement*. https://www.worldbank.org/en/about/articles-of-agreement/ibrd-articles-of-agreement. Downloaded: 30 November 2022.

WB (2011): P*rinciples for Effective Insolvency and Creditor/Debtor Regimes*. https://thedocs.worldbank.org/en/doc/538701606927038819-0130022020/original/ICRStandardJan2011withC1617.pdf. Downloaded: 30 November 2022.

Zilioli, Ch. (2020): *New Tasks for the European Central Bank: Between Separation, Synergies, and the Preservation of Independence*. In: Law & Financial Stability, International Monetary Fund, pp. 143–156. https://www.elibrary.imf.org/display/book/9781513523002/ch009.xml

Traditional versus AI-Based Fraud Detection: Cost Efficiency in the Field of Automobile Insurance*

Botond Benedek – Bálint Zsolt Nagy

Business practice and various industry reports all show that automobile insurance fraud is very common, which is why effective fraud detection is so important. In our study, we investigate whether today's widespread AI-based fraud detection methods are more effective from a financial (cost-effectiveness) point of view than methods based on traditional statistical-econometric tools. Based on our results, we came to the unexpected conclusion that the current AI-based automobile insurance fraud detection methods tested on a real database found in the literature are less cost-effective than traditional statistical-econometric methods.

Journal of Economic Literature (JEL) codes: G22, C14, C45

Keywords: automobile insurance, insurance fraud, fraud detection, cost-sensitive decision-making, data mining

1. Introduction

The consequences of insurance fraud have a serious impact on the insurance sector. Fraud creates distrust of the industry, causes economic damage and affects the overall cost of living. The Insurance Information Institute (III) in the USA (*III 2021*) reports that the total cost of insurance fraud in the USA between 2015 and 2019 amounted to between USD 38 billion and USD 83 billion per year. This means that the average American family has an additional expenditure on insurance fraud between USD 800 and USD 1,400 a year. The Association of British Insurers (ABI) highlights that in 2020 the value of fraudulent claims in the UK was GBP 1.1 billion (*ABI 2021*). Looking specifically at automobile insurance fraud, 7–10 per cent of insurance policies in the USA and Western Europe, 10–20 per cent in the Central

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Botond Benedek: Babeş-Bolyai University, Cluj-Napoca, Romania, Assistant Professor.
Email: botond.benedek@econ.ubbcluj.ro
Bálint Zsolt Nagy: Babeş-Bolyai University, Cluj-Napoca, Romania, Associate Professor.
Email: balint.nagy@econ.ubbcluj.ro

The research was supported by the Hungarian Academy of Sciences under scientific research grant number 86/12/2022/HTMT.

The first version of the Hungarian manuscript was received on 2 November 2022.

DOI: https://doi.org/10.33893/FER.22.2.77

and Eastern European regions, and 18–20 per cent in China are affected (*ABI 2021; III 2019*).

There is therefore no doubt that the identification of insurance fraud is an economically very important area of investigation. In our study, 24 academic journal articles and 3 conference proceedings on the detection of automobile insurance fraud indexed by the Web of Science database between 1990 and 2022 were analysed. This suggests that this area of research is still very much underdeveloped. There is an extensive literature on classical statistical-econometric fraud identification methods as well as on models based on artificial intelligence (AI) and machine learning, but there is a lack of systematic comparison and a lack of research on the cost-effectiveness of fraud identification. The literature in the Hungarian language is also incomplete in this area, and there is no generally accepted definition of insurance fraud, nor of fraudulent automobile insurance claims.

Therefore, this study aims to contribute to the development of our knowledge on automobile insurance fraud identification in three areas:

- After a comprehensive analysis of the international and Hungarian literature, we argue that the performance of any fraud detection system should be judged in terms of its cost-effectiveness. In other disciplines where the use of artificial intelligence (AI) has become widespread, such as healthcare, these cost-effective approaches have already become dominant (*Lee et al. 2017*; *Hill et al. 2020*).
- Considering the spread of numerous AI models available in the literature, we believe that there is a pressing need for a systematic meta-analysis that can present a ranking of these models and compare them in terms of their financial performance. Not least, we could not find any study that examined whether today's widespread AI-based methods are more financially (regarding their cost-effectiveness) efficient than the methods based on traditional statistical-econometric tools.
- Finally, we would like to contribute to the (quasi non-existent) literature in Hungarian on the subject, at least with generally acceptable definitions that will make it clear to the reader what insurance fraud or a fraudulent automobile insurance claim is.

After a review of the relevant literature (*Section 2*), our theoretical framework is presented (*Section 3*) in detail, together with the calculation method for cost savings proposed by *Benedek et al.* (*forthcoming*). In *Section 4*, we focus on the selected fraud detection methods and their cost-effectiveness, comparing traditional statistical and machine-learning-based fraud detection methods, and present the results of our detailed sensitivity analysis prepared using heatmaps. In the final section, the conclusions are drawn.

2. Overview of the literature

We begin our literature review by defining what is meant by insurance fraud and fraudulent automobile insurance claim. As defined by the Legal Information Institute (*LII 2023*) and under Massachusetts Regulation (MR) (which are the most widely accepted sources in the English-language literature), insurance fraud is any act done with the intent to obtain a fraudulent payment from an insurer. Police and prosecutors generally distinguish between two forms of insurance fraud: (1) intentional damage to the insured property (hard fraud) and (2) forgery of documents (soft fraud). Hard fraud is the less common of the two forms, when the perpetrator intentionally causes the destruction of property with the aim of obtaining the amount of damages later. A soft fraud occurs when the contracting party exaggerates an otherwise legitimate claim, or when he or she makes untrue statements and/or conceals certain conditions and circumstances. If we look specifically at the automobile insurance market, a fraudulent claim is one where the insured (1) makes a claim for an accident that did not happen; (2) makes multiple claims for a single accident; (3) submits a claim other than those resulting from the car automobile accident; (4) falsely reports lost wages/medical treatment costs for injuries; or (5) reports higher car repair costs than the repair actually cost (*LII 2023; MR 1993*).

2.1. International literature

In one of the earliest studies, *Weisberg and Derrig* (*1991*) listed potential fraud indicators (red flags) according to their relative frequency. In this study, 18 objective characteristics (out of 65 possible characteristics) of claims for bodily injury insurance were used to identify fraudulent claims. Despite this, the simplicity of the method used has led to only limited success. *Derrig and Ostaszewski*'s (*1995*) study of red flags and the problem of classifying fraudulent claims also shows that there is no consensus among experts regarding fraudulent claims. They therefore propose a fuzzy classification technique for the insurers. *Weisberg and Derrig* (*1998*) tested the usefulness of potential red flags, quantified the effectiveness of standard investigative techniques and mapped the ability of firms to further detect fraud.

Belhadji et al. (*2000*) presented an "expert system" that assists insurance company employees in decision-making. The tool is not directly applicable to a specific insurer because the parameters used are derived from calculations based on industry data, but it was an important step towards the data mining and artificial-intelligence-based fraud detection models that are prevalent today.

The novel approach (discrete choice model) presented by *Artís et al.* (*1999*; *2002*) tested the effect of the characteristics of the insured and the circumstances of the accident on the probability of committing fraud. In addition, these studies also focused on the problem of misclassification. Due to the nature of the model used and the characteristics of the real automobile insurance data series, fraudulent

claims had to be overweighted in the estimation. This paved the way for the examination of asymmetric data series (such as automobile insurance fraud) using various overweighting or underweighting techniques. In parallel, *Viaene et al.* (*2002*) compared the performance of different fraud detection methods. The authors of the study used only indicators for property damage, as these are the only ones available at an early stage of the assessment process.

After *Artís et al.* (*1999*; *2002*) opened the door to oversampling or undersampling techniques and *Viaene et al.* (*2002*) introduced the use of early stage indicators, several authors presented some form of classification method based on oversampling or undersampling (especially for property damage). For example, *Pérez et al.* (*2005*) compared the performance of their consolidated tree algorithm with that of the well-known C4.5 algorithms on an oversampled real automobile insurance database. *Bermúdez et al.* (*2008*) proposed an asymmetric logit model that was able to handle unbalanced data sets. A few years later, the researchers proposed two new approaches for the undersampling of the majority class to improve the performance of classifiers in unbalanced datasets. In the first approach, *Sundarkumar et al.* (*2015*) proposed the one-class support vector machine (OCSVM)-based undersampling, while in the second approach *Sundarkumar – Ravi* (*2015*) proposed the combined use of k-nearest neighbour (KNN) and OCSVM.

Šubelj et al. (*2011*) presented a novel expert system using social network analysis to identify groups of fraudsters, rather than a few isolated cases of automobile insurance fraud. *Farquad et al.* (*2012*) used a modified active-learning-based approach in order to construct "if..., then" type rules from a support vector machine "black box" for customer relationship management. *Gepp et al.* (*2012*) compared the decision tree, survival analysis and discriminant analysis methodology with the logistic regression used by *Wilson* (*2009*). The novelty of the approach proposed by *Tao et al.* (*2012*) was that each insurance claim could be classified into two categories (lawful and fraudulent) with two different probabilities at the same time.

Yan – Li (*2015*) approached the detection of automobile insurance fraud as a problem of detecting outliers. Therefore, an improved outlier identification method based on a version of the nearest neighbour algorithm completed with pruning rules was proposed. *Nian et al.* (*2016*) suggested an unsupervised spectral ranking algorithm (SRA) method to detect anomalies. *Shaeiri and Kazemitabar* (*2020*) further developed the SRA approach and presented an implementation methodology that allowed real-time application of SRA on large datasets. *Li et al.* (*2018*) combined individual classifiers into multiple classifier systems to increase classification accuracy. *Wang and Xu* (*2018*) proposed a text analysis based on deep neural network and latent Dirichlet allocation (LDA).

Finally, some authors have approached the problem of detecting automobile insurance fraud from a strictly financial perspective, with a strong emphasis on

cost-sensitive classification of damage. For example, *Phua et al.* (*2004*) compared the performance of their proposed approach with various widely used techniques and demonstrated the superior performance of the proposed method in terms of cost savings. *Viaene et al.* (*2007*) focused on the cost of the examination process rather than on minimising the error rate (misclassification) and showed that cost-sensitive fraud screening can be a profitable approach for property and casualty insurance companies. Finally, *Zelenkov* (*2019*) also proposed a cost-sensitivity-based approach, but with an example-dependent cost-sensitive meta-algorithm, AdaBoost (adaptive boosting), which assigned different costs not only to different classification errors (as in previous studies) but also to different compensation cases.

For a more comprehensive review of the related international literature, including the most important indicators used to identify fraud, the most commonly used databases and the most current challenges in fraud identification, see *Benedek et al.* (*2022*).

2.2. Literature in Hungarian

The use of fraud detection methods, or even insurance fraud as a scientific research topic, is completely absent from the Hungarian literature. In this respect, this study is certainly of premier value.

As there is a complete lack of scientific research on insurance fraud in Hungarian, we briefly review some literature in Hungarian where artificial intelligence and machine learning methods are applied to economic-financial problems.

The first economic and financial AI applications appeared in the field of corporate bankruptcy prediction models: a combination of logistic regressions and factor analysis was used by *Hámori* (*2001*), whose model had a classification accuracy of 95.3 per cent. *Virág – Kristóf* (*2005*) applied a neural-network-based model for bankruptcy prediction, using the advantage offered by multiple neural layers (4) and the backpropagation algorithm. The accuracy of the results obtained with neural networks exceeded the results obtained with linear discriminant analysis and logistic regression by a few percentage points. *Virág and Nyitrai* (*2013*) were the first to apply the support vector machine (SVM) method to data from Hungarian companies. Using different kernel functions, they achieved 5-per cent better performance with SVM than with neural networks. *Virág and Nyitrai* (*2014*) compared the performance of ensemble methods, AdaBoost and bootstrap aggregating, using C4.5 decision trees with data from nearly a thousand Hungarian companies between 2001 and 2012. Their results showed that bootstrap aggregating performed better, but very slightly ahead of AdaBoost. Among the more recent applications, we mention the study by *Ágoston* (*2022*), which applies SVM, bootstrap aggregating and random forest algorithms to bankruptcy prediction using a sample of firms in the Budapest and Pécs urban regions. Based on the accuracy of the out-of-sample classification indicators, the random forest seems to be the winner.

Among the AI studies outside the bankruptcy forecast but within the economy, the following are also worth mentioning: *Muraközy* (*2018*) argues that machine learning, which focuses on prediction, and econometrics, which studies causal relations, are not substitutes but rather complementary empirical disciplines. *Farkas et al.* (*2020*) discusses the potential applications of machine learning in agriculture. The application of AI can also be seen in the fields of business economics (management, marketing): *Benedek* (*1999*) analyses the efficiency of marketing actions using statistical and data mining methods, while *Danyi* (*2019*) looks at the likely effects of artificial intelligence in pricing policies and strategies. *Bánkúty-Balog* (*2020*) assesses the geo-economic impacts of the spread of AI in Hungary in the context of international competitiveness. Finally, *Csillag et al.* (*2022*) used machine-learning-based structural topic modelling (STM) to evaluate the prevalence of environmental topics in the media.

3. Conceptual and theoretical background

The identification of automobile insurance fraud is a binary classification problem, so the performance of any classification algorithm can be described by the confusion matrix in *Table 1.*[1]

Table 1
Binary classifier confusion matrix and performance indicators used in the evaluation

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">Predicted value</td><td rowspan="2">Performance indicators</td></tr>
<tr><td>Fraudulent claim</td><td>Lawful claim</td></tr>
<tr><td rowspan="2">Actual value</td><td>Fraudulent claim</td><td>True positive (TP)</td><td>False negative (FN)</td><td>Sensitivity (TPR): $\frac{TP}{TP+FN}$</td></tr>
<tr><td>Lawful claim</td><td>False positive (FP)</td><td>True negative (TN)</td><td>Specificity (TNR): $\frac{TN}{FP+TN}$</td></tr>
<tr><td colspan="2" rowspan="2">Performance indicators</td><td>Precision (PPV): $\frac{TP}{TP+FP}$</td><td>Negative predictive value (NPV): $\frac{TN}{TN+FN}$</td><td>Estimation accuracy (ACC): $\frac{TP+TN}{TP+FP+TN+FN}$</td></tr>
<tr><td colspan="3">F-score $\frac{(1+\beta^2)*TPR*PPV}{\beta^2*TPR+PPV}$</td></tr>
</table>

Note: In the case of F-score, β is a coefficient to adjust the relative importance of precision and sensitivity.

[1] The methodology and theory of confusion matrices can be traced back to the work of *Green – Swets* (*1966*).

Various performance indicators can be derived from the confusion matrix. The most widely used measures of classifier performance are accuracy (ACC), sensitivity (TPR), specificity (TNR) and F-score. However, these measures also have their limitations, especially on asymmetric data sets such as automobile insurance fraud. A detailed description of each performance indicator and a discussion of possible limitations can be found in the work of *Benedek et al.* (*forthcoming*).

However, from a business perspective, one possible way to overcome all the problems with performance indicators is to quantify the operating costs of individual classifiers rather than looking at the performance of different classifiers. This approach allows for easy comparability and can take into account the costs of various misrepresentations. In addition, most insurers consider it more important to minimise the costs of the detection process than to minimise the error rate of the classifier.

To quantify the cost savings of a (semi-)automated fraud detection system, two key factors need to be considered: (1) the cost of continued use of the systems; and (2) the cost of operating the alternative system. Part of the cost of the ongoing use of the systems is the cost of the manpower needed to carry out the new tasks of the fraud analysis department. However, the most important item here is the cost arising from false signalling by the system. If a lawful claim is deemed fraudulent by the system, the insurer pays for the unnecessary investigation (because the system only flags a potential fraudulent claim, but this has to be verified and proven by an expert). Likewise, if a fraudulent claim is deemed lawful by the system, the insurer pays the fraudster. Considering the large number of claims processed by insurers, the costs of false signalling by the system can be very significant. In determining the operational costs of an alternative system, *Phua et al.* (*2004*) suggest that the alternative where the insurer takes no action to verify the legitimacy of claims and simply pays out all claims should be considered. Thus, the approach to quantifying the cost savings of any system (CSDM – cost saving of the decision method) given by equation (1) proposed by *Phua et al.* (*2004*) is as follows:

$$CSDM = NA - (MC + FAC + NC + HC) \tag{1}$$

where *NA* is the "no action cost", i.e. the cost of the alternative where the insurer takes no action to verify the legitimacy of the claims. Furthermore, the misses cost (MC), false alarms cost (FAC), normals cost (NC) and hits cost (HC) are as follows:

$$MC = NFN * ACA;$$

$$FAC = NFP * (ACI + ACA);$$

$$NC = NTN * ACA;$$

$$HC = NTP * ACI,$$

where NFN is the number of false negative cases, NFP is the number of false positive cases, NTN is the number of true negative cases, NTP is the number of true positive cases, ACA is the average claim amount and ACI is the average cost per investigation.

Viaene et al. (*2007*) did not define the cost savings of a system, but its operating costs (OC) given by equation (2); however, the way of defining the inputs is the same as presented by *Phua et al.* (*2004*).

$$OC = MC + FAC + NC + HC \tag{2}$$

What is important from a business perspective is that in both cases the authors work under the assumption that true negative (TN) cases do not impose an additional cost (i.e. the additional cost of a true negative case is 0) for insurers, since in these cases it is about the normal claims process. However, during our interviews,[2] industry experts highlighted that in practice these true negative cases also have an additional cost. There is a similar discrepancy between business practice and the literature when it comes to calculating the costs of true positive cases. According to the literature, in true positive cases, the insurer does not pay the insured, i.e. the only costs incurred are those related to the investigation. In business practice, however, the situation is different. As several previous studies showed (e.g. *Derrig – Ostaszewski 1995*; *Weisberg – Derrig 1998*), the vast majority of automobile insurance fraud consists of so-called build-up[3] claims. Our interviewees pointed out that, contrary to the literature, in practice it is rare for an insurer to completely refuse to pay. They usually offer less than the amount requested for identified build-up claims. There are many reasons for this, such as the lengthy and costly court process or negative marketing.

In view of the differences between the literature and the business practice described above, we recommend the calculation method proposed by *Benedek et al.* (*forthcoming*), given by equation (3), to determine the real costs of detecting automobile insurance fraud:

$$CSDM = NA - (MC + FAC + NC + HC) \tag{3}$$

where *NA* is "no action cost".[4] Furthermore:

$$MC = NFN * (ACA + AAC);$$

$$FAC = NFP * (ACI + ACA);$$

[2] We conducted three in-depth interviews with Romanian insurance company executives and experts from multinational insurance companies on automobile insurance fraud. A 22-question questionnaire was then prepared and sent to all partner institutions of UNSAR (the National Association of Insurance and Reinsurance Companies in Romania).

[3] Cases where the insured or the professional repairer claims more than the actual cost of the repair.

[4] In this paper, we use the approach presented by *Phua et al.* (*2004*), but the costing method we propose would also work perfectly well if we used the operating costs of an alternative system instead of the "no action cost".

$$NC = NTN * (ACA + AAC);$$

$$HC = NTP * (ACA - ASCIFC + ACI);$$

where average administrative cost (AAC) and average savings in the case of identified fraudulent claims (ASCIFC) are denoted.

Finally, we should mention the preventive effect of fraud prevention programmes, because without effective prevention, over time premiums will have to be increased to a level that will "cope" with fraudulent payments, so that sooner or later the premium will reach a level that will no longer be competitive in the market. In this study, the prevention effect, which is much harder to quantify, is not explicitly included, but it would not even affect the results significantly, since the cost of prevention reduces the profitability of both classical statistical methods and AI-based methods in the short run.

4. Results

4.1. Cost-effectiveness meta-analysis of the selected methods

After reviewing the literature and identifying the research gaps, we conducted a meta-analysis of the selected methods, which enables us to rank and compare the methods of automobile insurance fraud identification. First, the cost saving potential of these methods was calculated using the proposed cost saving calculation method.

The logic behind the initially selected 24 journal articles and 3 conference papers was twofold. On the one hand, only the studies indexed by the Web of Science were considered, and on the other hand, we also kept in mind that we wanted to compare the performance of models using a traditional statistical-econometric approach from 1999–2012 with the performance of AI-based models from 2012–2022 tested on real data sets. However, some of the 27 studies identified were purely theoretical and offered no concrete fraud identification method. The authors of other studies (e.g. *Pathak et al. 2005*; *Padmaja et al. 2007*; *Bhowmik 2011*; *Xu et al. 2011*; *Karamizadeh – Zolfagharifar 2016*; *Badriyah et al. 2018*) conducted their research without using real company datasets. Finally, there were several studies in which the authors did not present the confusion matrix, so for these studies we were not able to determine the inputs necessary for our costing method.

Taking into account the above limitations, there are only 12 studies left in our sample with all the data needed to determine the cost-saving potential of each model. In the 12 articles, the authors propose and compare a total of 35 different methods, the full list of which can be found in *Table 4* in the *Appendix*.

As the percentages of fraudulent claims in the analysed studies are different, the sizes of the databases are very different, and, moreover, 2 of the 7 databases used

are from the United States, 1 from Canada, 2 from Spain, 1 from Russia and 1 from Slovenia, we first built a general framework where we assume that an insurer processes 10,000 claims, of which 10 per cent are fraudulent. Metavariables such as the average cost per investigation or the average claim amount were determined on the basis of the questionnaire survey mentioned earlier. The questionnaire was fully completed by five Romanian insurance companies with a combined market share of nearly 70 per cent. In this study, we used a market-share-weighted average of the values provided by the five insurers. They showed an average cost per investigation of USD 145, an average claim amount of USD 2,420, an average saving of USD 485 for identified fraudulent claims, and an average administrative cost of USD 12.

Table 2 summarises the cost-saving potential of the 35 methods for three different scenarios. Rows 2 to 7 of the table show the input parameters of the given scenario. These are the input meta-parameters whose values come from industry experts and which are always constant for each classical statistical or AI-based method. Row 8 is the most important row, the output, since it is obtained by interacting and processing the meta-parameters with specific algorithm parameters. That is, the final operating cost of an algorithm is equal to the number of claims in the different categories (false positive, false negative) defined by the confusion matrix multiplied by the constant value of the meta-parameter (average cost per investigation, average claim amount) associated with that category. In economic language, row 8 shows how many of the 35 methods had a higher operating cost than that of the alternative, i.e. if the insurer did not investigate the validity of the claims and simply paid out the claims received. Counter-intuitively, the best-case scenario here is the one with the highest rate of fraudulent claims, since in this case even a less efficient method can achieve higher cost savings.

Table 2
Cost-effectiveness of methods used to identify fraudulent claims

	Most likely scenario	Worst case scenario	Best scenario
	35 models	35 models	35 models
Proportion of fraudulent claims (%)	10	5	20
Average claim amount (USD)	2,420	2,420	2,420
Average cost per investigation (USD)	145	193	97
Average administrative cost (USD)	12	12	12
Average savings for identified fraudulent claims (USD)	485	315	1,213
Number of methods with an operating cost higher than the “no action cost”	27	31	0

Note: For the worst and best case scenarios, we used the extreme values provided by the insurance companies.

We emphasise that the data summarised in *Table 2* well illustrate the importance of the proposed cost savings calculation method from a business perspective. While the cost-saving calculation method proposed by *Phua et al.* (*2004*) classifies almost all models as cost-effective, our proposed method (which takes into account the costs incurred in the real fraud detection process) classifies only 22.85 per cent of the models as cost-effective even in the most likely scenario, while only 11.42 per cent of the methods can be classified as cost-effective in the worst-case scenario, compared to the 94.28 (and 68.57) per cent of the methods proposed by *Phua et al.* (*2004*).

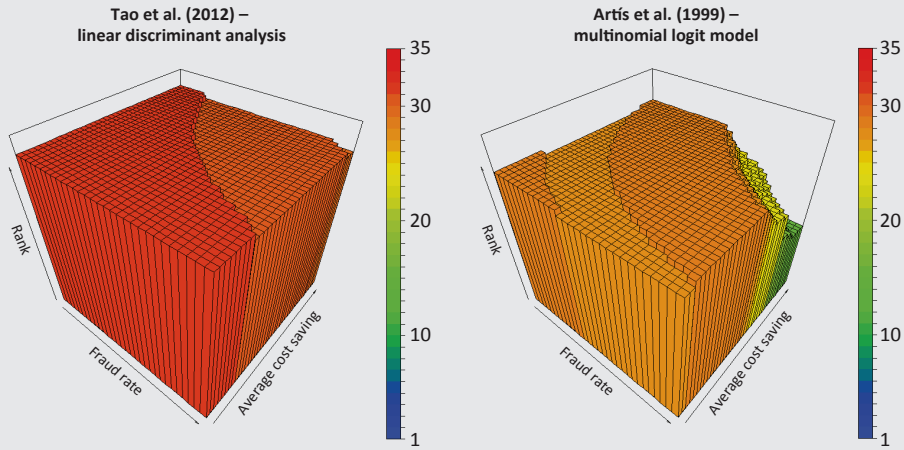
4.2. Heat maps of the cost-saving potential of fraud identification methods

In view of the rather surprising results revealed by the meta-analysis, we considered it an important step to further analyse each fraud detection method in depth and to investigate the circumstances under which the individual methods may be more beneficial than their counterparts. One reason for this approach is that, depending on the input parameters used in the meta-analysis (e.g. percentage of fraudulent claims, average cost per investigation), the cost-effectiveness of fraud detection methods varies significantly. The other reason is that some detection methods are unusable for some insurers, as these fraud detection methods use inputs (accident characteristics, police/medical reports, accident photographs) that are not (or not yet) available to the insurer.

In order to take into account as much as possible the specific characteristics of the fraud detection methods and to perform the meta-analysis with a wide range of input parameters, we ran 3 different simulations to investigate the performance of the methods and created heat maps to visualize the results.

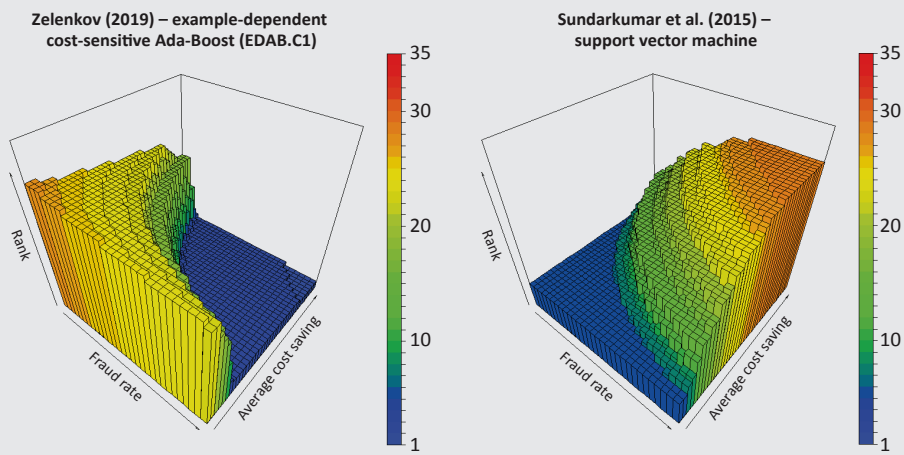
In the first simulation, a fixed investigation cost of USD 145 was assumed, while the percentage of fraudulent claims and the average savings in the case of identified fraudulent claims were varied. This approach can be very useful for insurance companies that work with a fixed cost per investigation (for example, by hiring a specialised external company to carry out the investigation and paying a pre-determined price for each claim), as they can easily decide which method is the most efficient for them in the given market circumstances. For example, if an insurance company is unable to use the fraud detection methods proposed by *Tao et al.* (*2012*) or *Bermúdez et al.* (*2008*) because it does not have the input parameters necessary to apply the model, but operates in a market with a high percentage of fraudulent claims and low average savings in the case of identified fraudulent claims, the multinomial logit model proposed by *Artís et al.* (*1999*) may be an optimal choice (*Figure 1*), as it performs almost as well as the method proposed by *Tao et al.* (*2012*). Likewise, any insurance company can easily choose the most appropriate method based on the percentage of fraudulent claims and the average savings in the case of fraudulent claims. For companies operating in a market with a low percentage of fraudulent claims and low average savings, the method proposed by *Zelenkov* (*2019*) seems to be better than the one proposed by *Sundarkumar et al.* (*2015*), see *Figure 2*.

Figure 1
Cost-saving ability of the models proposed by Tao et al. (2012) and Artís et al. (1999) on a heat map



Note: The cost-saving ability of the linear discriminant analysis model proposed by Tao et al. (2012) and the multinomial logit model proposed by Artís et al. (1999) compared to the cost-saving ability of the 35 models analysed under different scenarios.

Figure 2
Cost-saving ability of the models proposed by Zelenkov (2019) and Sundarkumar et al. (2015) on a heat map



Note: The cost-saving ability of the example-dependent cost-sensitive AdaBoost (EDAB.C1) model proposed by Zelenkov (2019) and the support vector machine model proposed by Sundarkumar et al. (2015) compared to the cost-saving ability of the 35 models analysed under different scenarios.

For the second simulation, the savings from identified fraudulent claims were held constant (USD 485) and the cost of investigation and the percentage of fraudulent claims were varied. In the third simulation, the percentage of fraudulent claims was held constant (10%) and the cost of investigation and the average savings in the case of identified fraudulent claims were varied.

4.3. Comparison of traditional statistical and machine-learning-based methods in terms of average cost savings

After the meta-analysis and heatmaps, a detailed non-parametric rank correlation analysis of the different fraud detection methods was performed. For a detailed discussion of Spearman's rank correlations, see *Benedek et al.* (*forthcoming*). The magnitude and significance of the correlations clearly show that the performance measures used in this study result in a consistent ranking of the fraud detection methods analysed (details in *Table 3* in the *Appendix*).

Perhaps the most interesting question in the study is whether AI-based detection methods are significantly more cost-effective than traditional statistical-econometric tools.

Obviously, AI and traditional statistical econometric methods are all parts of the same discipline generically called data science, and as such, the boundary between them is rather subjective and fluid, especially given the dynamic evolution of AI that is taking place before our eyes. For example, most machine learning courses start with the methodology of linear and logistic regression, which is also part of any standard econometrics curriculum. However, in our study, the following distinction was made: Any method developed after the emergence of the AI terminology in the literature was considered an AI or machine learning method. Therefore, e.g. linear and logistic regression as well as linear discriminant analysis were classified in the traditional category (since they do not require big data or neural nets) while genetic algorithms, neural nets, etc. were classified in the AI category.

As a first step, the differences in average cost savings between these two groups of methods were calculated, and the statistical significance of the differences was tested using the Mann–Whitney non-parametric test. These comparisons were performed on a wide range of combinations of input parameters (10,780 in total), resulting in a synthetic cross-tabulation between the average cost per test and the average savings of the identified fraudulent claims.

Table 5 in the *Appendix* clearly shows that the average cost savings for the vast majority of combinations are higher for traditional statistical methods[5] (the

[5] Although it is not the purpose of this study to examine the implementation costs of traditional statistical and AI methods, it is highly likely that the cost implications of traditional methods in this area are also lower, which further supports the conclusions observed in *Table 5* in the *Appendix*.

differences are positive and significant) than for AI-based methods, and we concluded that, surprisingly, there is no justification for insurance companies to invest heavily in AI-based fraud detection algorithms at this stage. This does not mean, of course, that these companies do not need software support in their operations, only that in most cases the traditional statistical software is sufficient.

5. Conclusions

In our research, we pointed out that there is a lack of literature examining the cost-effectiveness of methods for detecting automobile insurance fraud. Moreover, in the case of emerging markets, there is a complete lack of literature on the detection of automobile insurance fraud. Therefore, in this study, we applied the method proposed by *Benedek et al.* (*forthcoming*) to correctly calculate the cost-saving potential of automobile insurance fraud identification. The proposed method takes into account all costs incurred in a real fraud detection process (with particular emphasis on the fact that in the case of a fraudulent or partially fraudulent claim, the insurer will usually not deny payment completely but offer partial compensation).

In this cost-effectiveness study, we conducted a meta-analysis of 35 fraud detection methods from 12 different sources and concluded that most of the current methods of automobile insurance fraud detection in the literature are not profitable. In addition, we also pointed out that the approaches based on traditional statistical methods perform better than AI-based methods for the time being. In other words, there is no justification for insurance companies to make significant additional investments in AI-based fraud detection algorithms at this stage, and in most cases the use of traditional statistical software is sufficient. This result is consistent with that presented by *Benedek et al.* (*forthcoming*). This means that the use of traditional statistical methods is also more economical for the sample examined in this study (pre-2012 traditional statistical methods versus post-2012 AI-based approaches). With this result, the present study acts as a test of robustness and confirms previous research findings.

The most important limitation of the research, which is also an opportunity for further development, is that the input parameters in the meta-analysis are based on previous algorithms trained and tested on different datasets. The really convincing proof would be to run the same algorithms one by one on the same sample.

References

Ágoston, N. (2022): *Mesterséges intelligencia és gépi tanulási módszerek a vállalati fizetésképtelenség becslésére* (*Artificial intelligence and machine learning methods to estimate firm insolvency*). Statisztikai Szemle (Hungarian Statistical Review), 100(6): 584–609. https://doi.org/10.20311/stat2022.6.hu0584

Artís, M. – Ayuso, M. – Guillén, M. (1999): *Modelling different types of automobile insurance fraud behaviour in the Spanish market*. Insurance: Mathematics and Economics, 24(1–2): 67–81. https://doi.org/10.1016/S0167-6687(98)00038-9

Artís, M. – Ayuso, M. – Guillén, M. (2002): *Detection of Automobile Insurance Fraud With Discrete Choice Models and Misclassified Claims*. Journal of Risk and Insurance, 69(3): 325–340. https://doi.org/10.1111/1539-6975.00022

Association of British Insurers (2021): *No Time to Lie*. https://www.abi.org.uk/news/news-articles/2021/10/detected-fraud-2020/. Downloaded: 15 November 2021

Badriyah, T. – Rahmaniah, L. – Syarif, I. (2018): *Nearest neighbour and statistics method based for detecting fraud in auto insurance*. International Conference on Applied Engineering (ICAE), Batam, Indonesia, pp. 1–5. https://doi.org/10.1109/INCAE.2018.8579155

Bánkúty-Balog, L. (2022): *A mesterséges intelligencia elterjedésének geoökonómiai hatásai és Magyarország (The Geo-economic Ramifications of the Spread of Artificial Intelligence and Hungary)*. Külgazdaság, 66(7–8): 102–130. https://doi.org/10.47630/KULG.2022.66.7-8.102

Belhadji, E.B. – Dionne, G. – Tarkhani, F. (2000): *A Model for the Detection of Insurance Fraud*. The Geneva Papers on Risk and Insurance - Issues and Practice, 25(4): 517–538. https://doi.org/10.1111/1468-0440.00080

Benedek, G. (1999): *Mesterséges intelligencia az üzleti világban: Marketingakciók hatékonyságának elemzése statisztikai és Data Mining módszerekkel* (*Artificial intelligence in business: analysing the effectiveness of marketing actions using statistical and data mining methods*). Vezetéstudomány-Management and Business Journal, 30(11): 33–36.

Benedek, B. – Ciumas, C. – Nagy, B.Z. (2022): *Automobile insurance fraud detection in the age of big data – a systematic and comprehensive literature review*. Journal of Financial Regulation and Compliance, 30(4): 503–523. https://doi.org/10.1108/JFRC-11-2021-0102

Benedek, B. – Ciumas, C. – Nagy, B.Z. (forthcoming): *On the cost-efficiency of automobile insurance fraud detection methods – A meta-analysis*. Global Business Review, accepted for publication, forthcoming.

Bermúdez, L. – Pérez, J.M. – Ayuso, M. – Gómez, E. – Vázquez, F.J. (2008): *A Bayesian dichotomous model with asymmetric link for fraud in insurance*. Insurance: Mathematics and Economics, 42(2): 779–786. https://doi.org/10.1016/j.insmatheco.2007.08.002

Bhowmik, R. (2011): *Detecting auto insurance fraud by data mining techniques*. Journal of Emerging Trends in Computing and Information Sciences, 2(4): 156–162.

Csillag, J.B. – Granát, P.M. – Neszveda, G. (2022): *Media Attention to Environmental Issues and ESG Investing*. Financial and Economic Review, 21(4): 129–149. https://doi.org/10.33893/FER.21.4.129

Danyi, P. (2018): *A mesterséges intelligencia alkalmazása az árazásban (Artificial intelligence in pricing)*. Marketing & Menedzsment (Marketing & Management), 52(3–4): 5–18.

Derrig, R.A. – Ostaszewski, K.M. (1995): *Fuzzy techniques of pattern recognition in risk and claim classification*. Journal of Risk and Insurance, 62(3): 447–482. https://doi.org/10.2307/253819

Farkas, G. – Magyar, P. – Molnár, A. – Zubor-Nemes, A. (2020): *Adatbányászati módszerek alkalmazása a mezőgazdaságban – a gépi tanulás felhasználási lehetőségei* (*Adaptation of data mining methods in agriculture – potential uses of machine learning*). Gazdálkodás: Scientific Journal on Agricultural Economics, 64(1): 15–24.

Farquad, M.A. – Ravi, V. – Raju, S.B. (2012): *Analytical CRM in banking and finance using SVM: a modified active learning-based rule extraction approach.* International Journal of Electronic Customer Relationship Management, 6(1): 48–73. https://doi.org/10.1504/IJECRM.2012.046470

Gepp, A. – Wilson, H.J. – Kumar, K. – Bhattacharya, S. (2012): *A Comparative Analysis of Decision Trees Vis-a-vis Other Computational Data Mining Techniques in Automotive Insurance Fraud Detection*. Journal of Data Science, 10(3): 537–561. https://doi.org/10.6339/JDS.201207_10(3).0010

Green, D.M. – Swets, J.A. (1966): *Signal detection theory and psychophysics* (1 ed., Vol. 1). New York: Wiley.

Hámori, G. (2001): *A fizetésképtelenség előrejelzése logit-modellel* (*Logit model for predicting insolvency*). Bankszemle, 45(1–2): 65–87.

He, H. – Bai, Y. – Garcia, E. – Li, S. (2008): *ADASYN: Adaptive synthetic sampling approach for imbalanced learning*. IEEE International Joint Conference on Neural Networks (IEEE World Congress On Computational Intelligence), Hong Kong, pp. 1322–1328. https://doi.org/10.1109/IJCNN.2008.4633969

Hill, H.R. – Sandler, B. – Mokgokong, R. – Lister, S. – Ward, T. – Boyce, R. – Farooqui, U. – Gordon, J. (2020): *Cost-effectiveness of targeted screening for the identification of patients with atrial fibrillation: evaluation of a machine learning risk prediction algorithm*. Journal Of Medical Economics, 23(4): 386–393. https://doi.org/10.1080/13696998.2019.1706543

III (2019): *Insurance Fact Book.* Insurance Information Institute. Insurance Information Institute. https://www.iii.org/sites/default/files/docs/pdf/insurance_factbook_2019.pdf

III (2021): *Background on: Insurance fraud.* Insurance Information Institute. https://www.iii.org/article/background-on-insurance-fraud. Downloaded: 20 November 2021.

Karamizadeh, F. – Zolfagharifar, S.A. (2016): *Using the Clustering Algorithms and Rule-based of Data Mining to Identify Affecting Factors in the Profit and Loss of Third Party Insurance, Insurance Company Auto.* Indian Journal of Science and Technology, 9(7): 1–9. https://doi.org/10.17485/ijst/2016/v9i7/87846

Lee, A. – Taylor, P. – Kalpathy-Cramer, J. – Tufail, A. (2017): *Machine Learning Has Arrived!* Ophthalmology, 124(12): 1726–1728. https://doi.org/10.1016/j.ophtha.2017.08.046

LII (2023): *Insurance Fraud.* Legal Information Institute, Cornell Law School. https://www.law.cornell.edu/wex/insurance_fraud. Downloaded: 26 April 2023

Li, Y. – Yan, C. – Liu, W. – Li, M. (2018): *A principle component analysis-based random forest with the potential nearest neighbor method for automobile insurance fraud identification*. Applied Soft Computing, 70(September): 1000–1009. https://doi.org/10.1016/j.asoc.2017.07.027

Massachusetts Regulation (1993): *Division of Insurance Regulations*. Massachusetts government. https://www.mass.gov/service-details/division-of-insurance-regulations. Downloaded: 26 April 2023.

Muraközy, B. (2018): *Gépi tanulás, predikció és okság a közgazdaság-tudományban* (*Machine Learning, Prediction and Causality in Economics*). Magyar Tudomány, 179(7): 1027–1037. https://doi.org/10.1556/2065.179.2018.7.10

Nian, K. – Zhang, H. – Tayal, A. – Coleman, T. – Li, Y. (2016): *Auto insurance fraud detection using unsupervised spectral ranking for anomaly.* The Journal of Finance and Data Science, 2(1): 58–75. https://doi.org/10.1016/j.jfds.2016.03.001

Padmaja, T.M. – Dhulipalla, N. – Bapi, R.S. – Krishna, P.R. (2007): *Unbalanced data classification using extreme outlier elimination and sampling techniques for fraud detection.* 15th International Conference on Advanced Computing and Communications (ADCOM 2007), Guwahati, India, pp. 511–516. https://doi.org/10.1109/ADCOM.2007.74

Pathak, J. – Vidyarthi, N. – Summers, S.L. (2005): *A fuzzy-based algorithm for auditors to detect elements of fraud in settled insurance claims.* Managerial Auditing Journal, 20(6): 632–644. https://doi.org/10.1108/02686900510606119

Pérez, J.M. – Muguerza, J. – Arbelaitz, O. – Gurrutxaga, I. – Martín, J.I. (2005): *Consolidated Tree Classifier Learning in a Car Insurance Fraud Detection Domain with Class Imbalance.* In: Singh, S. – Singh, M. – Apte, C. – Perner, P. (eds.): *Pattern Recognition and Data Mining*. ICAPR 2005. Lecture Notes in Computer Science, vol 3686. Springer, Berlin, Heidelberg. https://doi.org/10.1007/11551188_41

Phua, C. – Alahakoon, D. – Lee, V. (2004): *Minority report in fraud detection: classification of skewed data.* ACM Sigkdd Explorations Newsletter, 6(1): 50–59. https://doi.org/10.1145/1007730.1007738

Shaeiri, Z. – Kazemitabar, S.J. (2020): *Fast unsupervised automobile insurance fraud detection based on spectral ranking of anomalies.* International Journal of Engineering, 33(7): 1240–1248. https://doi.org/10.5829/ije.2020.33.07a.10

Šubelj, L. – Furlan, Š. – Bajec, M. (2011): *An expert system for detecting automobile insurance fraud using social network analysis*. Expert Systems with Applications, 38(1): 1039–1052. https://doi.org/10.1016/j.eswa.2010.07.143

Subudhi, S. – Panigrahi, S. (2017): *Use of optimized Fuzzy C-Means clustering and supervised classifiers for automobile insurance fraud detection.* Journal of King Saud University – Computer and Information Sciences, 32(5): 568–575. https://doi.org/10.1016/j.jksuci.2017.09.010

Sundarkumar, G.G. – Ravi, V. (2015): *A novel hybrid undersampling method for mining unbalanced datasets in banking and insurance.* Engineering Applications of Artificial Intelligence, 37(January): 368–377. https://doi.org/10.1016/j.engappai.2014.09.019

Sundarkumar, G.G. – Ravi, V. – Siddeshwar, V. (2015): *One-class support vector machine based undersampling: Application to churn prediction and insurance fraud detection*. IEEE International Conference on Computational Intelligence and Research (ICCIC), Madurai, India, pp. 1–7. https://doi.org/10.1109/ICCIC.2015.7435726

Tao, H. – Zhixin, L. – Xiaodong, S. (2012): *Insurance fraud identification research based on fuzzy support vector machine with dual membership.* International Conference on Information Management, Innovation Management and Industrial Engineering, Sanya, pp. 457–460. https://doi.org/10.1109/ICIII.2012.6340016

Viaene, S. – Ayuso, M. – Guillen, M. – Van Gheel, D. – Dedene, G. (2007): *Strategies for detecting fraudulent claims in the automobile insurance industry.* European Journal of Operational Research, 176(1): 565–583. https://doi.org/10.1016/j.ejor.2005.08.005

Viaene, S. – Derrig, R.A. – Baesens, B. – Dedene, G. (2002): *A Comparison of State-of-the-Art Classification Techniques for Expert Automobile Insurance Claim Fraud Detection.* Journal of Risk and Insurance*,* 69(3): 373–421. https://doi.org/10.1111/1539-6975.00023

Virág, M. – Kristóf, T. (2005): *Az első hazai csődmodell újraszámítása neurális hálók segítségével* (*Recalculation of the first Hungarian bankruptcy-prediction model using neural networks*). Közgazdasági Szemle (Economic Review), 52(2) 144–162.

Virág, M. – Nyitrai, T. (2013): *Application of support vector machines on the basis of the first Hungarian bankruptcy model.* Society and Economy, 35(2): 227–248. https://doi.org/10.1556/SocEc.35.2013.2.6

Virág, M. – Nyitrai, T. (2014): *The application of ensemble methods in forecasting bankruptcy*. Financial and Economic Review, 13(4): 178–193. https://en-hitelintezetiszemle.mnb.hu/letoltes/8-virag-nyitrai-en.pdf

Wang, Y. – Xu, W. (2018): *Leveraging deep learning with LDA-based text analytics to detect automobile insurance fraud.* Decision Support Systems*,* 105(January): 87–95. https://doi.org/10.1016/j.dss.2017.11.001

Weisberg, H. – Derrig, R. (1991): *Fraud and Automobile Insurance: A Report on Bodily Injury Liability Claims in Massachusetts*. Journal of Insurance Regulation*,* 9(4): 497–541.

Weisberg, H. – Derrig, R. (1998): *Quantitative methods for detecting fraudulent automobile bodily injury claims*. Risques, 35: 75–99.

Wilson, J.H. (2009): *An analytical approach to detecting insurance fraud using logistic regression*. Journal of Finance and Accountancy, 85(150): 1–15.

Xu, W. – Wang, S. – Zhang, D. – Yang, B. (2011): *Random rough subspace based neural network ensemble for insurance fraud detection.* Fourth International Joint Conference on Computational Sciences and Optimization, Kunming and Lijiang City, China, pp. 1276–1280. https://doi.org/10.1109/CSO.2011.213

Yan, C. – Li, Y. (2015): *The Identification Algorithm and Model Construction of Automobile Insurance Fraud Based on Data Mining.* Fifth International Conference on Instrumentation and Measurement, Computer, Communication and Control (IMCCC), Qinhuangdao, China, pp. 1922–1928. https://doi.org/10.1109/IMCCC.2015.408

Zelenkov, Y. (2019): *Example-dependent cost-sensitive adaptive boosting*. Expert Systems with Applications, 135: 71–82. https://doi.org/10.1016/j.eswa.2019.06.009

Appendix

Table 3
Spearman's rank correlation coefficients between rankings based on different parameters

	Total savings	Sensitivity	Specificity	Precision	Negative predictive value	Estimation accuracy	F-score
Total savings	**1.000**						
Sensitivity	0.069 (0.731)	**1.000**					
Specificity	0.831 (49.41)***	–0.346 (–2.57)**	**1.000**				
Precision	0.924 (24.56)***	0.047 (0.48)	0.871 (19.15)***	**1.000**			
Negative predictive value	0.254 (2.47)	0.951 (33.51)***	–0.028 (–0.41)	0.252 (2.78)**	**1.000**		
Estimation accuracy	0.947 (98.34)***	–0.081 (–0.62)	0.957 (38.93)***	0.942 (25.87)***	0.135 (1.57)	**1.000**	
F-score	0.828 (19.11)***	0.278 (4.01)***	0.599 (6.85)***	0.792 (15.68)***	0.616 (6.29)***	0.732 (11.03)***	**1.000**

*Note: The formula used to determine the negative predictive value is: TN/(FN+TN). Student t-statistics in parentheses. *Significant at 10% level; **Significant at 5% level; ***Significant at 1% level.*

Table 4
The 35 fraud detection methods tested and their sensitivity and specificity

Author	Method	Sensitivity	Specificity
Artís et al. (1999)	multinomial logit model	0.6614	0.9065
	nested multinomial logit model	0.3209	0.8132
Belhadji et al. (2000)	probit regression – threshold 10%	0.6940	0.9145
	probit regression – threshold 20%	0.5373	0.9596
Artís et al. (2002)	logit regression with omission error	0.7793	0.6994
	logit regression without omission error	0.7703	0.7094
Bermúdez et al. (2008)	Bayesian skewed logit model	0.8515	0.9968
	standard logit and Bayesian logit models	0.8515	0.6043
Wilson (2009)	logit regression	0.5918	0.8163
Šubelj et al. (2011)	social network analysis	0.8913	0.8667
Tao et al. (2012)	linear discriminant analysis	0.7392	0.9738
	quadratic discriminant analysis	0.7933	0.9767
	naive Bayesian	0.8351	0.9815
Farquad et al. (2012)	MALBA (logistic) – 1,000 extra instances	0.8838	0.5534
	MALBA (normal) – 1,000 extra instances	0.8811	0.5588
	ALBA – 1,000 extra instances	0.8784	0.5656
	MALBA – 1,000 extra instances	0.8848	0.5560
Sundarkumar et al. (2015)	decision tree	0.9552	0.5658
	multi-layer perceptron	0.4859	0.7889
	support vector machine	0.9400	0.5639
	probabilistic neural network	0.9173	0.5533
	group method of data handling	0.7362	0.7148
Sundarkumar – Ravi (2015)	probabilistic neural network	0.8750	0.5894
	multi-layer perceptron	0.6458	0.7189
	decision tree	0.9074	0.5869
	group method of data handling	0.5686	0.8020
	support vector machine	0.9189	0.5839
Subudhi – Panigrahi (2017)	GAFCM – DT	0.6625	0.8765
	GAFCM – SVM	0.6970	0.8471
	GAFCM – MLP	0.6107	0.8400
	GAFCM – GMDH	0.5727	0.7976
Zelenkov (2019)	example-dependent cost-sensitive Ada-Boost (EDAB.C1)	0.2510	0.9301
	example-dependent cost-sensitive Ada-Boost (EDAB.C2)	0.5900	0.7327
	example-dependent cost-sensitive Ada-Boost (EDAB. C2-ROC)	0.4477	0.8050
	example-dependent cost-sensitive Ada-Boost (EDAB.C3)	0.2510	0.9301

Note: indicated in bold for traditional statistical econometric models

Table 5

Average cost savings differences between traditional statistical and AI-based identification methods

ASCIFC	ACI										
	100	110	120	130	140	150	160	170	180	190	200
160	73,100 (46)***	87,426 (45)***	101,753 (47)***	116,079 (48)***	130,405 (50)***	144,732 (51)***	159,058 (51)***	173,384 (51)***	187,711 (53)***	202,037 (53)***	216,363 (53)***
180	73,283 (45)***	87,610 (45)***	101,936 (46)***	116,262 (47)***	130,589 (48)***	144,915 (50)***	159,241 (51)***	173,568 (51)***	187,894 (51)***	202,221 (53)***	216,547 (53)***
200	73,467 (46)***	87,793 (46)***	102,120 (45)***	116,446 (46)***	130,772 (47)***	145,099 (48)***	159,425 (50)***	173,751 (51)***	188,078 (49)***	202,404 (51)***	216,730 (51)***
220	73,650 (44)***	87,977 (46)***	102,303 (46)***	116,629 (45)***	130,956 (46)***	145,282 (47)***	159,608 (48)***	173,935 (50)***	188,261 (51)***	202,588 (50)***	216,914 (51)***
240	73,834 (49)***	88,160 (46)***	102,487 (46)***	116,813 (45)***	131,139 (45)***	145,466 (47)***	159,792 (47)***	174,118 (48)***	188,445 (50)***	202,771 (50)***	217,097 (51)***
260	74,017 (49)***	88,344 (43)***	102,670 (47)***	116,996 (46)***	131,323 (45)***	145,649 (45)***	159,975 (47)***	174,302 (47,5)***	188,628 (48)***	202,955 (50)***	217,281 (50)***
280	74,201 (44)***	88,527 (49)***	102,853 (46)***	117,180 (46)***	131,506 (45)***	145,833 (45)***	160,159 (46)***	174,485 (47)***	188,812 (48)***	203,138 (48)***	217,464 (50)***
300	74,384 (42)***	88,711 (46,5)***	103,037 (43)***	117,363 (47)***	131,690 (46)***	146,016 (45)***	160,342 (45)***	174,669 (46)***	188,995 (47)***	203,322 (48)***	217,648 (48)***
320	74,568 (41)***	88,894 (48)***	103,220 (47)***	117,547 (46)***	131,873 (45)***	146,200 (46)***	160,526 (45)***	174,852 (45)***	189,179 (46)***	203,505 (47)***	217,831 (48)***
340	74,751 (42)***	89,078 (44)***	103,404 (47)***	117,730 (43)***	132,057 (46)***	146,383 (46)***	160,709 (45)***	175,036 (45)***	189,362 (45)***	203,689 (47)***	218,015 (47)***
360	74,935 (43)***	89,261 (42)***	103,587 (49)***	117,914 (46)***	132,240 (46)***	146,567 (45)***	160,893 (46)***	175,219 (45)***	189,546 (45)***	203,872 (46)***	218,198 (47)***
380	75,118 (47)***	89,445 (41)***	103,771 (46)***	118,097 (49)***	132,424 (44)***	146,750 (46)***	161,076 (46)***	175,403 (46)***	189,729 (45)***	204,056 (45)***	218,382 (46)***
400	75,302 (50)***	89,628 (42)***	103,954 (44)***	118,281 (46,5)***	132,607 (44)***	146,934 (46)***	161,260 (46)***	175,586 (46)***	189,913 (45)***	204,239 (45)***	218,565 (45)***
420	75,485 (51)***	89,812 (43)***	104,138 (42)***	118,464 (49)***	132,791 (49)***	147,117 (44)***	161,443 (47)***	175,770 (46)***	190,096 (46)***	204,423 (45)***	218,749 (45)***
440	75,669 (54)***	89,995 (43)***	104,321 (41)***	118,648 (45)***	132,974 (47)***	147,301 (44)***	161,627 (46)***	175,953 (46)***	190,280 (46)***	204,606 (46)***	218,932 (45)***
460	75,852 (60)***	90,179 (47)***	104,505 (41)***	118,831 (44)***	133,158 (49)***	147,484 (47)***	161,810 (44)***	176,137 (47)***	190,463 (45)***	204,790 (46)***	219,116 (45)***
480	76,036 (61)***	90,362 (50)***	104,688 (42)***	119,015 (42)***	133,341 (48)***	147,668 (49)***	161,994 (44)***	176,320 (46)***	190,647 (45)***	204,973 (46)***	219,299 (46)***
500	76,219 (61)***	90,546 (52)***	104,872 (43)***	119,198 (41)***	133,525 (44)***	147,851 (46,5)***	162,177 (47)***	176,504 (44)***	190,830 (47)***	205,157 (45)***	219,483 (46)***
520	76,403 (62)***	90,729 (53)***	105,055 (45)***	119,382 (41)***	133,708 (44)***	148,035 (49)***	162,361 (49)***	176,687 (43)***	191,014 (46)***	205,340 (47)***	219,666 (46)***
540	76,586 (65)***	90,913 (57)***	105,239 (47)***	119,565 (42)***	133,892 (42)***	148,218 (47,5)***	162,544 (47)***	176,871 (46)***	191,197 (44)***	205,523 (47)***	219,850 (45)***
560	76,770 (66)***	91,096 (60)***	105,422 (50)***	119,749 (43)***	134,075 (41)***	148,402 (44)***	162,728 (48)***	177,054 (49)***	191,381 (43)***	205,707 (46)***	220,033 (47)***
580	76,953 (73)***	91,280 (60)***	105,606 (51)***	119,932 (44)***	134,259 (41)***	148,585 (44)***	162,911 (49)***	177,238 (47)***	1915,64 (45)***	205,890 (44)***	220,217 (47)***
600	77,137 (73)***	91,463 (61)***	105,789 (51,5)***	120,116 (45)***	134,442 (42)***	148,769 (42)***	163,095 (46)***	177,421 (46,5)***	191,748 (47)***	206,074 (43)***	220,400 (46)***
620	77,320 (76)**	91,647 (62)***	105,973 (54)***	120,299 (47)***	134,626 (42)***	148,952 (41)***	163,278 (44)***	177,605 (49)***	191,931 (49)***	206,257 (44)***	220,584 (44)***
640	77,504 (77)**	91,830 (65)***	106,156 (60)***	120,483 (50)***	134,809 (43)***	149,136 (41)***	163,462 (44)***	177,788 (48)***	192,115 (47)***	206,441 (47)***	220,767 (43)***
660	77,687 (82)**	92,014 (66)***	106,340 (60)***	120,666 (51)***	134,993 (43)***	149,319 (41)***	163,645 (42)***	177,972 (45)***	192,298 (46)***	206,624 (49)***	220,951 (44)***
680	77,871 (87)**	92,197 (68)***	106,523 (60)***	120,850 (52)***	135,176 (46,5)***	149,503 (42)***	163,829 (41)***	178,155 (44)***	192,482 (49)***	206,808 (47)***	221,134 (47)***
700	78,054 (90)**	92,381 (73)***	106,707 (61)***	121,033 (54)***	135,360 (47)***	149,686 (43)***	164,012 (41)***	178,339 (44)***	192,665 (48)***	206,991 (46,5)***	221,318 (49)***

*Note: ASCIFC: average savings for identified fraudulent claims; ACI: average cost per investigation. Mann-Whitney U-statistics in parentheses. *Significant at 10% level; **Significant at 5% level; ***Significant at 1% level.*

The Uptake of Green Finance Tools in Agriculture – Results of a Q-methodology*

Anett Parádi-Dolgos – Tibor Bareith – László Vancsura – Arnold Csonka

In this period of climate change, green finance is expected to have complex consequences to address economic and environmental risks by improving the profitability of individual activities. There are clearly identifiable areas of green development in agriculture that require such funding. Our research investigates the effectiveness of green finance tools in financing the sustainable development of the pig sector, a key agricultural sub-sector. The results of a Q-methodology study carried out with actors in the product chain showed that green finance is an unknown area for them. They are uncertain and pessimistic about whether and to what extent green finance tools can contribute to the development of the sector, but all share the view that sustainable investment in the sector may require public intervention. The use of economic policy instruments may therefore be necessary to make a sector-specific green finance programme a success.

Journal of Economic Literature (JEL) codes: D25, O13, Q14

Keywords: green finance, sustainability, pig sector, agricultural financing, Q-methodology

1. Introduction

Tackling climate change and its consequences is one of the most pressing issues of our time: much of the world has already recognised that major economic and financial changes will be needed to mitigate and, where possible, reverse the negative effects of climate change. All economic actors, including financial institutions and central banks, have a role to play (*Deák 2021*). However, how and to what extent central banks should play a part is far from clear. The primary

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Anett Parádi-Dolgos: Hungarian University of Agricultural and Life Sciences, Associate Professor.
Email: paradi-dolgos.anett.katalin@uni-mate.hu
Tibor Bareith: Hungarian University of Agricultural and Life Sciences, Assistant Professor (corresponding author).
Email: btibor09@gmail.com
László Vancsura: Hungarian University of Agricultural and Life Sciences, Ph.D. Student.
Email: vancsura.laszlo@phd.uni-mate.hu
Arnold Csonka: Hungarian University of Agricultural and Life Sciences, Associate Professor.
Email: csonka.arnold@uni-mate.hu

The research was supported by the Green Finance Research Initiative of the Magyar Nemzeti Bank.

The first version of the Hungarian manuscript was received on 21 December 2022.

DOI: https://doi.org/10.33893/FER.22.2.99

responsibility of the Magyar Nemzeti Bank (MNB) is to preserve price stability, and therefore central bank decisions affecting green finance should be viewed through this lens (*Kolozsi et al. 2022*). The main objective of containing inflation should not be compromised by other, in this context secondary, responsibilities. The MNB's response to environmental challenges is the Green Programme,[1] which supports the Second National Climate Change Strategy adopted by the Parliament.[2] The Green Programme takes a comprehensive approach, covering a wide range of issues including material for families, support for research and recommendations for financial institutions.

The financial market has also entered a period of adaptation to climate change, with the rise of green finance. Green finance refers to financial products specifically designed to finance environmental, sustainability and social objectives. While the range of products is gradually expanding, and the amount of capital tied up in green finance is increasing, the capital required to combat climate change is a significant burden on humanity. At the same time, green finance has a positive impact on economic development by improving the ecological environment, increasing economic efficiency and diversifying economic structure (*Yang et al. 2021*).

All sectors are facing challenges, but the extent to which they are affected varies considerably. The importance of the agricultural sector to the national economy and its exposure is well known. The agricultural sector is characterised by social, economic and environmental risks in equal measure, but at the same time, together with the food industry, it forms the basis of the real economy. In the face of climate risks and increasing demand for raw materials, understanding and monitoring trends in the profitability, sustainability and competitiveness of the sector is certainly a key issue.

In the case of agriculture, quantifying these aspects and exploring solutions is essential. Globally, the agricultural sector is responsible for about 22 per cent of all greenhouse gas emissions (*IPCC 2022*). This share is much lower in developed countries, mainly due to significant reductions in livestock numbers, the more efficient use of fertilisers and a better management of organic fertilisers (*Migliorelli 2019*). There are many examples of the 'greening' of agriculture, e.g. environmentally friendly and energy-saving techniques are used in China to control diseases and pests (*Yu et al. 2020*); but this can also include water management, organic fertiliser management, etc. However, the natural and/or technical solutions used must be supported by appropriate financing in a way that does not reduce productivity and profitability. The problem is complicated by the need to finance not only compliance with sustainability or environmental criteria, but also to take

[1] https://www.mnb.hu/letoltes/az-mnb-zold-programja.pdf
[2] https://nakfo.mbfsz.gov.hu/sites/default/files/files/N%C3%89S_Ogy%20%C3%A1ltal%20elfogadott.PDF

account of parallel market pressures or changing social needs in certain sectors (e.g. pigs).

Our research investigates the effectiveness of green finance tools in financing the sustainable development of pig production.

With strong industrial linkages on both the input and output sides, the domestic pig sector is one of the most industrialised sectors of agriculture. Due to industrial production, economies of scale play a major role in the farm structure in this sector (*Duffy 2009*; *Hsu 2015*). However, meeting sustainability requirements is also an important element in increasing productivity. The need to address and prevent environmental problems associated with nitrogen discharges from intensive livestock farming is therefore growing.

In Hungary, the pig sector has been characterised by declining herd sizes and restructuring over the last two decades. The number of pigs fell by almost 28 per cent between 2000 and 2010 and by a further 10 per cent between 2010 and 2020 (*HCSO 2022a*), even though pig production concentrated and the pig population increased in several countries over the same period, e.g. in China and the USA (*Hsu 2015*). The fall in pig numbers mainly affected individual farms, but was less characteristic of farm organisations (*Csonka et al. 2021*). As a result, pig farming in Hungary is now dominated by partnerships, which account for four fifths of the pig population (*HCSO 2021*).

In addition, of course, the farm size structure has changed significantly, with an increasing proportion of the herd concentrated in larger farms. According to agricultural censuses, the share of farms with less than 50 pigs in the Hungarian pig population decreased from 26.1 per cent in 2010 to 12.6 per cent in 2020. Meanwhile, the share of farms with more than 500 head increased from 73.8 per cent to 87.4 per cent. Within the latter, the share of pigs kept in holdings with more than 5,000 head is 68 per cent (*HCSO 2022b*). It can be concluded that Hungary is now characterised by intensive pig farming, and the decisions that will determine the future of the sector are also taken on larger farms.

From a financial and policy point of view, the question is: In view of the importance of the pig sector, can green finance be applied to this sector? Do sustainability requirements help to improve competitiveness? Will producers be motivated to change? These questions will now be discussed on the basis of a review of the literature on agricultural financing and green finance as well as the results of a Q-methodology study.

2. Specificities of agricultural financing

Modern agricultural production requires a substantial amount of capital, most of which can usually only be financed from external sources. A price collapse due to an unexpected fall in demand or, possibly, working capital requirements resulting from a sharp increase in demand can cause serious problems. In terms of revenue and profitability, production and its efficiency is a risk factor that can adversely affect producers. One characteristic feature of agricultural production is the long time span involved in the production process (for example, the life cycle of winter wheat is 10 months, that of growing cattle is 18 months and that of slaughter pigs is about 7–8 months). One of the economic effects of this is that switching to another production process during the breeding season is either impossible or very time-consuming. In addition, the entire economic programme has to be developed and defined much earlier, before the start of the production process. The third economic consequence is that the payback period for investments and current assets is significantly longer than in most industries (*Ferencz 2014*). These characteristics affect, inter alia, the maturity of loans, the level of interest rates, taxation, etc.

The relatively long production processes and the sector's exposure to weather conditions make agriculture completely vulnerable to market conditions in the short term (*Dey – Mishra 2022*). The sector plays a key role in determining the price of inputs, but it is slower to adapt to market influences affecting agricultural activity. It is not possible to speed up the production process by changing the amount of labour, nor is it possible to multiply these processes. The relatively long span of the production process in the agricultural sector leads to a focus on long-term economic objectives and sustainable operation of the enterprise (*Vo – Ngo 2021*).

Given the seasonality and the production cycle, the additional costs arising from the interruption of the continuity of income, even assuming a diversified production system, remain a concern for agricultural enterprises, and even more so for small farms (*Sipiczki et al. 2019*). In the production process, inputs (materials, wages, etc.) need to be financed (*Horváth 2019*). Obviously, if this financing is provided by external sources, interest is an additional cost and therefore financial intermediation plays an important role, as empirically demonstrated by *Fogarasi and Zubor-Nemes* (*2017*). The coordination of sectors with different production cycles, the multifunctional structure of production and the disadvantages resulting from the specific characteristics of agricultural production can be mitigated (e.g. continuous income from dairy can cover the costs of wheat production or pig fattening until their recovery).

However, this particular cyclicality has important implications for agricultural policy. Until they sell their products, farmers are not always able to cover their expenses and living costs from their cash reserves during the production period.

3. The emergence of green finance in agriculture

The study by *Wang and Zhi* (*2016*) presents innovative green financial tools related to agriculture (environmental protection), such as environmental funds and biodiversity funds, debt-for-environment swaps (SWAPs), forestry securitisations, weather derivatives, nature-linked securities and green investment funds. *Akomea-Frimpong et al.* (*2021*) compiled a list of the green financial products most commonly used by banks: green credit/loans, green long-term investment accounts, carbon finance, climate finance, green securities and bonds, green insurance and green infrastructural bonds. The success of the green transition also depends on strategic cooperation with the country's financial system. Several studies have suggested that the financial sector will have to play a central role in the 'green transformation' (e.g. *Volz 2018*; *Moxey et al. 2021*; *Carauta et al. 2021*; *Manasses et al. 2022*).

The role of the financial sector varies considerably. In Europe, the Common Agricultural Policy (CAP) continues to be central, and the support system influences farmers' behaviour and decisions (*Migliorelli 2019*). *Moxey et al.* (*2021*) present a case study of the UK to show a positive example of blended finance, where public and private funding are combined to finance green investments. In addition to the advantages, they also point out that positive externalities do not immediately translate into benefits for farmers, which can be a barrier to greening, making subsidies a priority. In Brazil, producers were encouraged by subsidised credit (*Carauta et al. 2021*), with very favourable credit conditions and an average lending rate of 5 per cent, compared with the central bank's policy rate of 12 per cent. Nevertheless, the drawdown was lower than expected by the central bank. The authors argue that this is because other types of subsidised loans were available under a similar scheme where no green targets were required. This example also shows that there is a role for incentives to encourage farmers' commitment to sustainability goals. Public financing is needed also to compensate for the higher risk-taking by farmers and the lower results they can expect (*Zhang et al. 2021*). The national or UN SDGs will not be achieved per se if farmers are placed in the worst quartile of the risk-return trade-off.

With regard to green financial products, *Sárvári* (*2022*) points out that, in addition to the classic risk-return approach, investors should also place a strong emphasis on sustainability considerations. At the same time, the main barriers in the financial sector are related to the perception of the high risks and costs of green investment, which – combined with the lack of subsidies – results in projects that do not pay off (*Liebman et al. 2019*). *Agirman and Osman* (*2019*) approach it from a slightly different perspective: Without adequate financing, green goals and policies will be ineffective, because there is no economic development in the absence of financing, and there is no sustainable development without green financing.

The simplest form of financing is the greening of existing schemes, so it is no coincidence that the most popular green financial instruments are 'green bonds' and 'green loans'. Through their regulatory oversight over the financial system, central banks are in a powerful position (*Dikau – Volz 2018*). Green bonds are gaining a prominent role in sustainable development and offer more diversification opportunities for investors (*Naeem et al. 2022*), who can thus contribute to sustainability and mitigate environmental and social risks (*Kung et al. 2022*). However, access to green bonds is difficult for small producers, partly due to high transaction costs and limited availability of the bond market. The Hungarian agricultural sector is characterised by a high proportion of small producers, although their relative weight is decreasing in all segments. Green loans appear to be a viable solution not only in Hungary, but also in Europe, where the bond market is less important than in the USA. Green loans, like green bonds, become green when a sustainability or environmental objective is attached to the project they finance (e.g. Brazilian interest subsidised loans). The long payback period and the high risk can be a limitation of green lending. Just as investors do not like such investments, banks do not want to finance uncertain projects. This problem can be overcome if the government is prepared to provide a green loan guarantee to help lenders reduce their risks (*Zhang et al. 2021*).

In Asia, green finance is associated with some form of alternative financial incentives, most commonly microfinance (*Downing et al. 2022; Yu et al. 2020*) and FinTech solutions (*Yang et al. 2021*). In China, Ant Group (China's largest FinTech company) offers farmers the opportunity to raise funds from private individuals through a mobile app (Ant Forest). Their experience shows that green finance contributes to economic development. This is essentially microcredit – called digital finance – and no collateral is required. The model of *Yu et al.* (*2020*) highlights the need to improve credit availability, promote information acquisition and enhance social trust for digital finance to spread. *Wang and Zhi* (*2016*) mention two pillars that need to be strengthened for the spread of green finance: 1) reform of policies related to green finance and 2) innovation of financial tools. Among other things, *Akomea-Frimpong et al.* (*2021*) examined the green finance of credit institutions, finding that green banking policy is influenced by environmental and climate change policies, interest rates, religion, risks, social inclusion and social justice as well as banking regulations. The acceptance or adoption of green finance varies between countries with different socio-economic cultures. *Agirman and Osman* (*2019*) conclude that there is no single formula, noting that different countries face different challenges in this area.

National and higher-level targets are most effectively implemented at the local level, and accordingly local governments, along with actors in the financial system, need to commit to greening (*Guo et al. 2022*) and play a key role in monitoring as well

as supporting farmers. The authors propose a system of rewards and sanctions to encourage farmers to produce in an environmentally friendly way.

Migliorelli's (*2019*) study identifies the following 'problems' in adapting green finance in agriculture. (1) The exact definition of green agriculture: this is a definitional issue, because until we know exactly what constitutes green or sustainable agriculture, the associated term of green finance is also in question. (2) Access to bond markets is limited: firstly, bond issuance is only a good financing strategy above a certain size (small producers are excluded), and secondly, indirect financing channels are predominant in Europe. (3) Information asymmetries: agricultural management is very different from that of other businesses, which means that the financier needs specific knowledge to price loans. (4) A precise definition of green credits: this is also a definitional issue, i.e. what exactly makes a loan green? In their paper, *Agirman and Osman* (*2019*) mention five different definitions, which are broadly similar and include terms such as 'environmental considerations', 'economic growth with reduced emissions', 'private investment in green industries', 'clean energy', 'sustainability', 'climate change' and 'adaptation' etc. These issues call for a firm definition at the EU level.

The role of Common Agricultural Policy measures and subsidies should be highlighted here for the European Union, and for Hungary, in particular. Although this is not recent data, the Research Institute of Agricultural Economics (*AKI 2019*) calculated that for the period 2009–2015, investment grants accounted for about one third of the net investment (per livestock) of pig farms. Another study by the research team looked more closely at the impacts of VP-4.1.1-5-16 'Modernisation of pig farms' tender, which was launched in 2016. The aim was to contribute to improving competitiveness by providing opportunities for technological developments where increased resource efficiency in livestock farming leads, inter alia, to a reduction in specific energy consumption. Accordingly, support was also provided for the renovation of technical building installations and for energy efficiency modernisation of livestock farm buildings, the modernisation of technologies and the acquisition of renewable energy technologies. In this respect, therefore, the grant itself is a green finance tool which, according to our findings, is very effective in encouraging (or even obliging) the greening of investments. The green component will be further strengthened in the criteria for agricultural support in this support cycle ensuring that the sector meets sustainability and green finance criteria.

4. Methodology of the Q–factor analysis

Q-methodology is a relatively new primary research tool in Hungary.

The Q-factor analyses applied by Hungarian researchers are diverse, and the closest to the topic of this paper is the survey by *Horváth et al.* (*2020*), which analysed the perception of agroforestry. *Veres and Tarján* (*2018*) used the Q-methodology in their study of consumer decision-making. *Ásványi et al.* (*2014*) used this method to explore attitudes towards sustainability, while *Ásványi* (*2014*) also used it to investigate the relationship between corporate social responsibility and the support for classical music. The methodology has been used in a variety of ways, as shown in the study by *T. Kárász et al.* (*2022*) on the evaluation of curriculum development in response to the coronavirus. Following the work of *Gulácsi et al.* (*2011*), the views of Hungarian physicians were also assessed. There are also analyses in the field of tourism (*Ásványi – Chaker 2021*; *Csapody et al. 2023*).

The methodology was described by *William Stephenson* (*1935*), who described it as a tool for the study of subjective perspectives as early as 1935 and published a book on it in 1953 (*Stephenson 1953*). The method then spread quite rapidly in Anglo-Saxon political science and psychological research, but in Hungary it became known much later, only at the beginning of the 21st century (*Hofmeister Tóth – Simon 2006*).

The essence of Q-factor analysis is that, unlike traditional R-methodology, it does not seek to identify objective correlations that can be generalised, but rather examines the (subjective) perspectives of individuals, looking for similarities and differences between them. The methodology is therefore well suited to typing the different subjective viewpoints within the professional discourse on economic issues and to identifying different perspectives. Given the basic purpose and nature of the Q-methodology, we do not aim for a large, representative sample.

The method is always used to address a limited number of 10–50 people – experts or people who are deeply involved in the topic or discourse under study (*Brown 1996*). Participants are typically asked to rank a Q-set (*Stevenson 2019*) of 40–80 statements, where the statements represent typical opinions in the discourse on the topic under study. One of the most delicate aspects of the methodology is the correct choice of statements and the number of participants. There are no major restrictions on the number of statements in the literature (apart from the '40 to 80' rule of thumb). For a long time, researchers did not impose any technical restrictions on the sample size. Examples of the more important scientific publications in the agricultural sector are summarised in *Table 1.*

Table 1
Introducing Q-methodology to agricultural research

Author(s)	Year	Purpose	Number of statements/ participants
Davies and Hodge	*2007*	Surveying farmers' attitudes and motivations towards environmental management	33/102
Davies and Hodge	*2012*	Examining changes over time in perceptions of farming (agri-environment) by repeating a 2001 Q-methodology survey in 2008	33/34
Forouzani and Karami	*2011*	Exploring farmers' and experts' attitudes to water scarcity in agriculture	54/75
Pereira et al.	*2016*	Examining the impact of beef farmers on the agricultural innovation system among farmers who consider their farms to be advanced technology-based	49/26
Raatikainen and Barron	*2017*	Examining traditional rural biotopes in a socio-ecological sense, e.g. rural depopulation or the role of subsidies	60/20
Alexander et al.	*2018*	Exploring the acceptance of the transition to intensive rice production forced by market developments – Interestingly, the statements include pictures	16/35
Hu et al.	*2018*	Impacts of the Chinese government's 'supply-side structural reform' on grain farmers	33/26
Iofrida et al.	*2018*	Identifying stakeholders' willingness to adopt innovative approaches to sustainable olive production	56/28
Taheri et al.	*2020*	Exploring farmers' views on dust as an environmental issue	48/8
Venus et al.	*2021*	A survey of stakeholder preferences for biogas development	28/22
Pinillos et al.	*2021*	Landholders' perceptions of the Brazilian Forest Law on forest conservation on private land	36/31
Ciftcioglu	*2021*	Exploring public opinion on the agro-ecosystem	48/80

One important step forward in this area was the study by *Webler et al.* (*2009*), in which they argued that the number of participants should be limited according to the number of statements. They recommended that to reduce statistical error in factor analysis and the likelihood of misinterpretation, the ratio of participants to statements to be sorted should be between 1:3 and 1:2. Our research thus follows this recommendation.

In the survey, participants express their level of agreement related to each statement with a scale, similar to a Likert scale. The valuation range has a negative and a positive endpoint (where a positive endpoint represents complete agreement and a negative endpoint represents complete disagreement), and a value of '0' in the middle of the scale represents a neutral opinion (*Shayan 2014*). The survey forces a response that is normally distributed, i.e. each value on the scale can only be associated with a fixed number of statements (fewer at the extremes and more as the scale approaches zero).

Our research applied the methodology in the structure proposed by *Churruca et al.* (*2021*), and thus the detailed results are presented accordingly.

1. step: Identify topic

Given the topic of our study, this step was fairly straightforward in our case. The Q-methodology is used to examine expert opinions on the applicability of green finance tools in pig production.

2. step: Develop the Q-set

The Q-set was developed based on the literature review presented in this paper and our previous research in this sector. Members of our research team collected and refined the statements in the Q-set in three rounds. Throughout the group work, the main considerations were to formulate the statements based on the literature (reducing subjectivity) and to relate the statements to predefined topics that were relevant to the research objective (maintaining focus). As a result, we ended up with 39 statements (*Appendix*) distributed into three topics:

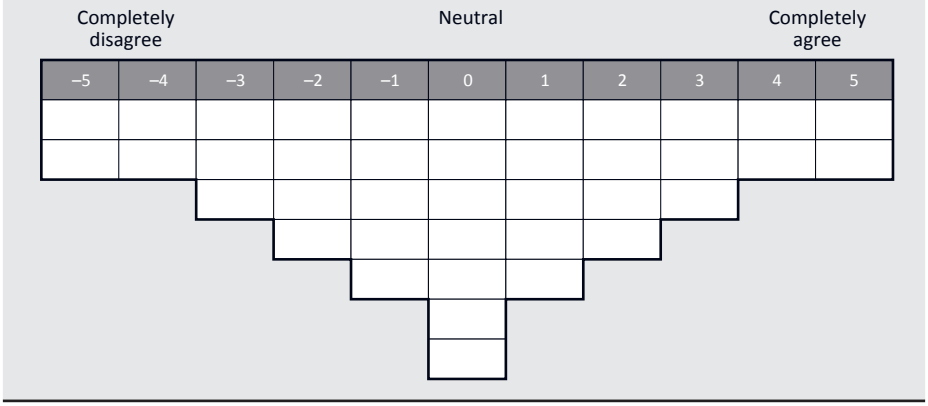
– The present and future of green and circular investments in the pig sector (18 statements),

– Views on the opportunities and constraints of agricultural finance as a whole (7 statements),

– The opportunities and importance of green finance in agriculture (14 statements).

Rating scale range: [–5;+5]. The number of statements that can be recorded for each value is shown in *Figure 1*.

Figure 1
Number of statements that can be recorded for each item of the rating scale (number)



3. step: The pilot Q-set

The Q-set and the evaluation system developed in Step 2 were tested with external experts who were later not involved in the 'live' research. The testing was carried out with three people: a consultant specialising in technological improvements on pig farms, a university researcher and an agricultural finance specialist. The testing did not result in any significant changes and the issues raised were addressed by modifying or replacing some questions.

4. step: Select participants

Experts from four professional fields were involved in the research. In compiling the list of experts, we relied heavily on the research team's network of contacts and the recommendations of the experts who helped with the testing. The number of experts involved was determined according to the aforementioned Webler recommendation (*Webler et al. 2009*). The number of statements per case was 39, so the recommended number of participants for reliable application of the method was between 13 (1:3 ratio) and 18 (1:2 ratio). Accordingly, 16 experts were involved in the research.

The number of experts per field:
– university researcher (1 person),
– agricultural finance specialists employed by banks (4 persons),
– decision-makers of pig farmers who were members of producer groups (6 persons),
– manager of a large meat company (1 person),
– central and regional managers of a national livestock breeding organisation (4 persons).

5. step: Q-sorting

The data was collected electronically, after telephone and e-mail consultation, using the web-based Q-sortware application developed for this purpose. Participants were asked for feedback on completion. The data from the survey was downloaded as a single file in csv format upon completion and the dataset was prepared in Excel for quantitative analysis.

Our decision to use Q-sortware was primarily motivated by the fact that it was free, easy to use and an effective replacement for face-to-face surveys. We had previously used this tool as PhD supervisors and in our EFOP-3.6.2-16 tender on agroforestry. The positive experience we had with the software was useful for this research, so we decided to use it.

6. step: Quantitative analysis of data (Q-factor analysis)

Quantitative analysis of the data was carried out using the STATA 15.1 statistical software, including the 'qfactor' module.[3] The suitability of the data sample for factor analysis was measured using the Kaiser-Meyer-Olkin (KMO) index. The minimum acceptable value of the KMO in social science research is 0.5. In our case, KMO=0.5712, i.e. the sample exceeded the minimum acceptable level. The number of factors was determined using the Kaiser criterion, i.e. only factors with an eigenvalue of at least one were included. Based on this criterion, five factors were selected, representing 66.32 per cent of the information contained in the original variable structure.

7. step: Qualitative interpretation of factors (opinion groups)

The quantitative analysis provided us with the key statements that distinguish each factor (i.e. opinion group) from the others, as well as the participants who fall into each opinion group. Based on this information, we made a qualitative assessment and gave each opinion group a name. The key statements that characterised each opinion group were presented in three groups: 1) The 'confirmation' zone contained the key statements of the opinion group that the group agreed with more than the other opinion groups; 2) The 'neutral' zone contained the statements that the group considered less extreme or radical than the other factors; 3). The 'rejection' zone represented the statements with which the group agreed less than the other factors.

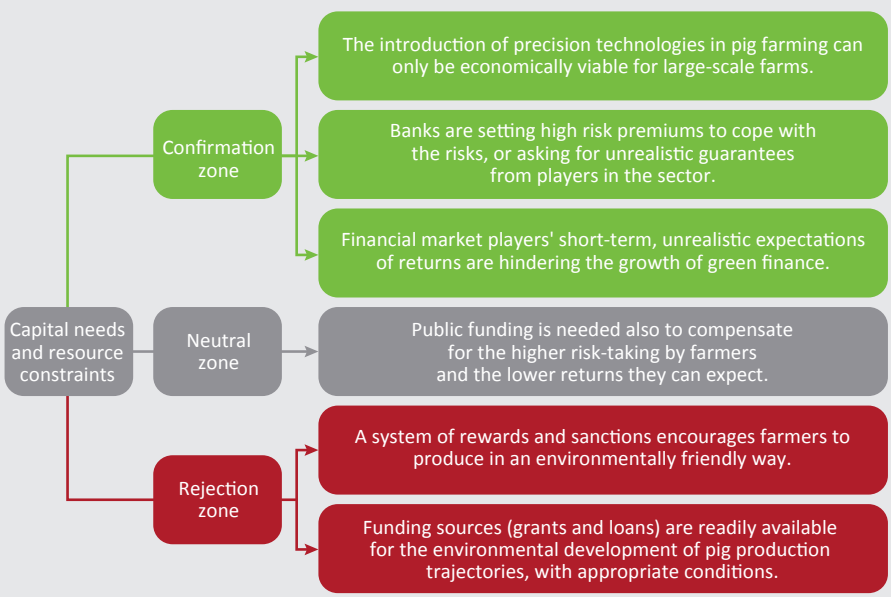
[3] Description: http://fmwww.bc.edu/RePEc/bocode/q/qfactor.sthlp

According to *Danielson et al.* (*2009*), the Q-methodology is an effective and useful tool for exploring subjectivity and divergent expert opinion on a less researched, novel topic. However, the views revealed cannot be treated as global and representative perspectives that can be extended to the whole population (in this case: the whole sector). Other methods, based on large sample surveys, are needed to identify the 'average' opinions that are representative of the sector as a whole. A large sample survey of this kind can be carried out as part of a new independent survey (*Hunter 2011*). *D'agostini et al.* (*2022*) also point out that the results of the Q-methodology cannot be generalised to the whole sector, but it is suitable for identifying previously hidden perspectives and opinions among experts. Another weakness of the method is that very complex, nuanced questions are sometimes condensed into overly simplistic statements.

5. Results and evaluation

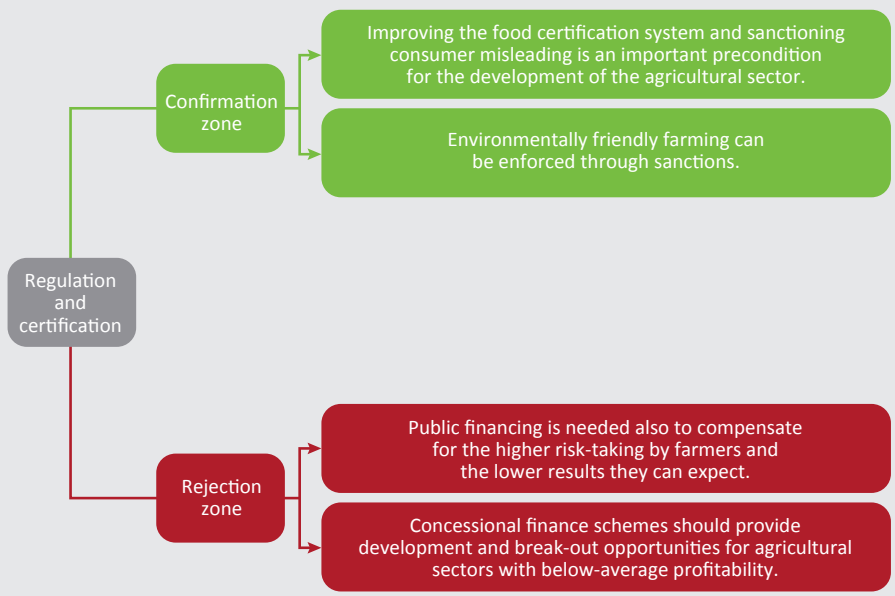
In the 5-factor analysis, 82 per cent of the participants could be categorised into one of the 5 factors. The views of the participants in the same factor were well separated from those in the other factors.

Figure 2
Key statements in the 'Capital needs and resource constraints' opinion group



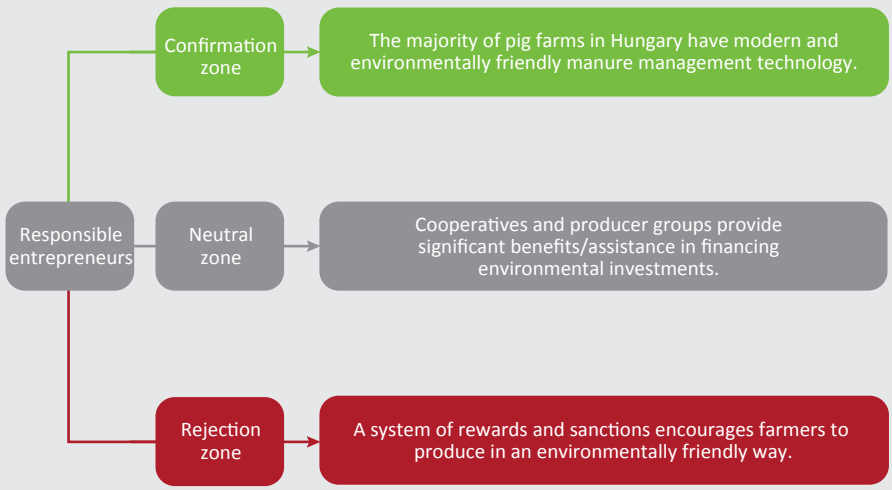
According to participants (*Figure 2*), precision technologies that increase the efficiency and effectiveness of farming can only be economically viable for large-scale farms. This idea points to the high capital needs, adding that the available funds require high collateral values, for which banks are setting excessive risk premiums. They confirm this by pointing to the lack of funding available for 'low cost' environmental improvements in pig production. Thus, participants clearly perceive a capital-intensive, but resource-poor market situation behind the sector's sustainability requirements. All the members of the group are researchers or professionals working in the pig sector.

Figure 3
Key statements in the 'Regulation and certification' opinion group



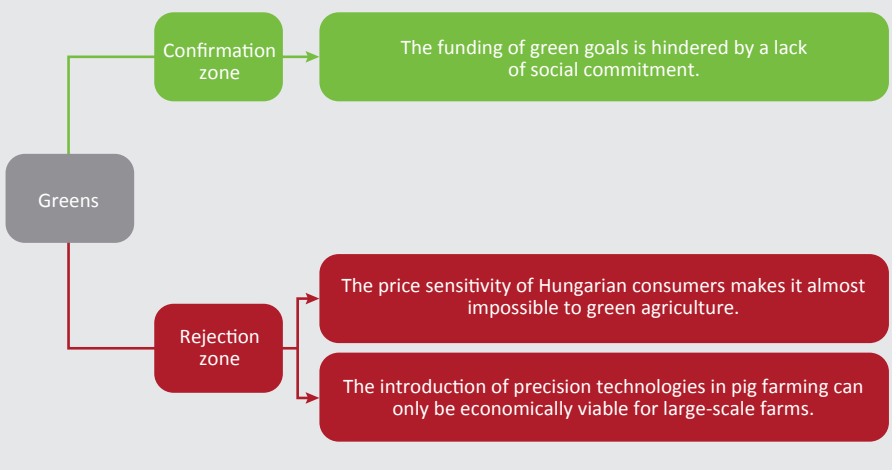
The members of the group, most of whom are involved in the financing of the agricultural sector, take a strong position on the need for regulation (*Figure 3*). They believe that the monitoring of the entire chain and consumer protection are the most important factors for the sustainability of the sector. However, they do not consider concessional finance schemes as a way of catching up, nor do they see public funding programmes as a means of managing risk and lower profitability.

Figure 4
Key statements in the 'Responsible entrepreneurs' opinion group



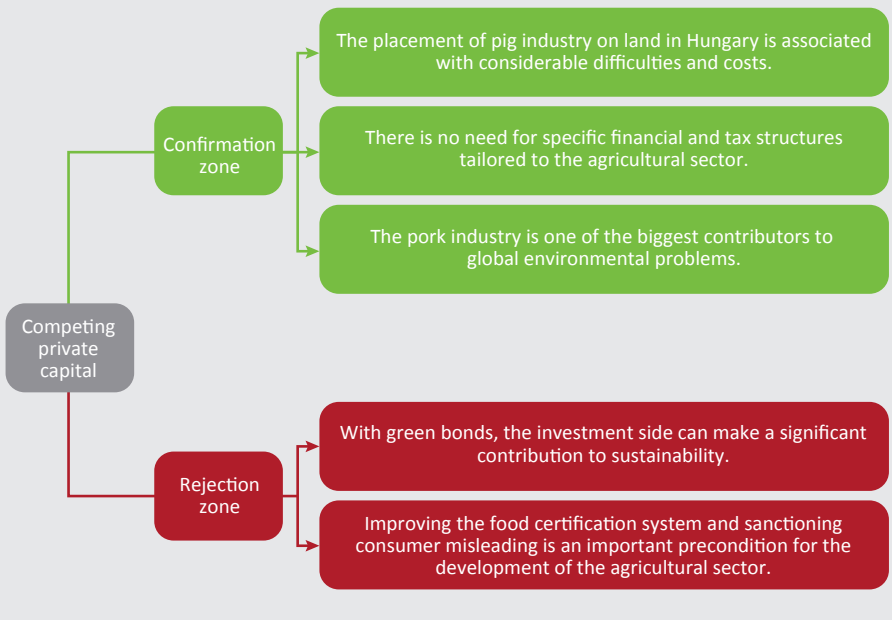
This group of participants believes that it is the responsibility of entrepreneurs to meet sustainability requirements. It is mainly the experts with practical experience in the pig industry who reject the need for public intervention and do not consider a system of rewards and sanctions to be effective. In their view, the pig farms in Hungary have modern, environmentally-friendly technology. They see the presence of producer groups and cooperatives as completely neutral on sustainability issues (*Figure 4*).

Figure 5
Key statements in the 'Greens' opinion group



The participants' environmental awareness and commitment to sustainability is most pronounced in this group (*Figure 5*). They believe that the effectiveness of green finance adapted to sustainable investment is limited due to a lack of social commitment. They confirm that it is not the price sensitivity of consumers that creates barriers to greening agriculture. They believe that the introduction of high-efficiency, precision technologies is economically viable even for smaller farms, given its positive impact on the environment.

Figure 6
Key statements in the 'Competing private capital' opinion group



This factor is strongly influenced by a belief in free markets (*Figure 6*). Compliance with environmental targets in the pig sector is seen by the group as having significant costs. As bankers, they think there is no need for sector-specific regulation or special financing arrangements. They deny that green bonds can make a significant contribution to sustainability goals and consider the sector to be the least responsible for global environmental problems.

Consistency between factors was measured for two statements. All participants were basically neutral on the positive impact of green finance on GDP and also on the banking risk of green lending.

6. Conclusions and proposals

The general conclusion that can be drawn from the Q-factor analysis is that green finance is a relatively new and unfamiliar field for the experts and actors in the product chain whom we interviewed. Most of them are uncertain, and in many cases pessimistic, about the extent to which green finance tools can contribute to the development of the sector. They all agree that green and sustainable investment in the sector requires public financing.

Based on the literature, international examples and our primary research findings, we make the following recommendations for pig production:

In addition to purely market-based green finance tools, it can play an important role in providing hybrid preferential financing complemented by public intervention. Learning from bad practices abroad, it is important that green products become more attractive in some respects than subsidised and market-based products. This advantage should be made clear to stakeholders, thereby increasing commitment to sustainability goals, especially among those who oppose them.

All opinion groups agree that, in addition to direct subsidies, indirect instruments, such as the provision of development-related tax benefits, can help achieve green objectives. The use of economic policy instruments is therefore necessary to make a sector-specific green finance programme a success.

Looking at the specific characteristics of the sector, attention should be paid to market exposure and cyclical income flows, which in parallel raise liquidity issues. Benefits at the individual and corporate level (including intermediaries) are a stronger motivator for green finance than emphasising macroeconomic and risk management benefits in communications.

Green finance should be included in sectoral development as a supportive tool to ensure the competitiveness and profitability of small and medium-sized enterprises.

Finally, we briefly summarise the limitations of our research and the conclusions that can be drawn from the results.

In line with the above, this study should be seen as a first step in a novel, specific and hitherto under-researched topic at the sectoral level. The methodology used identifies important, previously hidden expert opinions and positions, as well as conflicting views on the application of green finance tools in the product chain. Given the specificity of the Q-methodology, which does not allow us to generalise the results to the sector as a whole but rather to explore the varying views, the factors and conclusions presented here represent the specific perspectives on the use of green finance tools from a particular group of experts with a significant role

in the sector. These specific views can be an important starting point for formulating a sectoral green finance strategy, but further research may be useful to complement, refine and validate the structure of the views presented here.

References

Agirman, E. – Osman, A.B. (2019): *Green finance for sustainable development: A theoretical study*. Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi, 6(1): 243–253.

AKI (2019): *Investment data for pig farms.* Sertésinformációs Rendszer (Information System for Pig Farming). https://sertesinfo.aki.gov.hu/publikaciok/publikacio/a:711/A+sert%C3%A9start%C3%B3+gazdas%C3%A1gok+befektet%C3%A9si+adatai. Downloaded: 6 May 2023.

Akomea-Frimpong, I. – Adeabah, D. – Ofosu, D. – Tenakwah, E.J. (2021): *A review of studies on green finance of banks, research gaps and future directions*. Journal of Sustainable Finance & Investment, 12(4): 1241–1264. https://doi.org/10.1080/20430795.2020.1870202

Alexander, K.S. – Parry, L. – Thammavong, P. – Sacklokham, S. – Pasouvang, S. – Connell, J.G. – Jovanvic, T. – Moglia, M. – Larson, S. – Case, P. (2018): *Rice farming systems in Southern Lao PDR: Interpreting farmers' agricultural production decisions using Q methodology*. Agricultural Systems, 160(February): 1–10. https://doi.org/10.1016/j.agsy.2017.10.018

Ásványi, K. (2014): *A komolyzenére irányuló CSR vállalati megítélése-vállalati attitüdvizsgálat Q-módszerrel* (*Perceptions of CSR for classical music – a business attitudes survey using the Q-method*). Marketing & Menedzsment (Marketing & Management), 48(1): 37–46.

Ásványi, K. – Chaker, H. (2021): *A vendégek preferenciái a fenntartható szállodai attribútumokról* (*Guest preferences on sustainable hotel attributes*). Közép-Európai Közlemények (Central European Publications), 14(2): 83–105.

Ásványi, K. – Marjainé Szerényi, Zs. – Zsóka, Á. (2014): *A fenntartható fejlődés feltételeinek megjelenése a nagykörűi lakosság értékrendjében: egy Q-módszeres kutatás eredményei* (*The appearance of the conditions of sustainable development in the values of the population of Nagykörű: The results of a Q-methodology study*). Economica, 7(2): 68–79. https://doi.org/10.47282/ECONOMICA/2014/7/2/4333

Brown, S.R. (1996): *Q Methodology and Qualitative Research*. Qualitative Health Research, 6(4): 561–567. https://doi.org/10.1177/104973239600600408

Carauta, M. – Troost, C. – Guzman-Bustamante, I. – Hampf, A. – Libera, A. – Meurer, K. – Berger, T. (2021): *Climate-related land use policies in Brazil: How much has been achieved with economic incentives in agriculture?* Land Use Policy, 109(October): 105618. https://doi.org/10.1016/j.landusepol.2021.105618

Churruca, K. – Ludlow, K. – Wu, W. – Gibbons, K. – Nguyen, H.M. – Ellis, L.A. – Braithwaite, J. (2021): *A scoping review of Q-methodology in healthcare research*. BMC Medical Research Methodology, 21: 125. https://doi.org/10.1186/s12874-021-01309-7

Ciftcioglu, G.C. (2021): *The social valuation of agro-ecosystem services at different scales: A case study from Kyrenia (Girne) Region of Northern Cyprus*. Environmental Development, 39(September): 100645. https://doi.org/10.1016/j.envdev.2021.100645

Csapody, B. – Ásványi, K. – Jászberényi, M. (2023): *A Balaton és Budapest környéke turisztikai térségbe utazók fogyasztói preferenciáinak összehasonlító vizsgálata a helyi alapanyagok tükrében* (*Examination of consumer preferences in the light of seasonal and local ingredients at Lake Balaton and Greater Budapest region*). Észak-magyarországi Stratégiai Füzetek, 20(1): 62–72. https://doi.org/10.32976/stratfuz.2023.5

Csonka, A. – Bojnec, Š. – Fertő, I. (2021): *Spatial Transformation of the Pig Sector in Hungary and Slovenia: A Comparative Analysis*. Sustainability, 13(21): 11851. https://doi.org/10.3390/su132111851

D'agostini, E. – Jo, S. – Nam, H.-S. – Kim, Y.S. (2022): *Q-method and its application in clustering Hong Kong shippers' selection criteria of ocean carriers*. Research in Transportation Business & Management, 44(September): 100785. https://doi.org/10.1016/j.rtbm.2022.100785

Danielson, S. – Webler, T. – Tuler, S.P. (2009): *Using Q method for the formative evaluation of public participation processes*. Society & Natural Resources, 23(1), 92–96. https://doi.org/10.1080/08941920802438626

Davies, B.B. – Hodge, I.D. (2007): *Exploring environmental perspectives in lowland agriculture: A Q methodology study in East Anglia, UK*. Ecological Economics, 61(2–3): 323–333. https://doi.org/10.1016/j.ecolecon.2006.03.002

Davies, B.B. – Hodge, I.D. (2012): *Shifting environmental perspectives in agriculture: Repeated Q analysis and the stability of preference structures*. Ecological Economics, 83(November): 51–57. https://doi.org/10.1016/j.ecolecon.2012.08.013

Deák, V. (2021): *MNB's Green Programme.* Polgári Szemle (Civic Review Journal of Economic and Social Sciences), 17(4–6): 104–115. https://doi.org/10.24307/psz.2021.1208

Dey, K. – Mishra, P.K. (2022): *Mainstreaming blended finance in climate-smart agriculture: Complementarity, modality, and proximity*. Journal of Rural Studies, 92(May): 342–353. https://doi.org/10.1016/j.jrurstud.2022.04.011

Dikau, S. – Volz, U. (2018): *Central banking, climate change and green finance*. ADBI Working Paper 867, Tokyo: Asian Development Bank Institute, September. https://www.adb.org/publications/central-banking-climate-change-and-green-finance. Downloaded: 12 May 2022.

Downing, A.S. – Kumar, M. – Andersson, A. – Causevic, A. – Gustafsson, Ö. – Joshi, N.U. – Krishnamurthy, C.K.B. – Scholtens, B. – Crona, B. (2022): *Unlocking the unsustainable rice-wheat system of Indian Punjab: Assessing alternatives to crop-residue burning from a systems perspective*. Ecological Economics, 195(May): 107364. https://doi.org/10.1016/j.ecolecon.2022.107364

Duffy, M. (2009): *Economies of size in production agriculture*. Journal of Hunger & Environmental Nutrition, 4(3–4): 375–392. https://doi.org/10.1080/19320240903321292

Ferencz, Á. (2014): *A vidék munkahelyteremtő képességének lehetőségei* (*The potential of rural areas to create jobs*). GRADUS, 1(2): 133–139.

Fogarasi, J. – Zubor-Nemes, A. (2019): *A tőkeszerkezet hatása az agrárgazdasági teljesítményre* (*The impact of capital structure on agricultural performance*). Statisztikai Szemle (Hungarian Statistical Review), 95(4): 406–422. https://doi.org/10.20311/stat2017.04.hu0406

Forouzani, M. – Karami, E. (2011): *Agricultural water poverty index and sustainability*. Agronomy for Sustainable Development, 31: 415–431. https://doi.org/10.1051/agro/2010026

Gulácsi, L. – Péntek, M. – Hajdu, O. (2011): *Gyakorló orvosok egészségnyereség társadalmi elosztásával kapcsolatos attitűdje – a Q-vizsgálat* (*Practicing physicians' attitudes to the social distribution of health gains – the Q-sample*). Statisztikai Szemle (Hungarian Statistical Review), 89(9): 980–1006.

Guo, L. – Zhao, S. – Song, Y. – Tang, M. – Li, H. (2022): *Green Finance, Chemical Fertilizer Use and Carbon Emissions from Agricultural Production*. Agriculture, 12(3): 313. https://doi.org/10.3390/agriculture12030313

HCSO (2021): *4.1.1. Livestock.* Hungarian Central Statistical Office, Budapest. https://www.ksh.hu/docs/hun/xstadat/xstadat_evkozi/e_oma001.html. Downloaded: 5 May 2022.

HCSO (2022a): *19.1.1.27. Cattle, pigs, horses, sheep, buffaloes, donkeys, mules and goats [thousand head].* Hungarian Central Statistical Office, Budapest. https://www.ksh.hu/stadat_files/mez/hu/mez0027.html. Downloaded: 5 August 2022.

HCSO (2022b): *Agricultural census – Agricultural census 2020, Excel spreadsheets.* Hungarian Central Statistical Office, Budapest. https://www.ksh.hu/docs/hun/xftp/ac2020/ac2020.xlsx. Downloaded: 5 May 2023.

Hofmeister Tóth, Á. – Simon, J. (2006): *A Q-módszer elmélete és alkalmazása a marketingkutatásban* (*The theory and application of the Q-methodology in marketing research*). Vezetéstudomány-Budapest Management Review, 37(9): 16–26. https://doi.org/10.14267/VEZTUD.2006.09.02

Horváth, J. – Szerb, B. – Szente, V. (2020): *Az agrárerdészeti rendszerek megítélése az erdőgazdálkodó szakemberek szemszögéből* (*Perceptions of agroforestry systems from the perspective of forestry professionals*). Gazdálkodás: Scientific Journal on Agricultural Economics, 64(6): 505–518. https://doi.org/10.22004/ag.econ.308452

Horváth, J. (2019): *Agrárgazdaságtan és vállalatgazdaságtan* (*Agricultural economics and business economics*). University of Szeged, Szeged.

Hsu, S.L. (2015): *Scale Economies, Scale Externalities: Hog Farming and the Changing American Agricultural Industry*. FSU College of Law, Public Law Research Paper No. 745. https://doi.org/10.2139/ssrn.2584224

Hu, Y.F. – You, F. – Luo, Q.Y. (2018): *Characterizing the attitudes of the grain-planting farmers of Huaihe Basin, China*. Food Policy, 79(August): 224–234. https://doi.org/10.1016/j.foodpol.2018.07.007

Hunter, W.C. (2011): *Rukai indigenous tourism: Representations, cultural identity and Q method*. Tourism Management, 32(2): 335–348. https://doi.org/10.1016/j.tourman.2010.03.003

Iofrida, N. – De Luca, A.I. – Gulisano, G. – Strano, A. (2018): *An application of Q-methodology to Mediterranean olive production – stakeholders' understanding of sustainability issues*. Agricultural Systems, 162(May): 46–55. https://doi.org/10.1016/j.agsy.2018.01.020

IPCC (2022): *Climate Change 2022: Mitigation of Climate Change.* https://www.ipcc.ch/report/ar6/wg3/. Downloaded: 13 April 2022.

Kolozsi, P.P. – Horváth, B.I. – Csutiné Baranyai, J. – Tengely, V. (2022): *Monetary Policy and Green Transition.* Financial and Economic Review, 21(4): 7–28. https://doi.org/10.33893/FER.21.4.7

Kung, C.-C. – Lan, X. – Yang, Y. – Kung, S.-S. – Chang, M.-S. (2022): *Effects of green bonds on Taiwan's bioenergy development*. Energy, 238, Part A(January): 121567. https://doi.org/10.1016/j.energy.2021.121567

Liebman, A. – Reynolds, A. – Robertson, D. – Nolan, S. – Argyriou, M. – Sargent, B. (2019): *Green Finance in Indonesia*. In: Sachs, J. – Woo, W. – Yoshino, N. – Taghizadeh-Hesary, F. (eds.): Handbook of Green Finance. Sustainable Development. Springer, Singapore, pp. 557–586. https://doi.org/10.1007/978-981-13-0227-5_5

Manasses, G. – Paulik, É. – Tapaszti, A. (2022): *Green Bond Impact Report as an Essential Next Step in Market Development*. Financial and Economic Review, 21(4): 180–204. https://doi.org/10.33893/FER.21.4.180

Migliorelli, M. (2019): *The Development of Green Finance in EU Agriculture: Main Obstacles and Possible Ways Forward*. In: Migliorelli, M. – Dessertine, P. (eds.): The Rise of Green Finance in Europe. Palgrave Macmillan, Cham, pp. 175–206. https://doi.org/10.1007/978-3-030-22510-0_8

Moxey, A. – Smyth, M.-A. – Taylor, E. – Williams, A.P. (2021): *Barriers and opportunities facing the UK Peatland Code: A case-study of blended green finance*. Land Use Policy, 108(September): 105594. https://doi.org/10.1016/j.landusepol.2021.105594

Naeem, M.A. – Conlon, T. – Cotter, J. (2022): *Green bonds and other assets: Evidence from extreme risk transmission*. Journal of Environmental Management, 305(March): 114358. https://doi.org/10.1016/j.jenvman.2021.114358

Pereira, M.A. – Fairweather, J.R. – Woodford, K.B. – Nuthall, P.L. (2016): *Assessing the diversity of values and goals amongst Brazilian commercial-scale progressive beef farmers using Q-methodology.* Agricultural Systems, 144(May): 1–8. https://doi.org/10.1016/j.agsy.2016.01.004

Pinillos, D. – Poccard-Chapuis, R. – Bianchi, F.J. – Corbeels, M. – Timler, C.J. – Tittonell, P. – Ballester, M.V.R. – Schulte, R.P. (2021): *Landholders' perceptions on legal reserves and agricultural intensification: Diversity and implications for forest conservation in the eastern Brazilian Amazon*. Forest Policy and Economics, 129(August): 102504. https://doi.org/10.1016/j.forpol.2021.102504

Raatikainen, K.J. – Barron, E.S. (2017): *Current agri-environmental policies dismiss varied perceptions and discourses on management of traditional rural biotopes*. Land Use Policy, 69(December): 564–576. https://doi.org/10.1016/j.landusepol.2017.10.004

Sárvári, B. (2022): *Trends and Dilemmas in Green Financial Capacity Development*. Financial and Economic Review, 21(4): 205–216. https://en-hitelintezetiszemle.mnb.hu/letoltes/fer-21-4-fa1-sarvari.pdf

Shayan, F. (2014): *Doing Q-methodological research: theory, method and interpretation*. International Journal of Social Research Methodology, 17(1): 87–92. https://doi.org/10.1080/13645579.2014.861957

Sipiczki, Z. – Bareith, T. – Varga, J. (2019): *A magyarországi agrárszektor egyéni gazdaságai jövedelmezőségének alakulása 2013 és 2015 között* (*Trends in profitability of the individual farms in the Hungarian agricultural sector between 2013 and 2015*). Statisztikai Szemle (Hungarian Statistical Review), 97(1): 72–89. https://doi.org/10.20311/stat2019.1.hu0072

Stephenson, W. (1935): *Technique of Factor Analysis*. Nature, 136(September), 297. https://doi.org/10.1038/136297b0

Stephenson, W. (1953): *The Study of Behavior; Q-Technique and Its Methodology*. University of Chicago Press.

Stevenson, H. (2019): *Contemporary Discourses of Green Political Economy: A Q Method Analysis*. Journal of Environmental Policy & Planning, 21(5): 533–548. https://doi.org/10.1080/1523908X.2015.1118681

T. Kárász, J. – Nagybányai-Nagy, O. – Takács, N. – Takács, Sz. (2022): *Egy felsőoktatási e-learning tananyagfejlesztés értékelése* (*Evaluation of an e-learning curriculum development in tertiary education*). Educatio, 31(2): 303–312. https://doi.org/10.1556/2063.31.2022.2.10

Taheri, F. – Forouzani, M. – Yazdanpanah, M. – Ajili, A. (2020): *How farmers perceive the impact of dust phenomenon on agricultural production activities: A Q-methodology study*. Journal of Arid Environments, 173(February): 104028. https://doi.org/10.1016/j.jaridenv.2019.104028

Venus, T.E. – Strauss, F. – Venus, T.J. – Sauer, J. (2021): *Understanding stakeholder preferences for future biogas development in Germany*. Land Use Policy, 109(October): 105704. https://doi.org/10.1016/j.landusepol.2021.105704

Veres, Z. – Tarján, T. (2018): *Szekvenciális fogyasztói termékválasztás döntési kontinuuma* (*The decision-making continuum of sequential consumer-product choices*). Közgazdasági Szemle (Economic Review), 65(5): 525–550. https://doi.org/10.18414/Ksz.2018.5.525

Vo, P.H. – Ngo, T.Q. (2021): *The role of agricultural financing and development on sustainability: evidence from ASEAN countries.* AgBioForum, 23(1): 22–31.

Volz, U. (2018): *Fostering green finance for sustainable development in Asia*. ADBI Working Paper 814, March. http://doi.org/10.2139/ssrn.3198680

Wang, Y. – Zhi, Q. (2016): *The Role of Green Finance in Environmental Protection: Two Aspects of Market Mechanism and Policies*. Energy Procedia, 104(December): 311–316. https://doi.org/10.1016/j.egypro.2016.12.053

Webler, T. – Danielson, S. – Tuler, S. (2009): *Using Q method to reveal social perspectives in environmental research*. Greenfield MA: Social and Environmental Research Institute. www.betterevaluation.org/sites/default/files/Qprimer.pdf

Yang, Y. – Su, X. – Yao, S. (2021): *Nexus between green finance, fintech, and high-quality economic development: Empirical evidence from China*. Resources Policy, 74(December): 102445. https://doi.org/10.1016/j.resourpol.2021.102445

Yu, L. – Zhao, D. – Xue, Z. – Gao, Y. (2020): *Research on the use of digital finance and the adoption of green control techniques by family farms in China*. Technology in Society, 62(August): 101323. https://doi.org/10.1016/j.techsoc.2020.101323

Zhang, D. – Mohsin, M. – Rasheed, A.K. – Chang, Y. – Taghizadeh-Hesary, F. (2021): *Public spending and green economic growth in BRI region: Mediating role of green finance*. Energy Policy, 153(June): 112256. https://doi.org/10.1016/j.enpol.2021.112256

Annex: Statements used for Q-methodology

Circular Economy – pig sector	1	The majority of pig farms in Hungary have modern and environmentally friendly fertiliser management technology.
	2	The spreading of pig manure on land in Hungary is associated with considerable difficulties and costs.
	3	'Green' criteria (transport distance, organic production, reduced use of fertilisers, etc.) may become increasingly important in the future when purchasing feed.
	4	In Hungarian pig production, the full (re-)use of scrap cuttings (e.g. blood, fat, bones) is already established.
	5	The water management of domestic pig farms and abattoirs (water saving and efficiency, waste water treatment and recycling) can no longer be significantly improved.
	6	Environmentally friendly pork production should be based primarily on large farms and large processors.
	7	Smaller family pig farms and abattoirs are better suited to environmental concerns than large farms.
	8	Funding sources (grants and loans) are readily available for the environmental development of pig farms and abattoirs, with appropriate conditions.
	9	Farmers are primarily responsible for the environmental development of pig farms and abattoirs.
	10	Cooperatives and producer groups provide significant benefits/assistance in financing environmental investments.
	11	The introduction of precision technologies in pig farming can only be economically viable for large-scale farms.
	12	The decision-makers in the pig production do NOT have the necessary technological and financial knowledge to make decisions.
	13	Pig farms and abattoirs only engage in improving environmental efficiency if there are tangible economic benefits.
	14	The number of precision livestock farms will increase significantly over the next five years.
	15	The spreading of inadequately treated pig manure on arable land is a major risk to the environment in Hungary today.
	16	Pig farms in Hungary still have significant unused capacity to produce biogas.
	17	Pig production is one of the biggest contributors to global environmental problems.
	18	Environmentally friendly farming can be enforced through sanctions.
Agricultural finance	19	The agricultural sector is characterised by the accumulation of a considerable amount of debt.
	20	There is no need for specific financial and tax structures tailored to the agricultural sector.
	21	Banks are setting high risk premiums to cope with the risks, or asking for unrealistic guarantees from players in the sector.
	22	Agricultural subsidies make farms that are obstacles to sustainable development profitable.
	23	The environmental performance of the agricultural sector varies greatly depending on the region, so a uniform funding policy is bound to fail.
	24	Concessional financing schemes should provide development and break-out opportunities for agricultural sectors with below-average profitability.

ESG in agriculture	25	Green investments do not significantly reduce emissions.
	26	Green finance has a positive impact on GDP.
	27	Access to green investment funds is limited and difficult.
	28	Increasing green investment resources has a positive impact on the environment and business performance.
	29	Financial market players' short-term, unrealistic expectations of returns are hindering the growth of green finance.
	30	From a sustainability perspective, it is efficient for green investments to be financed by private sources, complemented by public sources.
	31	There is a need for incentives for agricultural stakeholders to commit to sustainability goals.
	32	Public financing is needed also to compensate for the higher risk-taking by farmers and the lower results they can expect.
	33	With green bonds, the investment side can make a significant contribution to sustainability.
	34	Green lending is a big risk for banks.
	35	Without public intervention, green credit programmes will fail.
	36	The funding of green goals is hindered by a lack of social commitment.
	37	A system of rewards and sanctions encourages farmers to produce in an environmentally friendly way.
	38	The price sensitivity of Hungarian consumers makes it almost impossible to green agriculture.
	39	Improving the food qualification system and sanctioning consumer misleading is an important precondition for the development of the agricultural sector.

The Role of Intangible Capital Investment and Intangible Assets in Improving Competitiveness*

Magdolna Csath

Based on international literature and data, this essay examines the conditions for improving competitiveness in Hungary in relation to intangible assets and capital investment. The link between productivity – as the basis for competitiveness – and intangible capital investment is also discussed. The essay argues that, although there is no consensus on the interpretation of the concepts examined and further analysis and modelling are needed, the relationships presented suggest that higher levels of intangible asset and capital investment would contribute to improving the productivity and competitiveness of the Hungarian economy. First, because this would improve the overall operational efficiency of tangible investments, and second, because it would support the transition to a knowledge economy, the key condition for boosting competitiveness.

Journal of Economic Literature (JEL) codes: E22, F63, I25, J24, O34

Keywords: intangible capital investment, intangible asset, intellectual capital, competitiveness, productivity

1. Introduction

In today's rapidly changing economic environment, characterised by new technological development and disruption, the conditions for improving competitiveness are also changing. A high rate of investment in intangible capital and a significant level of intangible assets are preconditions for a country to move away from competing by way of "cheapness" and towards embarking on a competitive path that is based on knowledge and innovation, i.e. to advance and become a knowledge economy. Intangible assets (stock) and intangible capital investment (flow) are closely related concepts. There is a time lag between the investment activity representing the flow and the size of the assets. Both concepts can be interpreted at the level of the national economy and at the corporate level. One common problem, however, is that in our ever-changing world, these are difficult to measure, and there is even debate as to what exactly is meant by these concepts.

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Magdolna Csath: Pázmány Péter Catholic University, Research Professor. Email: csath.magdolna@ppke.hu

The first version of the Hungarian manuscript was received on 10 December 2022.

DOI: https://doi.org/10.33893/FER.22.2.124

The most commonly used definitions, alongside intangible capital investment and intangible capital, are knowledge capital and knowledge assets. Other terms used are intellectual capital investment and intellectual assets. Hungarian literature also uses the expression 'smart capital' (*Matolcsy 2022*), although sometimes it is primarily meant to refer to the achievements of digitalisation (*Várnai 2022*). International literature widely uses the term 'intangible', as the author of this paper has in several articles (e.g. *Csath 2022*).

Finally, at the corporate level, there is a concept of immaterial assets in accounting, but its content is not the same as that of intellectual capital. Therefore, its total value cannot be included in standard corporate accounting, even though its impact on results can be demonstrated. There is no doubt, however, that there are still methodological uncertainties regarding the measurability of intangible assets and capital investment and how their economic effects can be described. Nonetheless, the amount of new value added increasingly depends on intangible capital investment and assets, both at the level of the national economy and at the corporate level. Referring to immaterial assets at the corporate level, which represents only a part of intangible assets, the *Hungarian Intellectual Property Office* put it this way in a release of the Hungarian Telegraph Office (MTI) on 2 December 2022:[1] *"One generation ago, material assets represented about 80 per cent of companies' assets, while immaterial assets accounted for only 20 per cent. By the turn of the millennium, this ratio had reversed, and today immaterial assets, i.e. intellectual property rights, account for around three quarters of a company's market value. IP* (*intellectual property*) *in its various forms* (*e.g. patents, trademarks, industrial designs, copyrights, trade secrets, licensing contracts*) *and the effective management and exploitation of R&D results can generate significant business benefits even in times of recession. IP savvy businesses can see up to 20 per cent more revenue than firms operating without IP protection".*

This awareness is therefore stronger at the company level, as companies look for new sources to improve competitiveness and profit growth. This recognition would also be much needed at the level of the national economy, as the opportunities for economic growth based on investment in machinery and technology and the involvement of cheap labour are being exhausted. Meanwhile, Hungary compares poorly with advanced economies in terms of intangible capital investment, and the state is also not sufficiently effective in building knowledge capital. The aim of this essay is to draw attention to the links between intangible capital investment and assets and competitiveness and productivity, as well as to present some of the relationships that are not usually the focus of macro- or micro-level research. However, analysing and modelling these relationships may help to more objectively identify the levels and ratios of tangible and intangible capital investment and assets

[1] http://os.mti.hu/hirek/173869/os-a_szellemi_tulajdon_nemzeti_hivatalanak_kozlemenye-1_resz

that lead to improvements in competitiveness, thus contributing to a more reliable selection of indicators for possible development policy models aimed at improving competitiveness and to a more systematic verification of model calculations. This paper defines intangible capital and intangible assets broadly to include all investments and assets that can be linked to knowledge and skills.

2. Overview of the literature

The first major work on intellectual resources was published in 1995 (*Nonaka – Takeuchi 1995*). The two Japanese authors wrote about two types of knowledge: knowledge that is explicit, measurable and transferable, and knowledge that is non-measurable and therefore difficult to transfer (tacit). They argued that an organisation with a considerable amount of knowledge that is hard to measure and with the capability of disseminating this knowledge has a significant competitive advantage that is difficult to replicate. "Tacit" knowledge can be considered as a concept closely related to intangible capital.

Wolters (*2007*) concludes that countries that rely on and invest in intangible knowledge and skills assets achieve better competitive positions than those that compete with cheap resources, be they raw material or cheap labour. This finding has since been confirmed in practice by the examples of countries that have topped competitiveness rankings based on knowledge and innovation. Denmark, Switzerland or Sweden can be cited here as examples.

Krogh et al. (*2000*) find a close link between intangible (tacit) knowledge and innovation. And innovation is a key condition for competitiveness. They argue that in order to mobilise knowledge assets, a supportive environment and a motivating organisational culture is needed, which itself can be considered as an intangible asset.

According to *Steward* (*1997*), the most important types of knowledge assets are information, business relationships, efficient organisations and the skills of employees.

Other authors speak of intellectual assets or intellectual capital. *Edvinsson and Malone* (*1997*) point out that the real value of a company also includes intellectual assets such as organisational capital, customer relations, employee morale, patents and trademarks.

Thum-Thysen et al. (*2017*) suggest that relying on intangible assets is a better way to increase new added value created locally than investing in machinery and infrastructure.

Palotai – Virág (*2016*) emphasise the key role of knowledge as an intangible asset, while *Baksay et al.* (*2022*) highlight the importance of the contribution of knowledge, talent and creativity to growth.

Intangible assets can also be increased through investments, which also have mutually reinforcing synergies. Adult education is an important investment that generates synergy effects, contributing to productivity growth in the short term and increasing the value of intangible knowledge assets in the longer term. Generally speaking, the knowledge component of the future intellectual wealth stock is determined by the current expenditures on education, the proportion of people in education and the quality of education. Education and training, but also organisational development, can lead to productivity growth in the shorter term.

Based on a survey of US firms, *McAfee – Brynjolfsson* (*2012*) found that the successful adoption of new machines and technologies required additional investments, mainly in changing business models and organisational systems and in training employees.

Brynjolfsson et al. (*2017*) argue that artificial intelligence (AI), the new technology of the future, will only be able to contribute to significant productivity growth if it is accompanied by intangible capital investment such as the expansion of knowledge and skills and organisational development. *Goodridge et al.* (*2016*) and *Corrado et al.* (*2017*) point out that the size of intangible assets affects the potential for productivity growth.

In an analysis of 10 European countries, *Roth – Tsakanikas* (*2021*) found that around 40 per cent of productivity growth was driven by knowledge investment. *Elnasri – Fox* (*2017*) show that investment in intangible assets also has spillover effects that increase total factor productivity.

Total factor productivity represents the additional productivity growth that cannot be explained by the effects of additional physical (machinery, technology) investment and changes in the employed labour force. Such additional productivity growth comes from training and the use of more efficient organisational and management systems, i.e. intangible capital investment. It is important to note, however, as mentioned above, that – precisely because of their spillover and usual synergy effects – investments in tangible and intangible assets contribute together to improving productivity and thus competitiveness, since economic output is produced from the combination of different inputs. These inputs include machinery and equipment, labour, software and data, but also organisational and management methods. Therefore, when countries or firms make investments in order to increase economic results, they should not forget any single important input: i.e. they should also invest in the related inputs in order to create synergies. This is confirmed by EU

research which found that physical (machinery, technology) investments are only effective if they are complemented by investments in knowledge and organisation. The research verified this relationship both at the level of companies and the national economy. Researchers therefore pointed out that, for government subsidy to stimulate innovation, the two types of investment need to be linked in order for government subsidy to be effective. For example, the subsidy should be conditional on organisational development and employee training. The ratios between the two types of investment, however, can be sector- and company-specific (*EC 2021*).

Measurement problems, however, do arise. In the case of macroeconomic intangible capital investment, it is even more difficult to measure the expected effects, mainly because of the longer time horizons. Investment in education today will only pay off in the form of an increase in intangible assets over a long period of time. On the other hand, intangible assets are also subject to amortisation. Knowledge becomes obsolete, and the novelty of a patent that is not implemented for a long time is lost as new developments occur in the field. There are no generally accepted methods for measuring the loss of value due to amortisation. It is precisely this measurement problem that explains the perceived lack of funding for intangible capital investment at both the public and corporate level. Furthermore, tangible investments such as machinery can be sold if necessary, so that at least part of their cost can be recovered. However, the costs of intangible knowledge and capital investment are, as *Haskel and Westlake* (*2018*) put it, "sunk costs", i.e. they cannot be recovered. At the same time, some intangible capital investments, such as intellectual property, can be protected, which can give an organisation a distinctive advantage in the longer term.

Based on the literature, it can be concluded that the role of intangible assets and capital investment is increasing today and that they have an impact on improving productivity, and consequently competitiveness, mainly through knowledge investment and organisational development. In times of major changes, they can increase the resilience of economies exposed to shocks (*OECD 2021*). Companies are also increasingly considering their intellectual resources, assets and intellectual capital as sources of a competitive advantage. At the national level, intangible capital investments, most of which are investments in knowledge creation or knowledge acquisition, can help the transition to the knowledge economy. It is important to stress that a high investment rate does not generally improve the chances of transition to the knowledge economy: it only does so if the proportion of intangible capital investment is high enough (*Roth 2022*). There are also several definitions of the knowledge economy. According to an early definition, the knowledge economy is an economy in which the majority of knowledge workers work with their "brains" and produce ideas, knowledge and information (*Drucker 2006*). In general, however, a knowledge economy can be defined as an economy that has the capability of

effectively producing, utilising and sharing knowledge for economic development (*Al-Fehaid – Shaili 2021*).

According to *EBRD* (*2019*), an economy can be described as a knowledge economy if growth is driven by innovation and improvements in total factor productivity. Based on this, the EBRD has constructed the Knowledge Economy Index, in which Hungary ranks last among the nine Central European and Baltic states surveyed. This ranking certainly justifies further analysis.

At the level of economic theories, focusing on the importance of local investment in knowledge and skills is a line of thought that can be categorised as an endogenous, resource-based growth theory.

However, the scope of the concepts is not yet sufficiently clear. Authors and research findings do not understand intangible capital investment and assets in exactly the same way, and there is also no agreed definition for intellectual capital as an intangible asset. The different definitions show that the conditions for development are increasingly linked to knowledge and innovation, and investment in machinery, technology and infrastructure is no longer sufficient. Another important conclusion is that skills and knowledge are playing an increasing role in improving productivity. Without enhancing productivity, there can be no substantial improvement in competitiveness, which is necessary for development. In the following, intangible capital investment is defined as investment in knowledge and innovation, while intangible assets refer to knowledge (human) and intellectual assets (capital) and innovation position. A more precise definition will be given later.

3. Definitions

Since our aim is to analyse characteristics that have been examined using a wide range of approaches and that do not yet have an agreed definition, we first need to define the area under study. Furthermore, comparative data are not provided for all characteristics, so the analysis can only be based on the available data. In the following, "intangible" asset are defined partly according to the European Investment Bank (EIB) definition (*EIB 2021*) and partly using the wording of the EU Innovation Scoreboard (*EC 2022*) and the Hungarian Central Statistical Office (HCSO) database. The database for the analyses is taken from Eurostat and the HCSO. The EIB only examines flow type data, while the EU Innovation Scoreboard, Eurostat and the HCSO database only contain data on specific intangible assets and capital investments. As a secondary data source, the analysis relies on the IMD Competitiveness Yearbook (*IMD 2022*) and the Magyar Nemzeti Bank (central bank of Hungary, MNB) Productivity Report (*MNB 2022*) (see *Table 1*).

Table 1
Assets and investment elements included in the analysis and secondary data sources

Source	Process/Investment (Flow)	Assets/Capital (Stock)
EIB study and database	Share of tangible and intangible investment within total investment	–
EU Innovation Scoreboard Eurostat databases	Government R&D* subsidy	Human/Knowledge asset Innovation position
	Public expenditures on education	Intellectual asset/capital
	Adult education participation rate	Share of people with tertiary education in the 25–34 year age group
HCSO databases	R&D expenditures to GDP	Number of nationally filed patents of domestic origin
Secondary sources	MNB Productivity Report (2022)	
	IMD Competitiveness Report (2022)	

*Note: * R&D: Research and Development*

The analysis focuses on the relationships between intangible capital investment and assets related to knowledge and innovation, and competitiveness and productivity positions. We do not examine all of the characteristics that describe each of the assets. For example, in the case of human assets, we do not deal with the analysis of health conditions, even though this is an obvious characteristic of human assets. Data are not analysed for all EU countries. We consider comparisons within the V4[2] countries to be important, as well as with those with closer economic links to them and those that rank particularly well in competitiveness rankings.

Finally, we use statistical methods to show the links between the indicators but do not include the indicators in mathematical models that also measure the correlation of relationships. One reason for this is that statistical data are not available for all indicators, nor are time series sufficiently long to allow a convincing analysis.

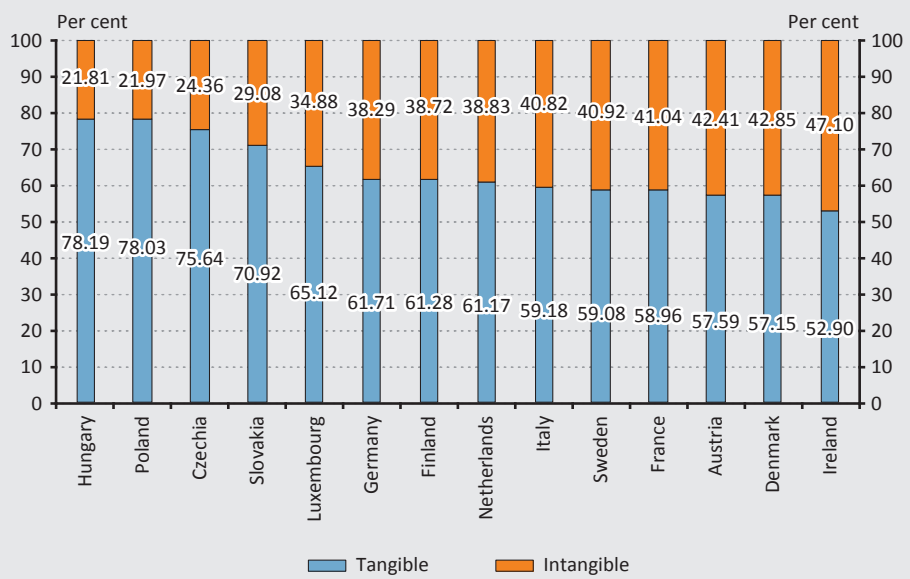
4. Analysis and conclusions

Figure 1 shows the breakdown of investments by tangible and intangible investments in 14 EU countries in 2020. The *EIB* (*2021*) defines tangible investment as investment in machinery, equipment, buildings and infrastructure. Intangible capital investment consists of investment in: research and development, software, data and website activities, training of employees and organisational and business process improvements. The results are sourced from a company survey. Note that only investment data, which are "flow" data, are included. "Stock" (status, asset value) data are not examined, even though the amount of intangible

[2] V4: Czechia, Hungary, Poland and Slovakia.

assets (e.g. patent portfolio, knowledge levels, employees with language skills, etc.) that a country or a company currently has is not irrelevant. A low asset level cannot be rapidly increased by a high investment rate, and the benefits of a high asset level are obscured by a low intangible capital investment rate. There is also a methodological problem with the treatment of R&D as intangible capital investment. R&D expenditure is an "intermediate" investment, as its result depends on what the expenditure is made on. If, for example, the R&D expenditure is transferred to foreign companies in the form of innovation grants, which result in the companies having their registered patents back home, then, although Hungarian R&D is expanding, the expenditure does not lead to patents that increase Hungarian national intellectual wealth. Or, for example, if a company buys technology from abroad with government R&D subsidy and it does not involve knowledge investment, it is in fact making a tangible investment. It should also be noted that the EIB analysis does not take into account an important intangible capital investment, namely general adult education. This is because its analysis is based on data collected from a sample of enterprises. It did, however, include expenditures on organisational and business process improvements, which are not easily measurable and which can be measured mainly in the business sector, although organisational innovation can bring significant efficiency gains in the public sector as well.

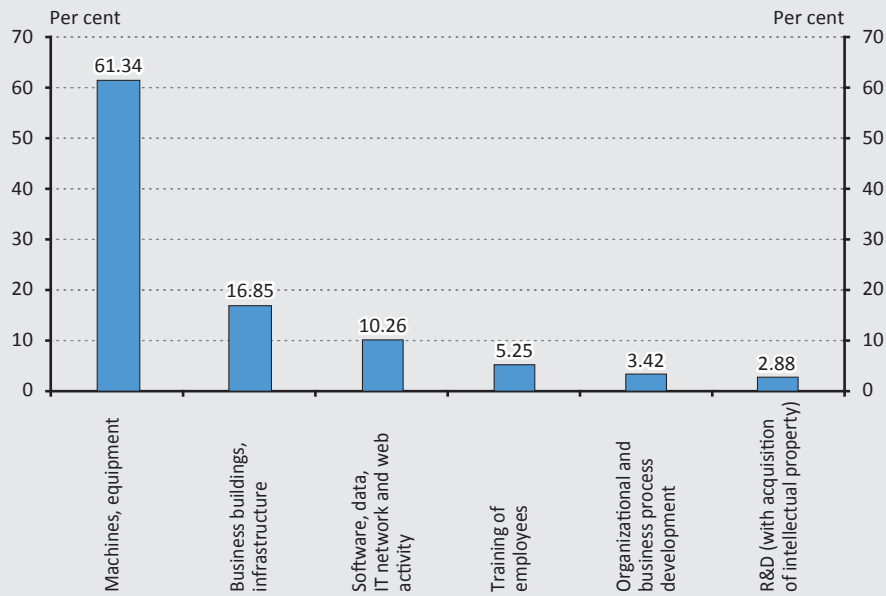
Figure 1
Share of tangible and intangible investment within total investment expenditure (2020)



Source: Calculated on the basis of EIB (2021)

Figure 1 shows that the more advanced economies are characterised by a higher share of intangible capital investment compared to the V4 countries. *Figure 2* shows that in the case of Hungary, the share of machinery and equipment within total investment is by far the highest (61.34 per cent).

Figure 2
Distribution of investments in Hungary, 2020

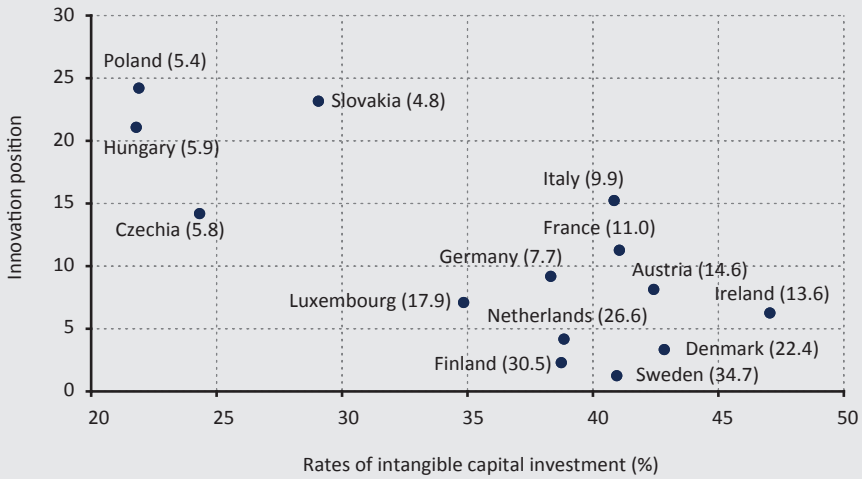


Source: EIB (2021)

The amounts devoted to the training of employees (5.25 per cent) and to organisation and business process improvements (3.42 per cent) are very low, and the share of R&D that involves knowledge investment (intellectual assets) is also not significant. As will be seen later, this lowers the chances of improving productivity, especially total factor productivity. A comparison of the ratios and competitiveness rankings makes it clear that the countries at the top of the competitiveness ranking are precisely those with high rates of knowledge investment. It would be interesting to analyse the data in terms of company size or number of employees, but these data are not available. Long time series would be needed to examine trends. It would also be worth looking at what other data are related to these data.

Figure 3 shows the relationship between intangible capital investment and innovation position, taking into account adult education data as a supporting activity.

Figure 3
Relationships between the rates of intangible capital investment, innovation position and adult education



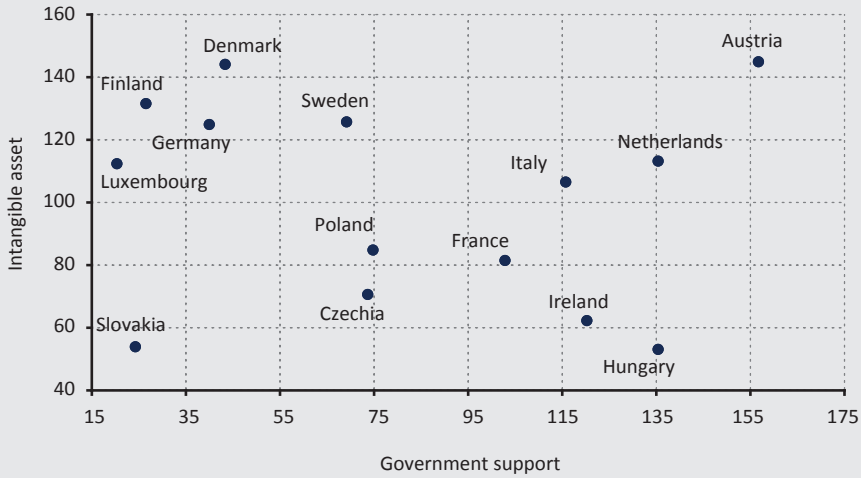
Note: In parentheses: Adult education participation rate in the 25–64 age group, 2021, in per cent.
Source: Calculated on the basis of EIB (2021), EC (2022), Eurostat (2022a)

Figure 3 shows that the innovation position relevant for competitiveness, and as measured by the ranking in the EU Innovation Scoreboard and interpreted as the "asset level" achieved, is closely related to the rate of intangible capital investment (*Figure 1, EIB 2021*) and, within that, the adult education participation rate for the 14 EU countries studied.[3] We can see that the position of the V4 countries is clearly distinct from that of the advanced economies. For the former, low levels of intangible capital investment and adult education are associated with a lower innovation position in the ranking. Only Czechia stands out slightly from the group. Countries with high rates of intangible capital investment and adult education participation are at the top of the innovation ranking.

Among intangible capital investments, R&D investments are generally also supported by the government. The government usually expects this support to produce innovation results and new intangible assets. Intangible assets are measured by patent, design and trademark applications per capita. By effectiveness, we mean the extent to which government R&D subsidy provides an incentive for firms to invest in R&D and the combined effect of the two types of investment in terms of new knowledge capital, typically a patented product, process or design. *EC* (*2022*) assesses the effectiveness of government subsidies by comparing the level of government subsidies relative to the EU average and the intangible asset level relative to the EU average.

[3] The minor overlap in the data, namely that both intangible capital investment and adult education include in-company training, should not have a major distorting effect on the comparison.

Figure 4
Relationships between intangible asset levels and government R&D subsidies



Note: On horizontal and vertical axes: EU27=100
Source: EC (2022)

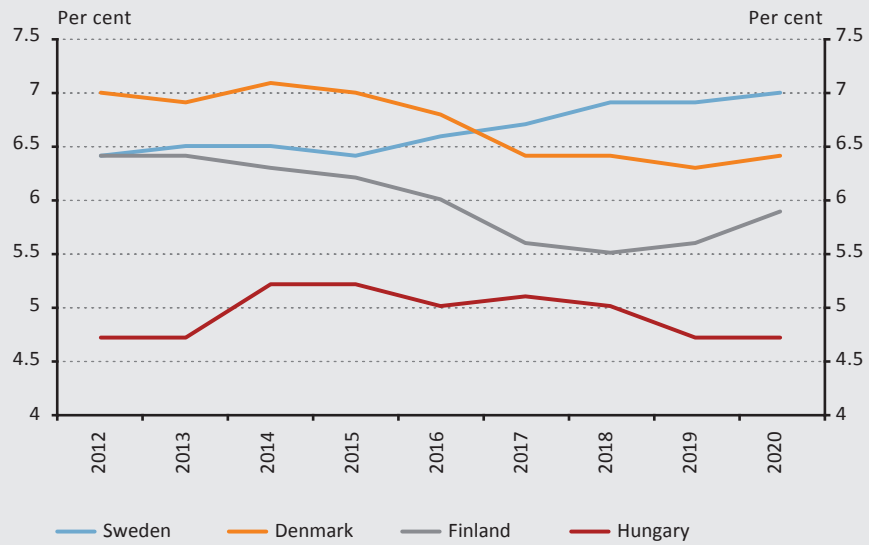
The relationships are illustrated in *Figure* 4. It shows that in Hungary, for example, the government R&D subsidy of 135.7 per cent, which is significant compared to the EU average, only generates an intangible asset level of 52.3 per cent. However, for countries with high intangible asset levels, government subsidies are insignificant. This is obviously in line with the data in *Figure 1*, i.e. where companies have significant intangible investment, including R&D, they generate a high level of intangible assets such as patents. This reflects inefficiencies in public spending, a phenomenon also highlighted by the *MNB* (*2022*) report. This issue will be returned to in the context of the Hungarian data (*Figure 7*).

It should be noted that, given the "flow" nature of public expenditures and the "stock" nature of intangible assets, additional valuable conclusions could be drawn by examining the relationships between longer time series. Unfortunately, however, such data are not available in this breakdown. The data suggest that corporate intangible investment contributes more to the growth of intangible assets than direct public support. This is particularly striking in the cases of Finland, Sweden and Denmark, for example, countries that create significant intellectual assets with very low levels of public support but high levels of corporate intangible capital investment (*Figure 1*).

But what else can contribute to a high level of intangible assets in these countries? It can be assumed that expenditures on education as intangible investments also have an impact on the level of intangible assets. It is therefore worth looking at what percentage of their GDP these countries spend on education in the longer

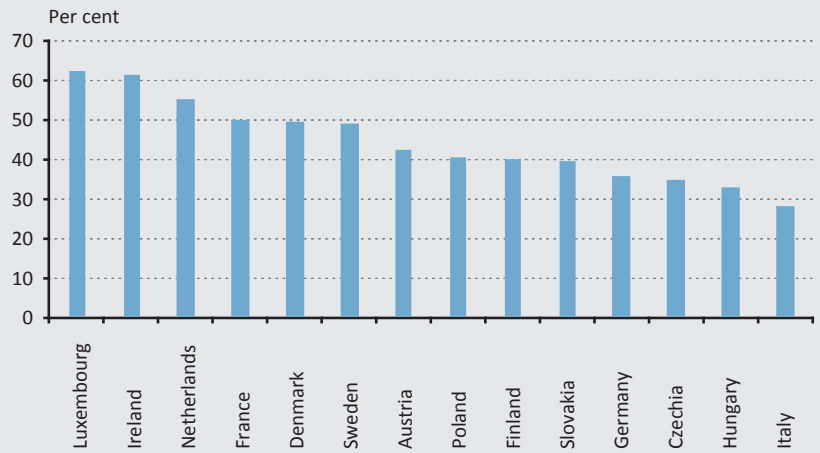
term. As we can see in *Figure 5*, these countries are characterised by a persistently high level of education expenditures, which obviously helps them to maintain a high intangible asset level.

Figure 5
Public expenditures on education as a share of GDP, 2020



Source: Eurostat (2022b)

Figure 6
Share of people with tertiary education in the 25–34 year age group, 2021

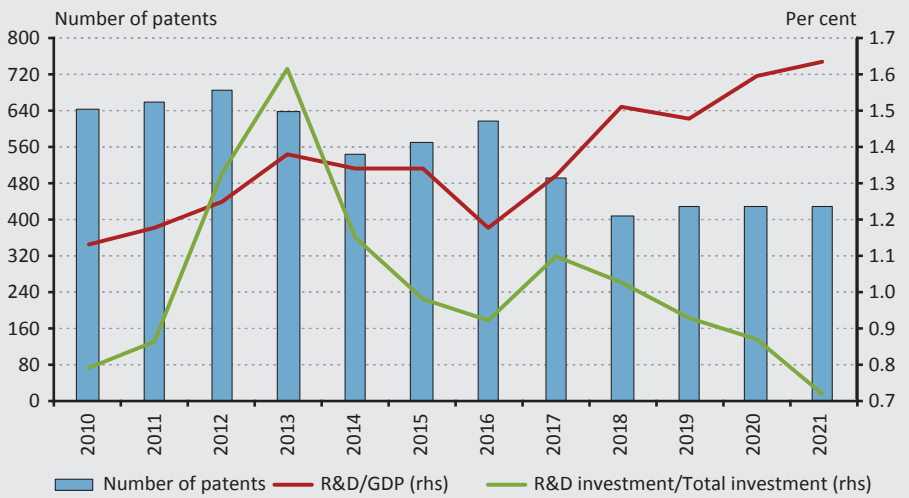


Source: Eurostat (2022c)

The share of people with tertiary education is also an important feature of knowledge assets (*Figure 6*). The Hungarian figure is the second lowest among the 14 countries surveyed, which is obviously linked to lower education expenditures to GDP (*Figure 5*).

Let us now examine the relationship between the ratio of R&D expenditures to GDP and the number of registered patents in Hungary over the longer term, between 2010 and 2021. Human/knowledge assets could be increased through higher knowledge investment – by increasing adult education expenditures and the ratio of education expenditures to GDP. This would likely contribute to higher productivity gains from investment in machinery and infrastructure.

Figure 7
Relationship between nationally filed domestic patent applications, the ratio of R&D expenditures to GDP and the share of R&D investment within total investment



Source: HCSO (2022)

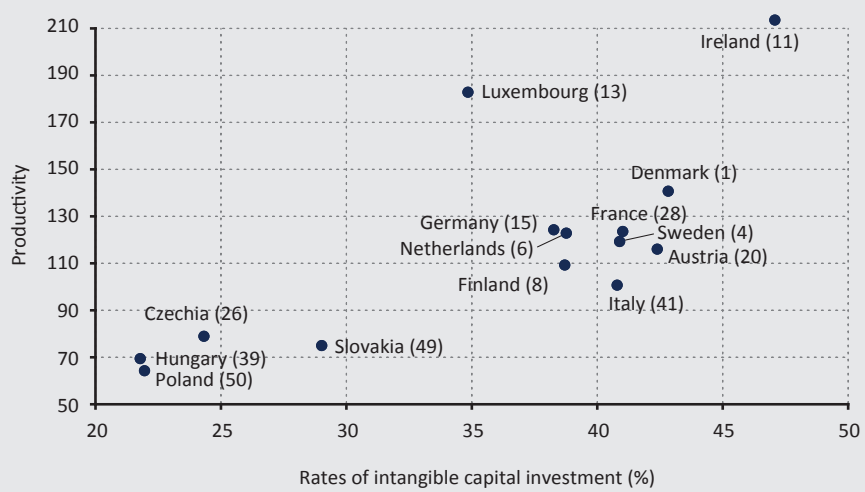
Figure 7 shows important correlations. One of the most important intangible expenditures is total R&D expenditures to GDP, which, as shown in *Figure 7*, has been steadily increasing since 2010, with the exception of one or two years, to reach 1.64 per cent by 2021, placing Hungary in the middle of the ranking in the EU (*EC 2022*). However, this positive trend is not reflected in the number of patents: on the contrary, the increasing R&D expenditure has been accompanied by a falling or stagnating number of patents. This is probably due to the two characteristics mentioned earlier. First, the support for R&D provided to foreign companies is included in the R&D-to-GDP ratio, but – if it does not result in Hungarian patents – it is not reflected in the increase in the number of patents. Second, some of the R&D expenditures do not result in any new intellectual property, as they may have

been used to buy machinery or foreign technology, and these physical investments were not complemented by knowledge investments, so that no intangible capital gains could be generated. Looking at the share of R&D investment within total investment, we can also see that this ratio rose until 2013 and then fell sharply, which may be related to the fact that the majority of investment was increasingly made in machinery, equipment and infrastructure (*Figures 1 and 2*). The MNB report also points to the lack of intangible capital investment: *"The main gap can be identified in innovation-related capital goods. The latter mainly refers to intangible assets."* (*MNB 2022:34*).

The data and relationships examined suggest that one of the key reasons for the innovation, competitiveness and productivity gap in Hungary is the lower levels of intangible assets (human assets, intellectual capital, low share of people with tertiary education, etc.) and knowledge investment that directly contributes to supporting these assets, compared to more developed economies in an international comparison. The impact of each of these factors on Hungary's competitiveness and productivity position could be quantified by further analysis, and mathematical modelling would help to identify the combined effects. Finally, let us consider a particularly important interrelationship that addresses perhaps the biggest problem facing the Hungarian economy.

Figure 8 shows the relationship between productivity data for 14 EU countries and intangible capital investment rates, with the position in the IMD 2022 Competitiveness Ranking in parentheses as an explanatory data point (*IMD 2022*).

Figure 8
Relationships between intangible capital investment rates, productivity and competitiveness



Note: Productivity: GDP/hour (PPP), EU27=100, 2021. Competitiveness position in parentheses.
Source: Calculations based on EIB (2021), Eurostat (2022d), IMD (2022)

As pointed out earlier, productivity is closely correlated with the share of intangible investment, mainly knowledge investment, within total investment, while higher productivity is associated with a better competitive position. Eurostat measures productivity by the gross value added (GVA) produced per hour worked, calculated at purchasing power parity (PPP). According to Eurostat data, Hungary's productivity is the second lowest among the countries surveyed, after Poland, at just 68.5 per cent of the EU average. Together with Poland, Hungary's intangible capital investment rate is also the lowest (*EIB 2021: Figure 1*). Hungary's competitiveness position is the 4th worst among the 14 countries surveyed (*IMD 2022*). The data and relationships examined could of course be extended, but it is clear from the above that the significant Hungarian "tangible" investments in machinery and infrastructure are not sufficient to improve innovation, competitiveness and productivity. As the literature also emphasises, without an adequate level of intangible capital investment as well as the knowledge assets and intangible assets it creates, it will not be possible to move to a more advanced knowledge-based economy, without which there will be no additional resources to further improve innovation, competitiveness and productivity.

It is also important to note that intangible capital investment not only increases the efficiency of the use of tangible investment, but also helps to accelerate the uptake, absorption and diffusion of foreign technologies (*Bruno et al. 2019*). This is an important finding, as it suggests that the impact of foreign investment on local development, mainly through productivity improvements, could be enhanced by increasing local intangible capital investment, for example in education and adult training.

5. Summary

The main aim of the paper was to draw attention to the importance of intangible capital investment and to the fact that Hungary's low level of productivity in an international comparison is related to its low level of intangible investment, especially knowledge investment, compared to developed countries. Furthermore, there is a clear link between low levels of knowledge assets and competitiveness positions.

The theory of intangible capital investment and intangible assets is still developing, and there is also a professional debate on the measurement methods. However, empirical research shows that locally generated and continuously increasing knowledge is becoming more and more important today. The importance of investing in it is therefore also growing. Of course, as with any other investment, an important condition for intangible capital investment is efficiency and return, which is even more difficult to measure in this case, where there are long time horizons,

spill-over effects and synergy advantages. In the case of businesses, the market and the stock exchange are increasingly focusing on the intangible assets that can be accumulated by a company, especially knowledge and intellectual assets, which are difficult to replicate. However, there is a need to measure Hungary's intangible assets at the national level and develop a strategy to consciously increase them. Based on its knowledge, innovation and competitiveness data, the Hungarian economy cannot yet be considered a knowledge-based economy according to the definitions given so far for the knowledge economy. The transition to the knowledge economy cannot be achieved without improving all types of knowledge assets and raising the level of knowledge investment needed to support them. As the data and relationships presented suggest, competing by being "cheap" along with the low levels of productivity and innovation will not be enough to catch up with the more advanced countries in the foreseeable future. And lagging behind could entail the risk of falling into the development trap.

Progress will of course still require both theoretical and methodological discussions. Such debates and research are ongoing. For example, the MNB's professional debates and publications are also looking for indicators and methods to better describe the level of development, as there is still no consensus on how to measure development more reliably. Another line of research could be the mathematical analysis of the links between the interrelationships outlined above and the indicators selected and analysed, but this would require more extensive and time-consuming research.

References

Al-Fehaid, H.Y.N. – Shaili, V. (2021): *Knowledge Economy and its Implications in the Kingdom of Saudi Arabia.* SSRN, 18 May. https://doi.org/10.2139/ssrn.3846918

Baksay, G. – Matolcsy, Gy. – Virág, B. (2022): *Új fenntartható közgazdaságtan* (*New Sustainable Economics*). *Global Discussion Paper*. Magyar Nemzeti Bank. https://www.mnb.hu/web/sw/static/file/uj-fenntarthato-kozgazdasagtan-single.pdf

Bruno, R.L. – Douarin, E. – Korosteleva, J.A. – Radosevic, S. (2019): *Determinants of Productivity Gap in the European Union: A Multilevel Perspective*. IZA Discussion Paper No. 12542. https://doi.org/10.2139/ssrn.3445808

Brynjolfsson, E. – Rock, D. – Syverson, C. (2017): *Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics*. NBER Working Paper No. 24001. https://doi.org/10.3386/w24001

Corrado, C. – Haskel, J. – Jona-Lasinio, C. (2017): *Knowledge Spillovers, ICT and Productivity Growth*. Oxford Bulletin of Economics and Statistics. 79(4): 592–618. https://doi.org/10.1111/obes.12171

Csath, M. (2022): *Growth or Development Trap*. Financial and Economic Review, 21(2): 152–174. https://doi.org/10.33893/FER.21.2.152

Drucker, P. (2006): *The Effective Executive*. HarperCollins, New York.

EBRD (2019): *Introduction the EBRD Knowledge Economy Index*. March. European Bank for Reconstruction and Development. https://www.ebrd.com/news/publications/brochures/ebrd-knowledge-economy-index.html. Downloaded: 5 March 2023.

EC (2021): *Reflections on Complementarities in Capital Formation & Production: Tangible & Intangible Assets Across Europe*. Discussion Paper 152. Luxembourg: Publications Office of the European Union.

EC (2022): *European Innovation Scoreboard 2022*. Publication Office of the European Union, Directorate-General for Research and Development. https://doi.org/10.2777/309907

Edvinsson, L. – Malone, M.S. (1997): *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower*. Harper Business.

EIB (2021): *EIB Investment Report 2020/2021: Building a smart and green Europe in the COVID-19 era*. European Investment Bank. https://doi.org/10.2867/904099

Elnasri, A. – Fox. K.J. (2017): *The contribution of research and innovation to productivity*. Journal of Productivity Analysis. 47: 291–308. https://doi.org/10.1007/s11123-017-0503-9

Eurostat (2022a): *Adult learning statistics. May 2022*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Adult_learning_statistics#And_what_about_the_participation_rate_of_adults_in_education_and_training_in_the_last_4_weeks_compared_to_12_months_in_2016.3F. Downloaded: 4 February 2023.

Eurostat (2022b): *General government expenditure by function in 2020*, 28 February 2022. https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/ddn-20220228-2. Downloaded: 30 January 2023.

Eurostat (2022c): *Educational attainment statistics*. https://ec.europa.eu/eurostat/databrowser/view/edat_ifs_9903/default/table?lang=en. Downloaded: 2 February 2023.

Eurostat (2022d): *Labour productivity per hour worked*, 30 January 2023. https://ec.europa.eu/eurostat/databrowser/view/nama_10_lp_ulc/default/table?lang=en. Downloaded: 3 February 2023.

Goodridge, P. – Haskel, J. – Wallis, G. (2016): *Spillovers from R&D and Other Intangible Investments: Evidence from UK Industries*. Review of Income and Wealth, 63(s1): S22–S48. https://doi.org/10.1111/roiw.12251

Haskel, J. – Westlake, S. (2018): *Capitalism without Capital. The Rise of the Intangible Economy*. Princeton University Press. Princeton & Oxford. https://doi.org/10.1515/9781400888320

HCSO (2022): *A kutatás-fejlesztés és az innováció főbb arányai* (*Main rates of R&D and innovation*). https://www.ksh.hu/stadat_files/tte/hu/tte0001.html. Downloaded: 30 November 2022.

IMD (2022): *IMD World Competitiveness Yearbook 2022*. International Institute for Management Development. Lausanne, Switzerland. https://www.imd.org/centers/world-competitiveness-center/rankings/world-competitiveness/

Krogh, von G. – Ichijo, K. – Nonaka, I. (2000): *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation*. Oxford University Press, Inc. New York. https://doi.org/10.1093/acprof:oso/9780195126167.001.0001

Matolcsy, Gy. (2022): *The Appearance of Economic, Social, Financial and Environmental Sustainability Aspects in the Practices of the National Bank of Hungary*. Public Finance Quarterly, 2022(3): 315–334. https://doi.org/10.35551/PFQ_2022_3_1

McAfee, A. – Brynjolfsson E. (2012): *Race Against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity and Irreversible Transforming Employment and the Economy*. Digital Frontiers Press, Cambridge, MA.

MNB (2022): *Productivity Report 2022*. Magyar Nemzeti Bank. https://www.mnb.hu/letoltes/termelekenysegi-jelentes-eng-2022-julius-digitalis.pdf

Nonaka, I. – Takeuchi, H. (1995): *The Knowledge-Creating Company*. Oxford University Press. New York.

OECD (2021): *Mind the financing gap: Enhancing the contribution of intangible assets to productivity*. OECD Economics Department. Working Papers No. 1681. https://doi.org/10.1787/7aefd0d9-en

Palotai, D. – Virág, B. (eds.) (2016): *Competitiveness and Growth*. Magyar Nemzeti Bank. https://www.mnb.hu/en/publications/mnb-book-series/competitiveness-and-growth

Roth, F. (2022): *Intangible Capital and Growth.* Essays on Labor Productivity, Monetary Economics, and Political Economy. Vol. 1. Contributions to Economics. Springer, Open Access. https://doi.org/10.1007/978-3-030-86186-5

Roth, F. – Tsakanikas, A. (2021): *Policies for Enhancing Growth from Intangibles at the Aggregate and Sectoral Levels*. European Policy Brief, GLOBALINTO, 17 November. https://globalinto.eu/wp-content/uploads/2021/11/GLOBALINTO-European_Policy_Brief-Macro-underpinnings.pdf. Downloaded: 1 December 2022.

Steward, T.A. (1997): *Intellectual Capital*. Nicholas Brealey Publishing, London.

Thum-Thysen, A. – Voigt, P. – Bilbao-Osorio, B. – Maier, C. – Ognyanova, D. (2017): *Unlocking investment in intangible assets*. Discussion Paper 047, EC – Economy and Finance, May. https://economy-finance.ec.europa.eu/publications/unlocking-investment-intangible-assets_en. Downloaded: 1 December 2022.

Várnai, T. (2022): *Relationship between capital and economic growth: shifting the focus from quantity to quality*. In: Baksay, G. – Matolcsy, Gy. – Virág, B. (eds.): New Sustainable Economics – Global Discussion Paper. Magyar Nemzeti Bank, pp. 71–80. https://www.mnb.hu/web/sw/static/file/NEW_SUSTAINABLE_ECONOMICS_-_Global_discussion_paper_2022.pdf

Wolters, T. (ed.) (2007): *Measuring the New Economy: Statistics between Hard-Boiled Indicators and Intangible Phenomena*. Emerald Group Publishing Ltd. Bingley, UK.

Households' Savings Portfolio Allocation in an Inflationary Environment in the MNB's New Quarterly Survey*

Tamás Briglevics – Annamária Hegedűs

Using data from the new quarterly household survey of the Magyar Nemzeti Bank (the Central Bank of Hungary, MNB), we show how households' saving habits changed between early 2022 and early 2023 as a result of higher inflation. Although savings plans changed considerably during the turbulent year 2022, the key difference is that households significantly increased their government bond holdings, mainly through inflation-linked, high-yielding government securities, at the expense of term deposits, showing that households with financial wealth are very sensitive to interest rates.

1. Introduction

In recent years, Hungarian households have had to cope with unprecedented shocks: the coronavirus pandemic and resulting lockdowns, followed by a surge in inflation as the economy reopened, and the war in a neighbouring country would have forced family budgets to be significantly restructured even if these events had all happened separately. Fortunately, these shocks were faced by a strengthened household sector, which had managed to increase its financial wealth (calculated without other ownership interest) by roughly one third in real terms between 2015 and 2019 (*Figure 1*).

Higher financial wealth (together with the forced savings generated during the pandemic) can effectively cushion the impact of the above shocks if it is accumulated across broad segments of society and in relatively liquid financial assets. However, financial accounts (along with macro statistics in general) do not provide sufficient information on such aspects. Therefore, the MNB has launched a new data collection programme to gather timely data on household savings at a quarterly frequency.[1]

---

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Tamás Briglevics: Magyar Nemzeti Bank, Senior Economic Researcher. Email: briglevicst@mnb.hu
Annamária Hegedűs: Magyar Nemzeti Bank, Analyst. Email: hegedusan@mnb.hu

[1] In recent years, several central banks around the world have launched regular surveys to assess the current financial situation and expectations of households, such as the European Central Bank: *Consumer Expectations Survey* (*Bańkowska et al. 2021*); Federal Reserve Bank of New York: *Survey of Consumer Expectations* (*Armantier et al. 2017*); and the Bank of Canada: *Canadian Survey of Consumer Expectations* (*Gosselin – Khan 2015*).

In this article, we use these data to show how household savings have changed since the beginning of 2022, mainly through the use of retail government securities, which provide effective protection against high inflation. First, we briefly present the methodology of the new survey, then we examine the changes at the household level behind the macro aggregates, and finally we present details on the evolution of the retail government securities portfolio.

2. Framework for the MNB's new household wealth survey

The 2008 crisis highlighted that an accurate assessment of the economic situation, especially in the household sector, requires the precise knowledge of the distribution of household wealth (*Krueger et al. 2016*). Central banks in advanced economies now conduct regular household wealth surveys: for example, the *Household Finance and Consumption Survey* in the euro area (*HFCS 2020*), the related *What do we live from?* household survey (*MNB 2022*) in Hungary, and the *Survey of Consumer Finances* in the United States (*SCF 2023*).

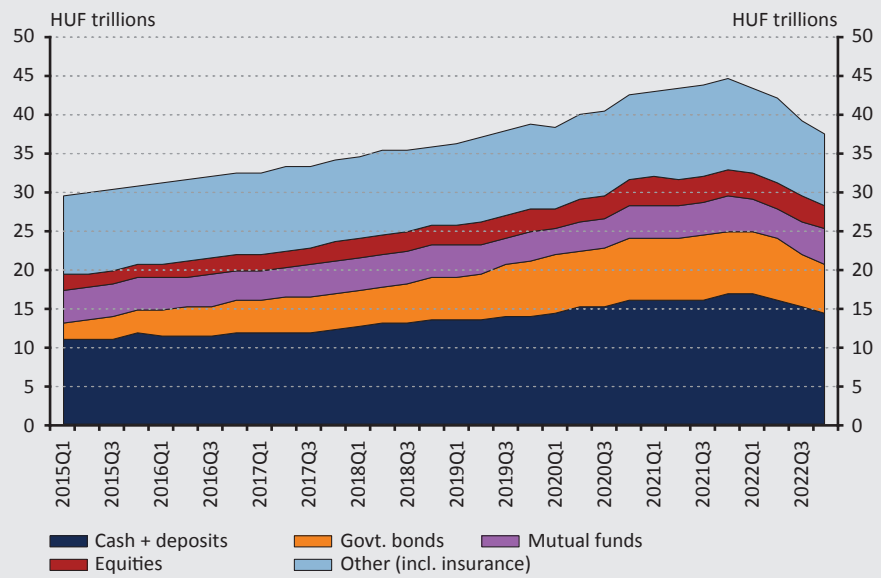
However, these surveys are typically only carried out every three years, and because data processing takes a long time, they cannot provide accurate, timely information in the case of frequent shocks. It is precisely to complement these detailed surveys that the MNB has started to use a survey that can be fielded and aggregated more quickly, with the added benefit of being able to include questions relevant in the current economic situation. The speed of data collection is ensured by a quarterly online questionnaire, for which respondents are selected from an online panel using stratified random sampling. Rapid data collection comes with methodological trade-offs: sampling is less sophisticated than, for example, the HFCS or SCF, and there is less time for data processing. Therefore, with the MNB quarterly surveys it is better to focus more on significant shifts, which can provide an appropriate snapshot of actual developments.

The sampling unit of the survey is a household, and the sample is representative of the gender, age and education of the head of the household, and of the region of the household. The sample was initially composed of 1,000 households with working-age household heads between 2021 Q3 and 2022 Q2, to which 300 households with retirement-age members were added from 2022 Q3.

3. Significant increase in household financial wealth from 2015

Including the forced savings due to lockdowns during the pandemic, household financial wealth (excluding other equity investments) increased by 50 per cent in real terms between 2015 and 2021, according to the financial accounts,[2] but as economies reopened, this trend reversed and savings started to fall in real terms. The macro statistics, however, tell us little about the distribution of this change across different household segments. Our survey reveals which demographic groups had financial wealth at the beginning of 2023. This aspect can be examined according to a wide range of demographic characteristics, such as household income, the education level of the head of household, or in regional breakdowns. For the sake of clarity, we stick to the breakdown by income, while the breakdown by other demographic factors yields the expected results due to the high correlation with income.

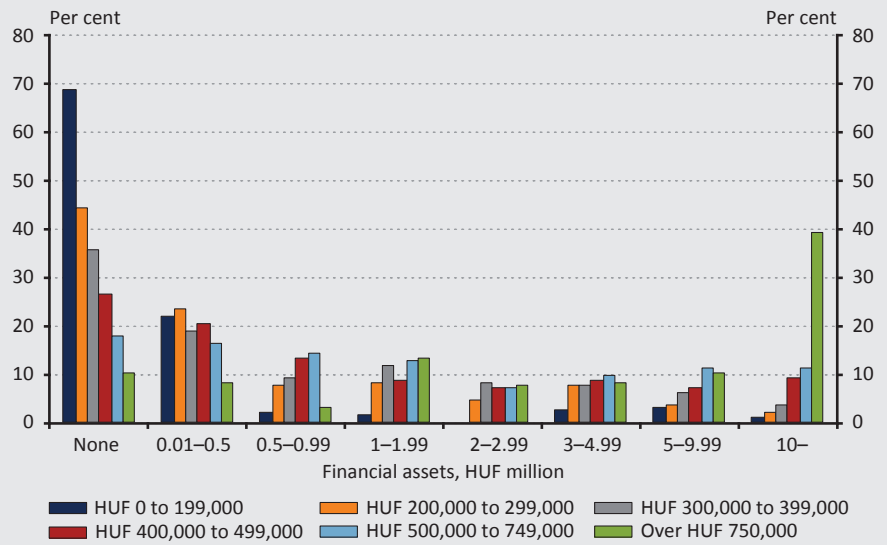
Figure 1
Household sector financial assets (excluding other equity investments) at current prices, in HUF trillions



Source: Financial accounts of the national economy (MNB)

[2] Since the survey does not ask about household assets held in non-listed companies, we have adjusted the macro statistics for this asset class for comparability.

Figure 2
Distribution of household financial assets by net monthly income (2023 Q1)



Note: Households with a working-age household head; values expressed as a percentage of households in the respective income group.

Source: Household wealth survey (MNB)

Figure 2 shows a strong correlation between financial wealth and income, for households with working-age household heads. 70 per cent of the lowest-income households have no financial assets, and another 22 per cent have less than HUF 0.5 million in savings. By contrast, 40 per cent of the highest earners have savings of more than HUF 10 million.

The distributions between these two extremes are more similar: the share of those with financial wealth between HUF 1 and 5 million is fairly stable among those earning between HUF 300,000 and 750,000. Precautionary balances of between HUF 0.5 million and HUF 1 million are mostly accumulated by those earning between HUF 400,000 and 750,000.

4. Changes in savings plans during 2022

As accumulation is the result of a longer process, it is also worth collecting information on savings plans. The survey asks whether households plan to save in the next 12 months. According to the financial accounts, the economic upturn in the pre-pandemic period was accompanied by a significant increase in household savings, boosted by the forced savings accumulated during the pandemic period (*Figure 3*). However, this picture changed significantly in early 2022, partly due to

consumption growth following the end of the lockdowns, and partly due to the sharp rise in inflation and the war. The qualitative question in the survey indicated a sharp decline in households' propensity to save in 2022 Q2. From a short-term perspective, one positive factor is that 2023 Q1 survey shows that the share of people planning to save has started to rise, but it has not yet reached the high level seen around the turn of the year in 2021–2022.

Figure 3
Trends in household sector savings

Source: Household wealth survey and financial accounts of the national economy (MNB)

A breakdown of savings plans by income group shows that although there are people in all groups who plan to save, the proportion of those in the highest income groups is roughly twice as high as it is in the lowest income groups (*Table 1*). These figures are qualitative: they do not show how much a household intends to save from its income, and of course there may be significant differences between income groups. Other differences can also be identified within particular income groups, for example by the education level of the household head. In this regard, it is interesting that the savings plans of those with a high school diploma are not significantly different from those with a college degree. However, those with lower education typically plan to save less.

There is not much difference between the savings plans of households with a household head with medium versus higher education level, but there are more

highly paid household heads among those with a higher education level, among whom a higher proportion is planning to save (in both education groups).

Looking at the structure of the gap between the plans in early 2022 and 2023, we can see that in 2023 households with a net income below HUF 750,000 had a lower propensity to save than one year earlier. However, as shown in *Figure 3*, savings was at its peak in early 2022, supported by strong income growth and government redistribution (personal income tax refunds).

Table 1
Savings plans by monthly net income of households

Net income (HUF)	2022 Q1 (per cent)	2023 Q1 (per cent)	Change (percentage point)
0 to 199,000	36.9	29.9	–7.0
200,000 to 299,000	41.8	47.2	5.5
300,000 to 399,000	52.3	42.3	–10.0
400,000 to 499,000	60.5	50.8	–9.8
500,000 to 749,000	69.1	64.2	–4.9
over 750,000	78.6	80.2	1.6

Source: Household wealth survey (MNB)

5. Evolution of savings portfolios

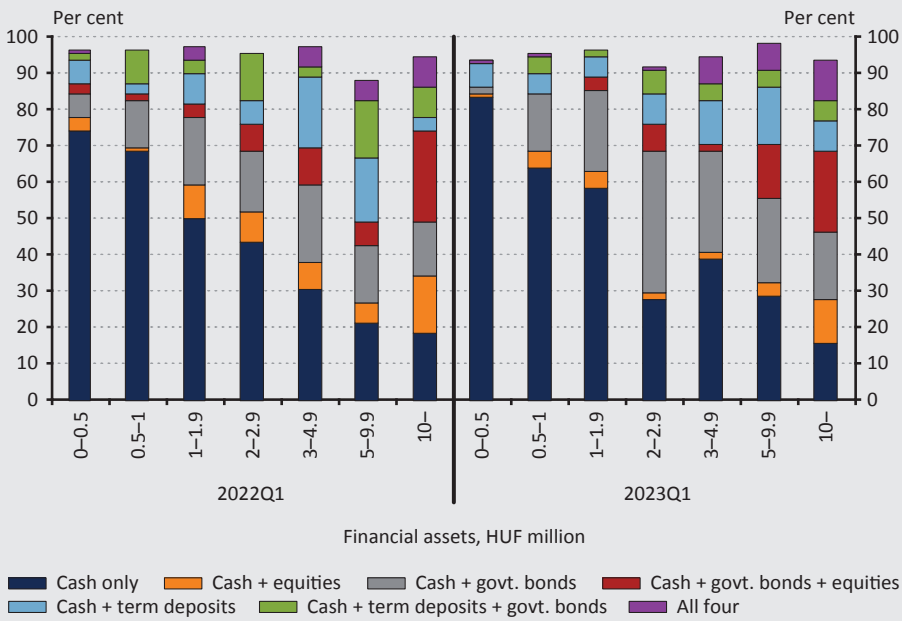
In recent years, not only have there been extreme fluctuations in the level of savings, the structure of savings has also changed significantly. In the survey, respondents were asked about their financial assets (cash, current account deposits, fixed deposits, government securities, other bonds, investment certificates, equities, pension fund savings, life and pension insurance). In the interests of clarity, the most common assets were grouped into four categories: (1) cash and cash equivalents (cash and current account deposits), (2) term deposits, (3) government securities, (4) risky assets (mutual funds and equities). We then looked at what *combinations* of these four asset classes are held by households with different financial wealth.[3]

[3] As shown in *Figure 4*, these combinations cover the portfolios of more than 90 per cent of households; accordingly, we decided not to analyse the other assets (other bonds, pension fund savings, life and pension insurance) separately. In addition, pension and life insurance savings are less liquid than the four asset classes analysed in more detail, and therefore households are unlikely to be able to reallocate them in the short term. Of course, substantial portfolio shifts in investments managed by pension funds and insurance companies may also occur, but this falls outside the scope of our feature article, which focuses on the decisions of households.

Households with low financial wealth mainly hold liquid assets, but above HUF 0.5 million, government securities and fixed-term deposits also appear alongside liquid assets in 2022 (*Figure 4*). Riskier assets appear with households having more than HUF 1 million in savings, but are only really significant in the wealthiest segment.

Looking at 2023, the most striking change is that, among households with savings between HUF 1 million and 10 million, government bond holdings have become much more widespread. This increase was largely driven by a decrease in fixed-term deposits, but in the HUF 2 million to 3 million segment, the share of portfolios consisting exclusively of the most liquid assets has also decreased significantly.

Figure 4
Household financial portfolio changes between Q1 2022 and Q1 2023



Note: The columns in the figure do not add up to 100 per cent as infrequently selected asset portfolios are omitted. govt.: government

Source: Household wealth survey (MNB)

Restructuring of the portfolios was not limited to shifts between assets: significant shifts also took place within the government bond portfolios, with the growing popularity of inflation-linked government securities as the main driver of the changes shown in *Figure 4*. This change is analysed in more detail below.

6. Characteristics of the retail government securities market

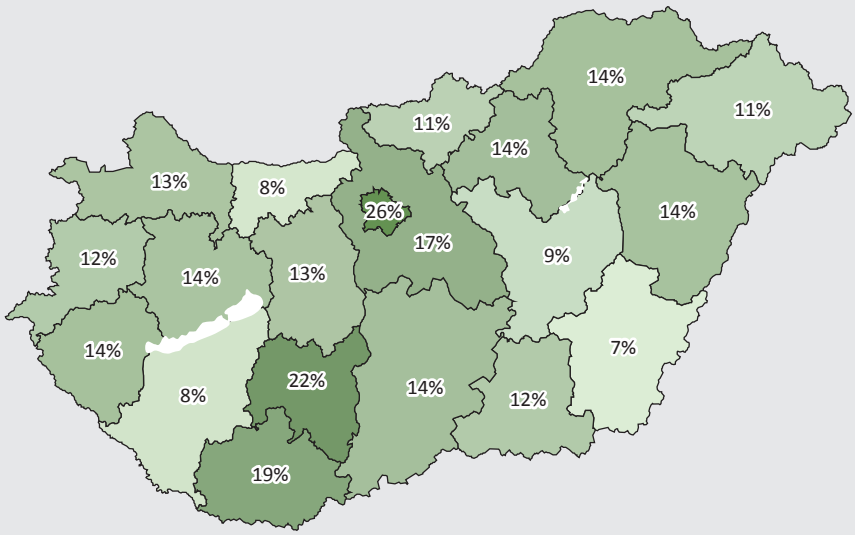
Among retail government securities, the inflation-linked Premium Hungarian Government Security (*PMÁP*) *has become the most popular product.* Since the renewal of the strategy in 2019, one of the main elements of which was the introduction of the Hungarian Government Security Plus (MÁP Plusz), government securities have become one of the most popular forms of saving among households: according to preliminary financial account data, 12 per cent of households' financial assets were held in these instruments at the end of 2022, representing an outstanding stock of over HUF 10 trillion. According to statistics published by the Government Debt Management Agency (ÁKK), retail government securities accounted for around one fifth of total government debt at the end of January 2023, making them particularly important from a debt financing perspective. The changing inflationary environment prompted investors to rebalance their portfolios. On the one hand, holdings of the fixed interest rate Hungarian Government Security Plus gradually declined due to increased selling by investors before maturity, while the inflation-linked Premium Hungarian Government Security became the most popular and most widely held retail product: its amount outstanding doubled in one year, reaching nearly HUF 4,800 billion by the end of January 2023, according to monthly securities statistics.

The share of government security holders increases with households' savings. According to the latest survey, conducted in February 2023, 19 per cent of respondents hold government securities, which can be considered relatively stable in line with previous data collection (the share has been in the range of 13–18 per cent). In cities, a higher proportion of households typically own government securities, with Budapest standing out, with 26 per cent of respondents holding this investment according to the results of previous surveys. There are no significant differences in government securities ownership by county (*Figure 5*).

The share of government security holders rises in line with the increase in households' net monthly income. Almost 40 per cent of respondents with earnings over HUF 750,000 hold government securities, while less than one tenth of respondents in the lowest income category (under HUF 200,000) entered the market. A similar picture emerges when examining educational attainment: as the number of years of education increases, the share of government security holders also increases. This also reflects the strong positive correlation between educational attainment and income level.

This form of saving is least popular in the younger age group (18–30 years), which exhibits significantly lower shares of government security holders compared to other age groups, with a share of slightly above 10 per cent among all constituents and 15 per cent when narrowed down to those with savings.

Figure 5
Percentage of government security holders by county



Note: In relation to the number of respondents living in a given county, based on data from all previous surveys.

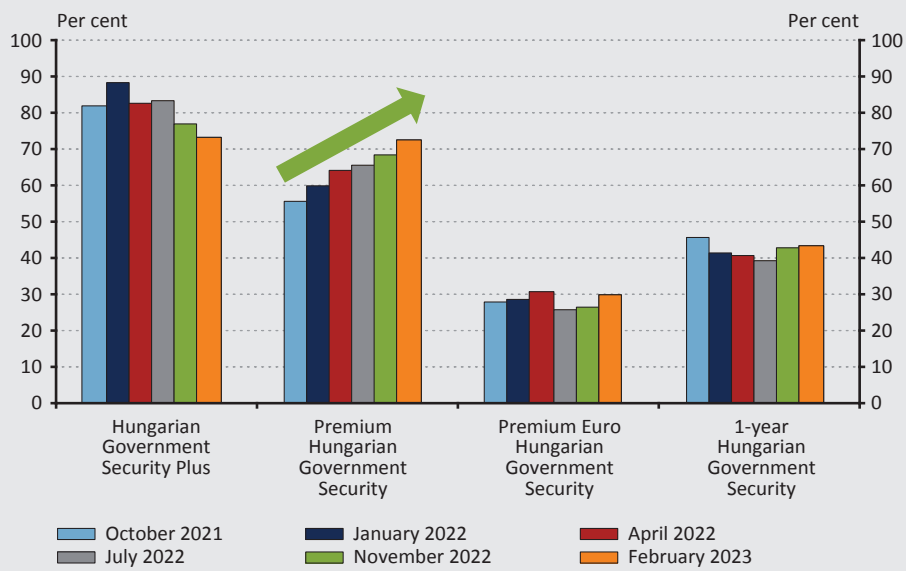
Source: Household wealth survey (MNB)

Investors report that they only buy occasionally, mainly upon maturity of their existing government securities, and the share of those investing regularly in government securities is low and slightly decreasing. However, nearly three quarters of holders do not plan to sell their existing government securities before maturity, and 77 per cent of investors plan to renew their securities at maturity at least partially.

Government security holders appreciate the high interest rates and risk-free nature of this investment the most. Respondents who hold government securities rank the top-rated features of this product group in the survey. In first place was the favourable interest rate, which one half of the respondents considered to be a very important factor. This is closely followed by its risk-free nature: in line with this, the survey shows that those with an average risk appetite are most likely to hold government securities. In third place is the fact that this form of investment is exempt from interest tax. Favourable terms for selling the securities before maturity and easy accessibility are also important, although investors place less emphasis on these than on the features listed above. There are no significant differences in the role of information channels: in addition to advisors, advertising and press releases, recommendations from acquaintances are also important when it comes to buying government securities.

It can also be observed in the results of the surveys so far that the Premium Hungarian Government Security, which provides protection against inflation, has been gradually gaining ground. Familiarity with the product among retail government security holders has been steadily increasing since autumn 2021, and the latest data show that it has even caught up with the Hungarian Government Security Plus: more than 70 per cent of government security holders said they had heard of the Premium Hungarian Government Security (*Figure 6*). At the same time, the general familiarity with government securities remains low among those who have not entered the market: less than one fifth of these respondents have heard of this instrument. At the end of January 2023, a new 7-year series of the Premium Hungarian Government Security was launched in conjunction with the publication of the annual inflation data for 2022, with an initial interest rate of 16 per cent. The majority of survey respondents (35 per cent) had heard about the product through press releases, but it also reached many people through advertising and online banking platforms. One tenth of respondents had learned about the new Premium Hungarian Government Security series on social media.

Figure 6
Familiarity with government security products among government security holders



Source: Household wealth survey (MNB)

However, buying new types of government securities is not the only way for households to adapt to the changing inflationary environment, and thus we assessed which other types of investments have become more popular as a result of higher inflation. Since spring 2022, the share of respondents looking for instruments offering protection against inflation has been gradually increasing. In the latest survey, more than one third of respondents had already invested to protect themselves against inflation, an increase of 16 percentage points compared to spring 2022. The most popular instrument was the Premium Hungarian Government Security, with 18 per cent of respondents buying more of it to hedge against inflation. This also represents a substantial increase compared to one year ago, when the inflation-linked instrument was only ranked in third place behind foreign currency and cash/bank deposit options.

7. Reasons for avoiding the government securities market

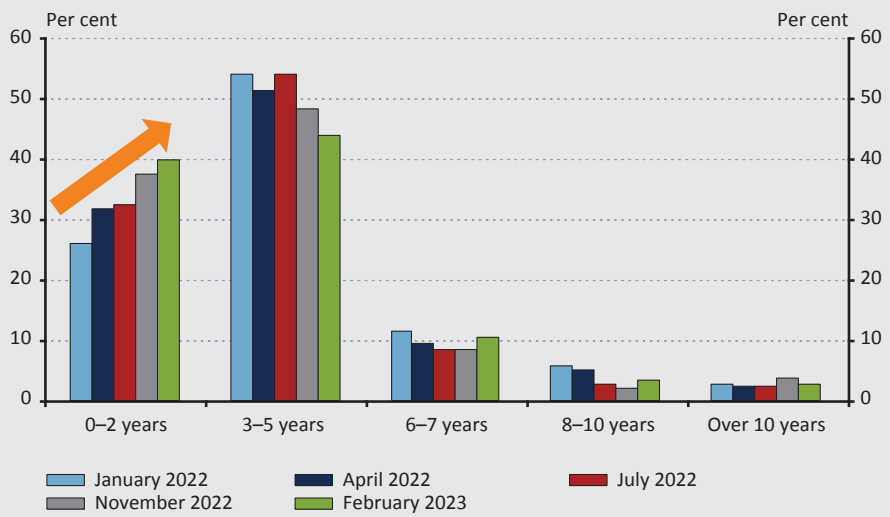
The main reason given by respondents for avoiding the government securities market was a lack of savings, with almost one half of those without government securities not buying for this reason. As seen in *Figure 4*, the HUF 500,000 level may be the threshold for entering the market, as the proportion of government security holders with savings below this level is negligible. However, plenty of people did not buy this form of investment for other reasons. The main disincentives were the perceived low interest rates and the perceived riskiness (the very factors that were considered most attractive to government security holders), but the ranking of these two factors reversed over time. Between 2021 and mid-2022, the main reason for avoiding the market was that potential investors did not find government security yields attractive enough. However, the proportion of investors who considered the yields to be low gradually declined as the yields of certain government security instruments increased.

As a mirror image to this, the perception of the riskiness of government securities is increasingly prominent in the responses. This points to a lack of confidence in government securities. By educational level, more than one third of those with higher education did not buy government securities because of the perceived risk, while the proportion is even higher for those with lower educational attainment. A significant proportion (46 per cent) of respondents who say they do not take any risk in their investments also consider government securities to be risky. This also supports the assumption that some investors are not aware of the true risk rating of government securities. However, it also highlights the importance of other risks associated with the products, such as a lack of confidence in the predictability and long-term foreseeability of the schemes. Other reasons given for not buying were lack of familiarity with the products and difficulties in opening a securities account:

however, according to the responses, these aspects were reported relatively rarely as barriers to purchasing.

The survey posed two questions to understand the motivations of those planning to buy government securities. The first asks what would be the minimum annual interest rate at which the respondent would invest in government securities. Currently, more than 40 per cent of potential buyers are already attracted by double-digit yields, while one quarter of those surveyed would consider entering the market if interest rates were above 15 per cent. For the second question, participants had to answer what would be the longest tenor of government security they would be willing to buy (*Figure 7*). Interest in 8-year and longer instruments is negligible, but one tenth of potential investors are open to 6- to 7-year products. The share of investors looking for short tenor investments (0–2 years) is gradually increasing, while interest in 3- to 5-year instruments is declining in parallel, according to surveys to date. This could be explained by the general uncertainty in 2022 and a strong increase in short-term yields, as evidenced by surging retail demand for short tenor Discount Treasury Bills.

Figure 7
Government security tenor preferences among potential buyers



Source: Household wealth survey (MNB)

8. Conclusion

Overall, the financial portfolio of households has changed significantly over the past year, with the share of government security holdings increasing, mainly due to a reduction in fixed-term deposits and sight deposit holdings. Looking at retail government securities in more detail, we see that the rising inflationary environment has led to a shift towards variable interest rate products. The Premium Hungarian Government Security has become the most popular government security, with its particularly attractive inflation-linked interest rate. In other words, part of the population reacted flexibly to changes in (real) interest rates. The other part of the population, however, does not take advantage of the opportunity offered by higher-yielding government securities, largely because they do not have enough savings; but there is also a segment that is distrustful of government securities.

References

Armantier, O. – Topa, G. – van der Klaauw, W. – Zafar, B. (2017): *An Overview of the Survey of Consumer Expectations*. FRBNY Economic Policy Review, December 2017: 51–72. https://www.newyorkfed.org/medialibrary/media/research/epr/2017/epr_2017_survey-consumer-expectations_armantier.pdf

Bańkowska, K. – Borlescu, A.M. – Charalambakis, E. –Da Silva, A.D. – Di Laurea, D. – Dossche, M. – Georgarakos, D. – Honkkila, J. – Kennedy, N. – Kenny, G. – Kolndrekaj, A. – Meyer, J. – Rusinova, D. – Teppa, F. – Törmälehto, V.M. (2021): *ECB Consumer Expectations Survey: an overview and first evaluation*, ECB Occasional Paper Series, No. 287, December. https://doi.org/10.2139/ssrn.3981218

Gosselin, M.-A. – Khan, M. (2015): *A Survey of Consumer Expectations for Canada*. Bank of Canada Review, Autumn 2015: 14–23. https://www.bankofcanada.ca/wp-content/uploads/2015/11/boc-review-autumn15-gosselin.pdf

HFCS (2020): *The Household Finance and Consumption Survey: Results from the 2017 wave*. Household Finance and Consumption Network, ECB Statistical Papers No 36, March. https://www.ecb.europa.eu/pub/pdf/scpsps/ecb.sps36~0245ed80c7.en.pdf

Krueger, D. – Mitman, K. – Perri, F. (2016): *Macroeconomics and Household Heterogeneity*. In: Taylor, J.B. – Uhlig, H. (eds.): Handbook of Macroeconomics, Vol. 2, North Holland, pp. 843–921. https://doi.org/10.1016/bs.hesmac.2016.04.003

MNB (2022): *What Do We Live From? 2020 - presentation of the first results of Household Finance and Consumption Survey.* Directorate Statistics, Magyar Nemzeti Bank. https://statisztika.mnb.hu/sw/static/file/vagyonfelmeres-2020-web-en.pdf

SCF (2023): *Survey of Consumer Finances*. Board of Governors of the Federal Reserve System. https://www.federalreserve.gov/econres/scfindex.htm. Downloaded: 28 April 2023.

Financing Options for Solar Power Capacity in Hungary*

Nóra Baji-Gál Imréné Szarvas

The past period has highlighted that the more efficient use of renewable energy sources is crucial in terms of sustainability, environmental protection, energy supply security and the national economy. It is essential that efficient financing structures, attracting the full spectrum of financial and capital market resources, are put in place to finance new investments. This article explores the question of what new investments and financial market and capital market funds are needed to support the growth of renewable energy, and discusses new financing structures that support the growth of renewable energy investments.

1. Introduction

Making the greatest possible use of renewable energy is essential for sustainable energy management. This not only helps protect our environment and mitigate the negative impacts of climate change,[1] it also contributes to reducing dependence on imported fuels and enhances security of supply. In addition, the expansion of renewable energy is also good for the national economy, as it creates new investments and jobs.[2]

Recognising the long-term importance of renewable energy, Hungarian energy policy has put a strong emphasis on increasing solar power capacity in particular and has included this in strategic documents: the National Clean Development Strategy,[3] the National Energy and Climate Plan[4] and the National Energy Strategy.[5] Hungarian solar power capacity increased from 349 MW in 2017 to 3,837 MW in 2022 (*Figure 1*) and is expected to grow significantly in the coming years to reach the target of 6,000 MW in 2030, as set out in the National Energy Strategy.

---

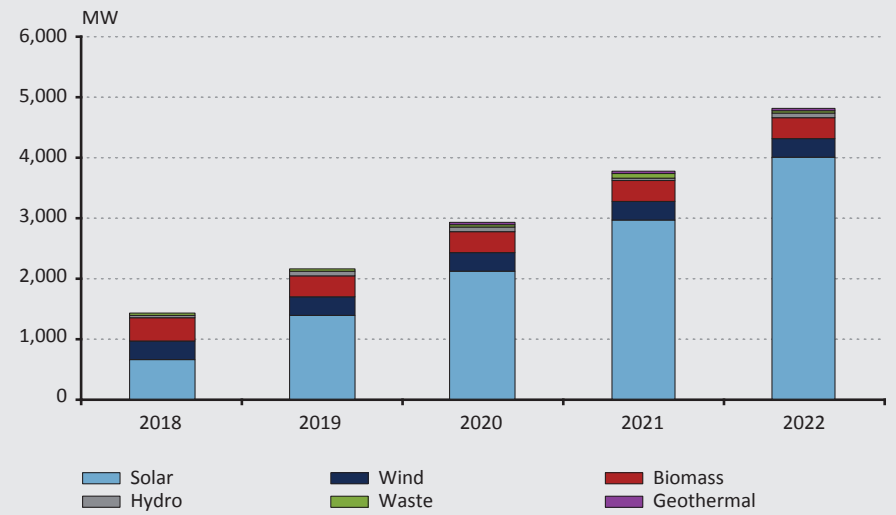
* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Nóra Baji-Gál Imréné Szarvas: Magyar Nemzeti Bank, Advisor. Email: szarvasn@mnb.hu

This technical article follows up on the Solar Energy Forum organised by the Zero Carbon Centre and considers the investment and financing aspects raised at that event (*Zero Carbon Centre 2022*) as well as individual research findings.

[1] *Chen et al.* (*2022*)
[2] *Gielen* (*2019*)
[3] *ITM* (*2020a*)
[4] *ITM* (*2020b*)
[5] *ITM* (*2020b*)

Figure 1
Increase in installed renewable power capacities (MW) in Hungary

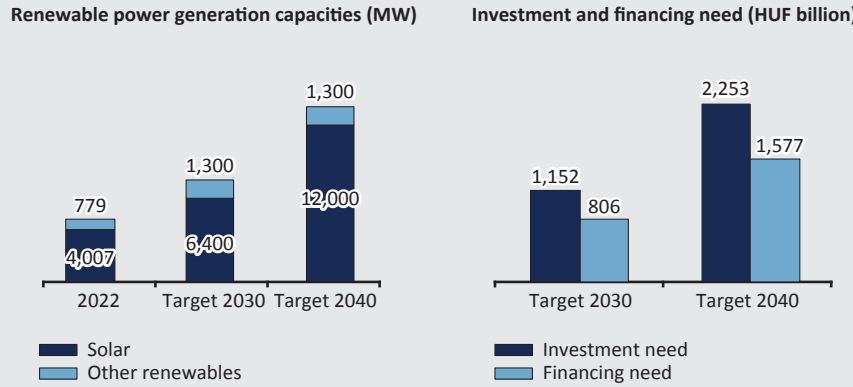


Source: Hungarian Electricity Transmission System Operator Ltd. (MAVIR): Energy MIX - Power generation capacities and PV statistics (31 December 2022) https://www.mavir.hu/documents/10258/245818953/BT_2015-20221231_ig_BR+NT_HU_v2.pdf/8a194c9e-aa9d-14a7-75ad-0290b97afb0b?t=1676311480461. Downloaded: 27 February 2023.

Based on the analysis of *Baji-Gál Imréné Szarvas et al.* (2020), approximately HUF 2,250 billion of new investment will be needed to build the solar power capacity planned for 2040. This represents annual greenfield investments amounting to HUF 112 billion.[6] This could potentially require new PV bank loans of HUF 1,600 billion (*Figure 2*). However, the electricity transmission and distribution system also faces a huge challenge in accommodating such a large volume of weather-dependent generation capacity. In its current state, the system cannot accommodate new capacity or can only do so conditionally, and it is thus necessary to build flexibility reserves and upgrade the network, which may cost up to HUF 500 billion.

[6] 2020. Calculations are based on annual price levels.

Figure 2
Objectives of the National Energy Strategy and the resulting investment and financing need



Source: MNB; Baji-Gál Imréné Szarvas et al. (2020), Figure 1

The total financing needs, estimated at HUF 2,100 billion, would account for nearly 6 per cent of the loan volume of credit institutions and 17 per cent of loans granted to corporates,[7] which exceeds the volume of banks' exposure to the commercial real estate sector in Hungary.[8] The Hungarian banking sector has played a significant role in financing the solar power capacity that has been built so far, but with the changing macroeconomic environment, investors and financers face new challenges. To maintain the momentum in renewable energy investment and green financing, innovative financing solutions need to be developed to meet the challenges.

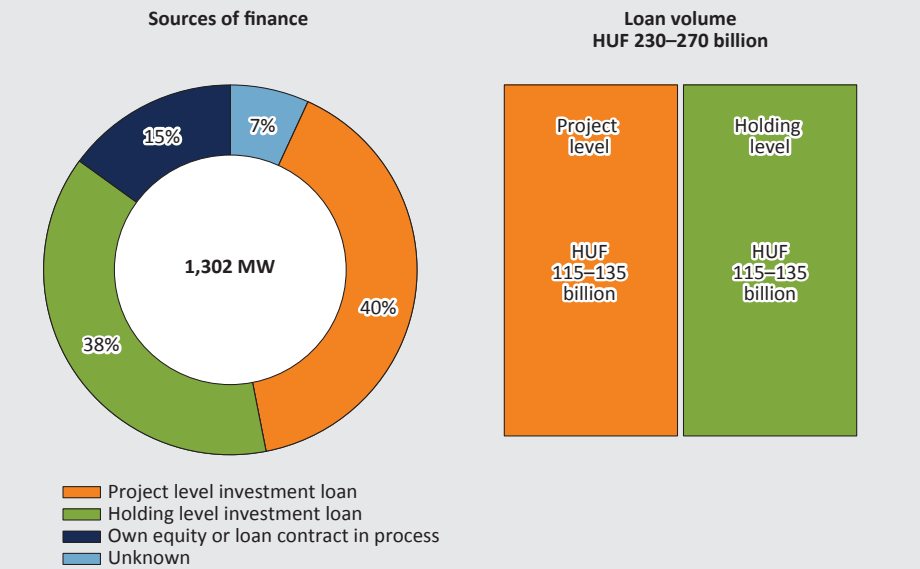
2. Current forms of renewable energy financing in Hungary

2.1. Project finance

According to a 2020 analysis of the Magyar Nemzeti Bank (central bank of Hungary, MNB),[9] renewable energy plants that received a power generation permit in Hungary by 30 September 2019 were predominantly financed through project finance (*Figure 3*). Lending for renewable energy investments was also facilitated by the *Preferential Capital Requirement Programme for Green Corporate and Municipality Financing*[10] announced by the MNB, which is available from 2021 for banks financing sustainable projects.

[7] Source: MNB: Credit institutions sector data at end of 2022 Q3 (December 2022). https://statisztika.mnb.hu/timeseries/data-5203. Downloaded: 25 January 2023.
[8] *MNB* (*2022*)
[9] *Baji-Gál Imréné Szarvas et al.* (*2020*)
[10] https://mnb.hu/letoltes/zold-vallalati-es-onkormanyzati-tokekovetelmeny-kedvezmeny.pdf. Downloaded: 25 April 2023.

Figure 3
Financing sources and outstanding loan amounts for built solar power plants



Source: Baji-Gál Imréné Szarvas et al. (2020), Figure 9

Project finance is an excellent tool for financing innovative and greenfield investments. The advantage for project sponsors is that financing is limited to the project, and thus its risks can be separated from the sponsors' other activities. The project is valued on a stand-alone basis, independently of the parent company's balance sheet, and is therefore suitable for financing growth beyond the size of the owner company and achieving maximum leverage. In addition to the above, the assets of the project company as well as the financing, permits and contracts are exclusively linked to the project company and can be sold together with it. Project finance provides strong lender control over the assets built and the cash flows they generate, limiting the financing risks and thus achieving lower interest rates than other financing structures, which is of paramount importance from a sponsor and return perspective. Last but not least, project loans can be restructured in the case of an unexpected market or other event adversely affecting the project, and financing conditions can be flexibly adapted to cash flow volatilities.

However, a stricter structure is also rigid, which may limit further growth in a mature market. The bureaucratic steps of lender approval may slow down sponsor decisions and the implementation of projects. An example is the distribution of free cash flow generated by the project, which is not only an administrative burden to authorise, but also affects sponsor returns through mandatory cash sweep mechanisms.

In addition to the constraints, the project financing structures currently penetrating the renewable energy market also carry a number of risks, which have been highlighted by recent macroeconomic uncertainties. Exposure to unhedged FX and interest risks may jeopardise project returns, especially in the phase of project development, design and construction, when own equity is spent, project agreements[11] are signed and bank financing is still in process. During this period, investment costs may be strongly affected EUR and USD volatility, while financing costs may be affected by interest rate fluctuations. At a weighted average cost of capital (*WACC*)[12] level at 6–8 per cent, the financing cost may reach one third of the total cost base, which has a fundamental impact on the project return.

2.2. General (plain vanilla) corporate bonds

Issuing bonds is an important financing tool for mature markets. Its main advantage is flexibility: while lenders impose a number of contractual commitments on assets and cash flows, bonds are issued in clean, bullet[13] structure with free use of funds. This is because the debt service of bonds relies on the financial strength of the issuing company, with no restrictions. It also has the advantage of attracting institutional investors, which can be important if bank financing sources are limited. However, the costs of bonds are typically higher. In addition to documentation, review and advisory fees, yields are also higher than lending rates, reflecting the higher risks associated with a looser financing structure.

Bond issuance requires sufficient financial strength of the issuer and is typically only available as an option for mature companies. The disadvantage of bonds is that the commitments cannot be limited to specific projects, so the risks of individual projects and business lines cannot be separated. Another drawback is that the typical 5- to 10-year bond tenor does not perfectly match that of renewable energy projects, which require 15 to 20 years of financing, causing a refinancing need at maturity.

Under the Bonds for Growth Programme announced by the MNB, nine issuers in the energy sector, including five dedicated solar power issuers, have come forward, but a number of issuers in other industries have also used the bond proceeds for installing PV capacities.

[11] Such as technology supply and works contracts.
[12] *Juhász* (*2019*)
[13] Repayment due in one lump sum at maturity.

3. Possible future forms of renewable energy financing

3.1. Green bonds

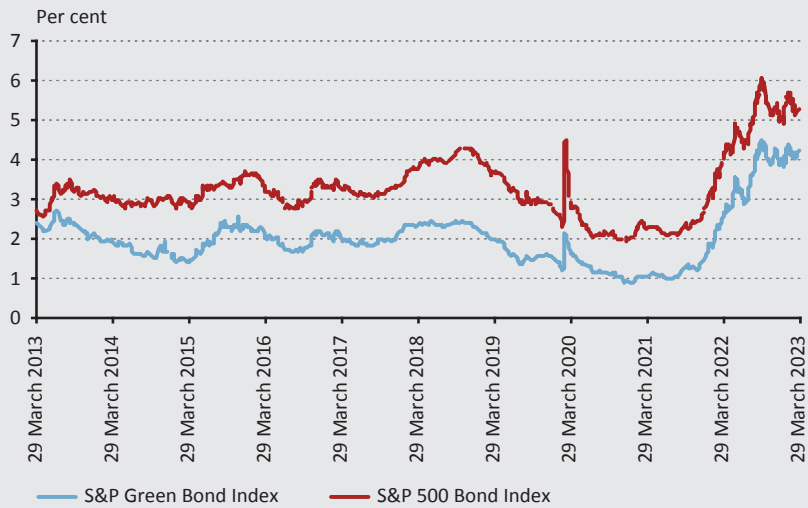
Green bonds are a novel instrument for financing renewable energy. The use of green bond proceeds is linked to sustainable goals, which the issuer ensures are met by publishing a green framework, an allocation report demonstrating the use of proceeds and an impact report presenting the environmental impact of the green projects. The green framework defines the principles, internal processes and levels of responsibilities that govern the selection of green projects and the use and management of proceeds as well as reporting. Further details on the issuance of green bonds can be found in the MNB's *Guide on Issuing Green Bonds* (*Baji-Gál Imréné Szarvas et al. 2022*).

The constraints of green bonds are also their main advantage: they provide more favourable financing for sustainable investments at lower yields; this yield difference is called the greenium. Buyers of green bonds (green bond investors) have a focus on sustainability goals, aiming to increase the proportion of sustainable securities in their portfolio, and they are ready to accept lower yields, for example on green bonds, to achieve this. The motivation for building a sustainable securities portfolio is, for example, the popularity of ESG investments (e.g. investment funds) and compliance with European sustainability regulations[14] for financial institutions. From a project point of view, bond funds are similar to loans, with bond yields representing an expense item corresponding to loan interest. Lower green bond yields provide lower financing costs for renewable power plants, thereby reducing project expenses and boosting profits. The greenium therefore increases the profitability of renewable power plants by reducing their financing expenses, making them more attractive to sponsor companies and promoting the spread of renewable energy.

Figure 4 and *Table 1* illustrate the level of the greenium in international bond markets.

[14] *SFDR Regulation (EU 2019/2088) and EU Implementing Regulation 2022/2453 on Pillar 3 of the CRR Regulation on ESG disclosures.*

Figure 4
Comparison of S&P green bond and traditional bond index yields



Source: S&P

Table 1
Comparison of S&P green bond and traditional bond index yields

	Yield to Maturity (%)		
	24 April 2013	**24 April 2018**	**24 April 2023**
Total Return S&P Green Bond Index	2.24	2.37	4.24
Total Return S&P 500 Bond Index	2.6	3.93	5.31

Source: S&P

The greenium lowers the cost of financing for companies engaged in sustainable activities, reducing the weighted average cost of capital and improves the return on investment in renewable energy power plants.[15]

$$NPV = \sum_{i=0}^{n} \frac{CF_i}{(1+WACC)^i} \qquad 0 = NPV = \sum_{i=0}^{n} CF_i\,(1+IRR)^{-i} \qquad WACC = \frac{D}{(E+D)} r_d + \frac{E}{(E+D)} r_e$$

NPV: net present value
CF: investments' Cash Flow
IRR: internal rate of return
WACC: weighted average cost of capital
n: number of periods

D: financial debt, loans and bonds
r_d: cost of financial debt, credit and bond sources
E: own equity
r_e: cost of equity

[15] *Delapedra-Silva et al. (2022)*

The special documentation of green bonds also entails additional costs: external review is required to verify compliance with international green bond standards and to audit post-issuance reports. It is worth noting, however, that a green framework can be linked to the issuance of more green bonds and even green loans, so the costs can be significantly reduced at the transaction level.

Green bond investments can be reported as sustainable investments based on the European sustainability reporting regulations, and bank investors may benefit from prudential capital relief under the *Preferential Capital Requirement Programme for Green Corporate and Municipality Financing*[16] introduced by the MNB.

3.2. Leasing

In the renewable energy market in Western Europe, there are several examples of power plants being financed through leasing (*Dunlop – Roesch 2016*). The main advantage is that operative leasing does not burden the balance sheet of the sponsor company, and thus financing constraints can be loosened and the debt structure improved. Project development companies may be attracted to a sale-and-lease-back structure, where the sponsor builds the power plant on own equity and sells it to a leasing company after connecting to the grid, and at the same time a lease contract is signed for the power plant. This structure gives the sponsor complete freedom during the construction phase, and then the opportunity for an equity recap, which may be used for the development further projects.

3.3. Covered bonds

Covered bonds can be an innovative way of financing renewable energy projects, combining the advantages of bond issuance and project financing. The primary source of payments for covered bonds are the assets financed and collateralised, thus limiting the risks to a specific project or portfolio (*Damerow et al. 2012*). The collaterals behind the bond reduce bond investor risk, which may have a favourable impact on financing costs, while the presence in the capital markets can also attract funds from institutional investors.

Covered bonds also have their limitations. The maturity does not perfectly match the pay-back period of the assets financed, and accordingly refinancing may be required. Covered bonds also have to meet consistent yield payment requirements, which implies continuous, steady cash flow generation. This can only be achieved through carefully built project portfolios which are diversified both legally and in terms of grid connection date. In the case of bonds, restructuring is very cumbersome, so construction risks are difficult to manage. This problem could be simplified by building a portfolio of power plants, which are already connected and

[16] https://mnb.hu/letoltes/zold-vallalati-es-onkormanyzati-tokekovetelmeny-kedvezmeny.pdf. Downloaded: 25 April 2023.

operating. The remaining pay-back period of these projects is also shorter and more in line with the maturity of bonds, thus reducing refinancing risk.

3.4. Securitisation

In the future, securitisation[17] could open up a new funding opportunity, primarily for financing banks rather than project sponsors. Securitisation is a process in which the loan portfolio of a bank is clustered into maturity- and risk-wise homogenous units, which, together with their assets and cash flows, serve as collateral for the securities issued. This form of financing could also indirectly channel fresh institutional investor funding into the renewable energy market and loosen sector limits on bank financing.

4. Challenges and opportunities of innovative financing products

The development of renewable energy financing requires combining the advantages and overcoming the limitations of the financing structures described above, which is possible through market development and the creation of a supportive legal environment.

4.1. Loans

The bureaucratic burden of bank loans may be reduced by the development of "plain vanilla" solar project loans, offering a simplified loan product with standardised terms and conditions for fit-in-average renewable projects, rather than tailor-made structures. This would speed up the administration time of financing both on the sponsor and the bank side, but is conditional on the preparation of problem-free projects that meet the standards acceptable to banks.

The flexibility of bank lending may be increased by the development of portfolio-based project financing, which, with a sufficient portfolio-building track record, could help diversify lender risk and give the sponsor greater flexibility in the terms and conditions of individual projects (e.g. cash sweep, mandatory reserves).

Recent interest rate fluctuations have highlighted the importance of fixed-interest loan products in project finance. To promote renewable energy production, it is essential to develop fixed-interest loan programmes or financing schemes that mitigate interest rate fluctuations.

[17] Regulation (EU) 2017/2402 of the European Parliament and of the Council of 12 December 2017 laying down a general framework for securitisation and creating a specific framework for simple, transparent and standardised securitisation, and amending Directives 2009/65/EC, 2009/138/EC and 2011/61/EU and Regulations (EC) No 1060/2009 and (EU) No 648/2012: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R2402&from=EN

To reduce the need for subsidies in the renewable energy system, market penetration of PPA-based[18] renewable energy generation[19] is needed, which could be facilitated by shorter-term, partially amortising loans. At the end of the maturity of the PPA contract (e.g. 5 years), the refinancing risk may be managed by concluding a new PPA. This could be a new opportunity, especially for sponsors with a good track record in managing renewable power plants and PPA contracts.

4.2. Bonds

Portfolio-based bond financing can combine the flexibility of bonds with the non-recourse nature of project finance. The issuance of portfolio-based bonds primarily faces legal obstacles.[20] Currently, there is no clear legal regime for the management of bond collaterals (e.g. collateral pool, collateral agent or consignee) and investor representation (e.g. collateral collection or restructuring decisions). The proliferation of project-based or portfolio-based covered bonds would require, first and foremost, the establishment of sufficient legal regulation.

From a business perspective, the issuance of portfolio-based bonds requires diversified, stable project portfolio building, a precondition for which is a stable regulatory environment in the fields of permits, subsidies, taxation, grid connection, settlements and other regulations. Better alignment between bond maturities and the project pay-back period is also needed, as the pay-back period of renewable energy projects is significantly longer than the 5- to 7-year maturity typical in the Hungarian bond market. There are several solutions to this. For example, by building a portfolio consisting exclusively of completed, operational projects, which may also represent a more acceptable bond risk by excluding the construction period. Another solution could be to exempt renewable power plants from paying the Robin Hood tax, which would significantly improve project returns and shorten the financing period of projects. Given that the investment costs of renewable power plants are mainly denominated in EUR and USD, and that free-market energy trading is essentially EUR-based, it may be reasonable to increase the rate of EUR-based bonds in the renewable energy sector, which could reduce the currency and interest rate risks of projects and shorten their pay-back period.

4.3. Leasing

The main obstacle to the financing of renewable power plants via leasing is the management of the leased asset: as an official permit-based activity, the assets cannot be leased on their own, they must be accompanied by ownership of the real estate where the plant is located and the business share of the project company holding the renewable energy production licence, which raises legal issues in the

[18] Power Purchase Agreement
[19] *IRENA* (*2022*)
[20] *Deloitte Legal Göndöcz and Partners* (*2021*)

case of the acquisition of the leasing company. More favourable legislation would facilitate the leasing of renewable power plants and their further construction.

4.4. Securitisation

The use of securitisation would help to raise funds for banks and relieve sector constraints, but it faces legal obstacles and therefore a clear legal framework is needed. Similarly to covered bonds, there is a need to establish regulation and legal practices for collateral management, investor representation and related legal instruments. In addition to the regulation, securitisation could become a preferred form of financing by introducing a bank-based renewable energy securitisation programme to initiate transactions and market development.

5. Conclusion

Solar power is currently mainly financed in a project finance structure, which allows projects to be managed on a stand-alone basis and finances the growth phase of the market and sponsors, but may hinder further growth and does not manage interest rate and currency risks well in the construction phase. Further growth in renewable energy investments could be supported by several innovative forms of financing. Simple, standardised "plain vanilla" solar project loans could improve the predictability and planning of financing, thus speeding up the project preparation phase, especially for medium- or smaller-scale projects. Secured bonds could attract capital market funding to finance a portfolio of power plants. This would require appropriate legislation, a stable regulatory environment and grid connectivity. Programmes to manage the foreign exchange and interest rate risks associated with renewable power plant projects (e.g. loan guarantee schemes or fixed interest rate financing sources) would reduce sponsor and financer risks, improve project returns and help maintain financer and sponsor appetite. The renewable energy market could then develop further, subsidy requirements could be reduced, and renewable energy technologies could move further towards the desired grid parity.[21]

[21] Grid parity: power generation that is cost-competitive with the cost of producing the energy mix running on the electricity grid.

References

Baji-Gál Imréné Szarvas, N. – Gyura, G. – Papp, D. – Jókuthy, L. (2020): *A hazai megújulóenergia-termelés finanszírozása* (*Financing the Hungarian renewable energy production*). Magyar Nemzeti Bank. https://mnb.hu/letoltes/20210121-hazai-megujulo-energiatermeles-finanszirozasa.pdf. Downloaded: 25 January 2023.

Baji-Gál Imréné Szarvas, N. – Trenka-Horváth, K. – Bécsi, A. – Tapaszti, A. – Windisch, K. – Elek, F.A. (2022): *Zöld kötvény kibocsátási útmutató* (*Guide for green bond issuances*). Magyar Nemzeti Bank. https://www.mnb.hu/letoltes/mnb-zold-kotveny-utmutato.pdf. Downloaded: 25 January 2023.

Chen, C. – Pinar, M. – Stengos, T. (2022): *Renewable energy and CO_2 emissions: New evidence with the panel threshold model*. Renewable Energy, 194(July): 117–128. https://doi.org/10.1016/j.renene.2022.05.095

Damerow, F. – Kidney, S. – Clenaghan, S. (2012): *How covered bond markets can be adapted for renewable energy finance and how this could catalyse innovation in low-carbon capital markets.* Discussion Paper, Climate Bonds Initiative. http://www.ecosystemservices.co.uk/_docs/Climate%20Bonds%20RE%20covered%20bonds%2022May2012%20(published).pdf. Downloaded: 25 January 2023.

Delapedra-Silva, V. – Ferreira, P. – Cunha, J. – Kimura, H. (2022): *Methods for Financial Assessment of Renewable Energy Projects: A Review*. Processes, 10(2): 184. https://doi.org/10.3390/pr10020184

Deloitte Legal Göndöcz and Partners (2021): *Designing recommendations for a sustainable capital markets strategy and action plan for Hungary.*

Dunlop, S. – Roesch, A. (2016): *EU-wide solar PV business models: guidelines for implementation.* EU Implementation Guideline. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5ad6c9db5&appId=PPGMS. Downloaded: 25 January 2023

Gielen, D. – Boshell, F. – Saygin, D. – Bazilian, M.D. – Wagner, N. – Gorini, R. (2019): *The role of renewable energy in the global energy transformation*. Energy Strategy Reviews, 24(April): 38–50. https://doi.org/10.1016/j.esr.2019.01.006

IRENA (2022): *RE-organising power systems for the transition.* International Renewable Energy Agency, Abu Dhabi. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jun/IRENA_Organising_Power_Systems_2022.pdf?rev=9c979df4adda4fe19cce18ab02f86e9c. Downloaded: 25 January 2023

ITM (2020a): *Nemzeti Tiszta Fejlődés Stratégia 2020-2050* (*National Clean Development Strategy 2020–2050*). Innovációs és Technológiai Minisztérium (Ministry for Innovation and Technology). https://cdn.kormany.hu/uploads/document/5/54/54e/54e01bf45e08607b21906196f75d836de9d6cc47.pdf. Downloaded: 25 January 2023.

ITM (2020b): *Nemzeti Energia- és Klímaterv és Nemzeti Energiastratégia 2030 kitekintéssel 2040-ig* (*National Energy and Climate Plan and National Energy Strategy 2030, with Outlook to 2040*). Innovációs és Technológiai Minisztérium (Ministry for Innovation and Technology). https://www.enhat.mekh.hu/strategiak. Downloaded: 25 January 2023.

Juhász, P. (2019): *A súlyozott átlagos tőkeköltség alkalmazásának kihívásai* (*Challenges in applying the weighted average cost of capital*). Közgazdasági Szemle (Economic Review), 67(July–August): 805–823. http://dx.doi.org/10.18414/KSZ.2019.7-8.805

MNB (2022): *Commercial Real Estate Market Report, 2022 October*. Magyar Nemzeti Bank. https://www.mnb.hu/letoltes/commercial-real-estate-market-report-october-2022.pdf. Downloaded: 25 January 2023.

Zéró Karbon Központ (2022): *Policy Brief.* Policy paper based on MNB – ZKK Solar Energy Forum III. https://zerocarbonhub.hu/wp-content/uploads/2021/09/ZKK_halozati_csatlakozas_Policy-Paper-2022_04.pdf. Downloaded: 25 January 2023.

The Art of Ageing*

Imre Semsei

Dmitry Kaminskiy – Margaretta Colangelo:
Longevity Industry 1.0: Defining the Biggest and Most Complex Industry in Human History
Deep Knowledge Group, 2020, p. 449.
ISBN: 978-1916391710
Hungarian translation:
A Hosszúélet-ipar 1.0 – A legnagyobb és legkomplexebb iparág az emberiség történetében
Pallas Athéné Könyvkiadó, 2023, p. 402.
ISBN: 978-963-573-096-4

We all know that doing and not doing something are two different things. And the same holds true for doing something and doing something *right.* When someone excels in something, that is an art. And the same is true for ageing. Everyone would like to live a long, healthy life, but only few people *want* this: there is also a distinction here. *Longevity Industry 1.0: Defining the Biggest and Most Complex Industry in Human History* by *Dmitry Kaminskiy* and *Margaretta Colangelo* helps people in the latter group in finding the opportunities they can use to slow down ageing and stay healthy throughout their lives.

During my entire career in gerontology, what vexed me the most was the lack of a *complete, comprehensive overview* of research into ageing. Everyone got lost in the details, dealing with their own narrow discipline, with barely any thought for gerontology as a whole. Even I was only focused on research and theoretical gerontology, and had very little overview of the other fields in ageing. This only changed when I had to teach gerontology at the university, because I could hardly start teaching without knowing the various areas myself.

I can safely say that *Longevity Industry 1.0* is the book I was waiting for, as it summarises everything there is to know about ageing, and I was very glad that I was asked to be the book's technical editor. Of course, this is only Version 1.0, but it already outlines the correct approach to ageing and living a long life. The authors

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Imre Semsei: University of Debrecen, Pro-Dean, Academic Advisor. Email: semsei.imre@etk.unideb.hu

describe their ideas and broad results in four parts, presenting everything there is to know about ageing today, such as:

I. Longevity Mega-Complexity: Challenges, Issues, Opportunities

II. Longevity Policy and Governance

III. Longevity Financial Industry

IV. Longevity Industry (Science, Technology & Biomedicine)

The first part talks about the immensely complex issue of ageing. The authors argue that it is "the biggest and most complex industry in human history", and I am inclined to agree. This is because researching gerontology is not enough in itself, the results should also be applied, and this topic has to be addressed in its full complexity rather than from a single aspect. The authors attempt to do exactly this, although they are not gerontologists themselves: Kaminskiy is an investor, while Colangelo is an expert in technological innovation. But one does not have to be a gerontologist to see that merely studying ageing will not be enough for practical implementation. The two authors founded the *"Deep Knowledge Group"* (https://www.dkv.global/), where ageing is examined in its full complexity in the spirit of the motto: *"Knowledge is Power, Deep Knowledge is Transcendent Power*".

They realised that an intricate issue can only be understood in its complexity, and the results of gerontology can only be applied in practice with an elaborate approach. Managing complexity requires the use of artificial intelligence (AI), the results of gerontology (Longevity), biotechnology (BioTech), pharmaceuticals research (Pharma), the financial technology (FinTech), space technology (SpaceTech), the differences between genders (FemTech), the available knowledge has to be processed (data science), and last but not least a field can only develop fully and flourish when accompanied by the appropriate investments (InvestTech).

The second part describes other technologies, such as GovTech and social implementation "technologies". National and intergovernmental initiatives as well as independent and municipal programmes are also discussed. Readers also learn about the top-performing countries in these technologies, as well as their ideas and strategies regarding the longevity industry. For example, the Swiss "Longevity Valley" is presented (by way of analogy with the Silicon Valley), along with the achievements of the UK and the US in the longevity industry. The authors suspect that in the future the governments that will be able to remain in power will be those that recognise the importance of the longevity industry, making it their top priority in their national agendas.

Part III discusses in detail the financial aspects of the longevity industry in particular. Like every sector, the financial sector has to identify the tremendous opportunities

offered by the longevity industry. The book describes the emerging financial trends and new financial systems that have, among other things, adapted to the needs of the elderly, the number of whom continues to increase, along with their economic weight. To ensure that a healthy, long life is coupled with prosperity, the rise of financing institutions focusing on longevity (e.g. banks, pension funds, health funds) is required, and in fact, vital. This chapter also talks about several existing examples, which could be applied by other nations, too.

Part IV is about the longevity industry itself, along with the science (gerontology) and various technologies, such as precision medicine, and the experts in the discipline are also presented by contributing professionals. One needs to give credit to the authors who have realised that the scientific topics need to be discussed by professionals. Readers also get a glimpse of the results of gerontology and receive tips for living a long life. The differences between the two genders in terms of ageing are also mentioned, as this is a factor that must be taken into account. It is understood that summarising, processing and understanding this vast amount of knowledge requires "superhuman" skills. I also found during my research that this discipline and the results were so complex and diverse that I was unable to review and integrate every result. However, this is now facilitated by the increasingly "smart" artificial intelligence (AI), which can analyse data, explore trends and make findings that may otherwise remain unidentified during research. It comes as no surprise that artificial intelligence can "spot" things that may be overlooked by humans. It is therefore crucial to use AI in researching ageing and in the longevity industry, without it we would be in the dark for a long time. The importance of artificial intelligence is illustrated by the fact that certain corporate boards already have a "spot" reserved for AI, which may even have veto rights during decision-making.

All in all, this is a much-needed book that fills a long-standing void. Studying this book would be vital for almost everyone who wishes to live a long, healthy life. At the same time, it is particularly useful for people in finance in preparing for the inevitable changes. Gerontologist will also find it a real treat, and we can hardly wait for the next instalment in the series: *Longevity Industry 2.0 – DeepTech Engineering the Accelerated Trajectory of Human Longevity: The Blueprint and Pathway from Longevity Industry 1.0 to 2.0.* We are getting closer to treating ageing as an art.

Report on the "New Age of Central Banking in Emerging Markets" Conference*

Ádám Kerényi

The Corvinus University of Budapest, the Bank for International Settlements (BIS) and the London School of Economics and Political Science (LSE) organised an international conference entitled "New Age of Central Banking in Emerging Markets". Held on 17 March 2023, the event was supported by the Magyar Nemzeti Bank (the central bank of Hungary, MNB) and provided a forum for high-level decision-makers and leading global financial experts to discuss the most topical issues in today's central bank tasks: fighting inflation and promoting central bank digital currencies (CBDCs).

The motivation of the conference was to analyse the emerging market institutions, which used to lag behind those in advanced economies. From a historical perspective, however, catching up was already occurring before the pandemic, particularly in the area of central banking. In the aftermath of the pandemic, central banks in major emerging markets responded faster and more aggressively to signs of emerging inflation than their peers in advanced economies. Their timely reaction may have prevented higher inflation and larger capital outflows. The issues discussed included the following: (i) Are emerging market monetary policy frameworks better equipped to react to inflationary pressures? (ii) What roles have institutional development and governance in emerging markets played over the past two decades? (iii) Has policy tightening yielded clear gains for early-starter emerging markets? (iv) To what extent have systemic central banks, such as the Federal Reserve and the European Central Bank, helped emerging market counterparts with currency swaps and repos? (v) Is there currently a risk of global "over-tightening" by central banks around the world, in reaction to global inflationary pressures? And can – or should — central banks cooperate better to avoid such risk?

According to the premise of the conference, emerging markets have undergone changes that point in the direction of being much better able to cope with economic policy and economic shocks. However, central bank interest rate increases have an impact on financial stability, and thus it is necessary to examine how much the economy and the financial system can handle without serious damage, as well as

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Ádám Kerényi: Research Centre for Economics and Regional Studies, Research Fellow.
E-mail: kerenyi.adam@krtk.hu

what the central budget balance (higher interest expenditure) and the real economy (excessively falling demand should not turn into recession) can take. Participants at the conference were in absolute agreement that as long as inflation remains high, tight monetary conditions must be maintained as the only way to bring inflation down.

The Honorary doctorate award ceremony

A ceremony granting an honorary doctorate to *Dr Agustín Carstens* was organised on the margins of the event. The *Doctor Honoris Causa* award recognised Carstens's post-academic career in policy institutions and international financial organisations. Carstens began his career in 1980 at the Bank of Mexico. From 1999 to 2000, he was Executive Director at the IMF. He later served as Mexico's deputy finance minister (2000–2003) and as Deputy Managing Director of the IMF (2003–2006). He was Mexico's finance minister from 2006 to 2009. Carstens has been a member of the Financial Stability Board since 2010 and is a member of the Group of Thirty. He became General Manager of the Bank of International Settlements on 1 December 2017, was Governor of the Bank of Mexico from 2010 to 2017 and was a member of the BIS Board from 2011 to 2017. He was chair of the Global Economy Meeting and the Economic Consultative Committee from 2013 until 2017. He also chaired the International Monetary and Financial Committee, the International Monetary Fund's (IMF) policy advisory committee from 2015 to 2017.

Luiz Pereira, Deputy General Manager of the Bank for International Settlements, sent a video message expressing his views on the well-deserved recognition honouring Carstens' influence, especially the importance of good policy and academic work. In the ceremony, the title was conferred on Carstens by *Előd Takáts*, Rector of Corvinus University of Budapest, who worked at the BIS in Basel from 2009 to 2021 where he took part in Basel III development.

Carstens' acceptance speech had two parts. In the first part, he claimed that a virtuous circle must be created between the theory, research and implementation of economic policies. The virtuous cycle starts with the high-level conceptualisation of policies. It then moves to formalisation – determining the details of how policies can be applied to the real world. The next stage is implementation, as policies are actually put into practice. This is followed by monitoring, to make sure that policies operate as they should, and evaluation, to determine if they have achieved their intended objectives. As a final stage, based on the evaluation, policies must be adapted, which may in turn initiate a new stage of conceptualisation and design.[1] According to Carstens, close interaction between theory and practice should

[1] See in more detail: https://www.bis.org/speeches/sp230320a.htm

be sought at each stage. Economic theory can, and in many cases has been, an inspiration for public policies. Economic science cannot advance without learning from public policies that have been implemented, because in some circumstances, practice advances faster than theory.

The second part of *Carstens*'s acceptance speech featured two practical, real world examples. The first example concerned inflation, which had re-emerged in the past year as the most significant macroeconomic challenge facing central banks. In 2020–2021, most central banks expected that the Covid pandemic would add to the forces keeping inflation low. In 2022, inflation had risen but was expected to be transitory. According to Carstens, there is clearly much that we still do not know about inflation. Researchers have been working hard to fill the gaps. Central banks must act decisively to bring inflation down. In this way, policy is moving ahead of theory, teaching lessons about the inflationary process, and monetary policy transmission in a high-debt environment. The second example concerned innovation in money and payments systems. BigTechs have enlarged their footprint in the financial system, particularly in the sphere of payments. Central banks must provide money that meets public needs and expectations. If they do not, then other, less trusted, institutions will step in to meet that demand. According to Carstens, central banks are aware of the challenge, as they are already experimenting with CBDCs. He emphasised that this did not mean that central banks want to get rid of cash. Central banks should be ready, in a given case, to meet markets' demand for a digital representation of money.

Morning panel: Central banks fighting inflation in advanced and emerging markets

The session was chaired by *Andrés Velasco*, Dean of the School of Public Policy at the London School of Economics and Political Science**,** who was the Minister of Finance of Chile between 2006 and 2010. The title of the presentation by *Christopher Erceg*, Deputy Director of the Monetary and Capital Markets Department at the IMF, was "*Battling High Inflation*". The Covid crisis hit the global economy hard and necessitated an unprecedented policy response. The global economy contracted sharply in 2020, with output falling 3 per cent below the 2019 level and activity in consumer-oriented services suffering particularly large declines. In addition to public health measures, policymakers responded aggressively and creatively to cushion the blow to the real economy, notably by easing fiscal policy and monetary policy (see more *Chen et al. 2022*). According to Erceg, there was little historical precedent for "winning a battle" against inflation so easily, and the financial markets appear too optimistic about the likelihood of bringing down inflation quickly. Upside risks were intensified by strong labour markets in many countries. The high inflation over the past two years increases the risk of de-anchoring in response to further

adverse cost shocks. Focusing on inflation reduction, he mentioned three urgent topics: (i) appropriate central bank risk management strategy, (ii) financial stability risks, and (iii) the potential contribution of other policies (such as fiscal). Central banks' risk management strategy should take account of the risk that inflation may be much more persistent than in recent history. There is a need to push towards a more aggressive policy response to inflation pressures. However, providing liquidity support while tightening could lead to confusion between monetary and financial stability objectives. An optimal output-inflation trade-off means restraining output more today if a rise in inflation is expected to last longer. Central banks may counter financial stresses via liquidity support, which may include asset purchases (sovereign, corporate) and lending to a broad set of counterparties. According to Erceg, fiscal policy can be helpful in assisting monetary policy: with more fiscal consolidation, interest rates do not have to rise as sharply, which might also add to reducing financial stability risks and may contribute to debt sustainability. In the final part of the presentation, Erceg emphasised that energy subsidies to cushion the real effects of energy shocks and reduce headline inflation may appear attractive, but have many downsides, because the energy subsidy policy may reduce incentive to conserve energy and/or expand aggregate demand and may be counterproductive by boosting core inflation. Although fiscal dominance would make the task of reining in inflation more costly, it is crucial to maintain strong and independent central banks, according to the Deputy Director of the IMF's Monetary and Capital Markets Department.

Ricardo Reis, A.W. Phillips Professor of Economics, London School of Economics and Political Science, presented a contribution entitled "*What can keep inflation high?*" In his view, economic policy is always a balancing act. Independent and mandate-oriented central banks are capable of achieving the inflation targets very soon by implementing high interest rates, but they should not to do so because of extra-monetary policy reasons. *Reis* compared the following potential dominant factors on central banks: (i) misjudgement, (ii) expectations, (iii) fiscal, (iv) financial, and (v) fear of recession. The dominance is *misjudgement*, when a central bank uses outdated theories or measurements of the economy, finding excuses for why inflation was rising. A central bank is dominated by *expectations* when expected inflation is persistently high and the central bank does not talk and act tough enough to reestablish its credibility and reputation. A central bank is *fiscally* dominated when it does not bring inflation under control because it fears damaging the government's budget. It is the fiscal authority that dominates, forcing the central bank to not harm its fiscal position. The central bank is *financially* dominated when it resists bringing inflation down because it fears damaging parts of the financial system in the process. The financial sector dominates the central bank, forcing it not to risk a financial crisis. The central bank is dominated by the *fear of a recession* if it persistently raises policy rates too little or too late because it is concerned about

the depth of the ensuing recession. In response to Reis's speech in the Q&A session Carstens commented that central banks before Covid were afraid of low inflation and expectations were difficult to manage, he also mentioned that he preferred the terms strength or autonomy instead of dominance. Carstens claimed that autonomy is much bigger than independence.

Egon Zakrajšek – a native of Slovenia – joined the BIS in 2019 after nearly 25 years with the US Federal Reserve System. In his presentation[2] "*The two-regime view of inflation*", he introduced an alternative view of the inflation process, which might provide insights that will help central bankers tackle the inflationary challenges they face today and prevent their re-emergence in the future. The presentation outlined the two-regime view of inflation. This view characterises the inflation process as two regimes – a low- and a high-inflation regime – with self-reinforcing transitions from the low- to the high-inflation one. The two regimes tend to become entrenched unless severely tested. However, while inflation tends to be self-stabilising in the low-inflation regime, it is especially sensitive to relative price increases in the high-inflation regime. The presented alternative view of the inflation process[3] highlighted how the behaviour of inflation is quite different at low and high levels. According to Zakrajšek, the empirical evidence indicates that inflation behaves very differently in the two regimes. When inflation has settled at a low level, measured inflation mostly reflects sector-specific price changes that are only loosely correlated with each other. Thus, the component of price changes that is common across different goods and services is small. Those price changes tend to leave only a temporary imprint on the inflation rate itself. Equally important, wages and prices, which are at the very core of the inflation process, are only loosely linked with each other. As a result, inflation tends to be self-stabilising. By contrast, a high-inflation regime has no such properties. The importance of the common component of price changes is much greater, wages and prices are more tightly linked, and inflation is especially sensitive to changes in salient prices, such as those of food and energy, as well as to fluctuations in the exchange rate. Thus, while in a high-inflation regime the inflation rate is not self-stabilising, the regime itself is self-entrenching, just like its low-inflation counterpart. This view of inflation has significant implications for monetary policy. First, it suggests that it would be desirable to conduct monetary policy flexibly in low inflation regimes, tolerating moderate, even if persistent, deviations from narrowly defined targets. Second, it highlights the importance of being pre-emptive when the risk of a transition to the high-inflation regime

[2] The presentation was based on the following paper: *Borio et al*. *2023*.

[3] *Zakrajšek* made no attempt to construct a formal model. The theoretical framework was based on a joint modelling of the dynamics of prices over time using a very general Bayesian VAR (vector auto regression). The modelling strategy most suited is the cointegrating model, which posits that the variables in the model are tied together by a long-run relationship such that any deviations from the long-run relationship are stationary. In turn, the short-run dynamics are constructed such that the changes in the variables depend on each other and also on their distance from the long-run relationship – the so-called error-correction mechanism. Zakrajšek mentioned that statistical analysis should be deepened and broadened further.

increases, although assessing this risk in real time remains challenging. Central banks' response to the recent inflation flare-up can be seen partly in this light. Although slow to realise the strength of the underlying inflation surge, in part as a result of limitations of prevailing models and forecasting tools, central banks were then forceful in raising the pace of policy tightening.

Zsolt Kuti, Executive Director responsible for Monetary Policy, Financial Analysis and Statistics at the MNB, a Popovics Awardee, delivered a speech entitled "*Central banks fighting inflation in advanced and emerging markets – the case of Hungary*". According to Kuti, the track record of Hungarian monetary policy was successful because in 44 out of 48 months between 2017 and 2020 domestic inflation remained within the MNB's tolerance band. To fight against inflation, the MNB was the first in the European Union to begin the cycle of interest rate hikes. Kuti noted that the effective interest rate had risen by more than 17 percentage points in Hungary. Compared to the regional countries, annual average inflation in 2022 was moderately higher in Hungary, because of higher food and fuel price inflation, which explain most of the excess inflation in Hungary compared to regional peers. Yet according to the presented data, the structure of inflation has been changing recently, and domestic factors have started to dominate inflation developments in Hungary. In response to these challenges, the MNB had strengthened monetary transmission using various instruments in the past half year. Domestic inflation was expected to reach the single-digit range at the end of the year.

The afternoon panel – Central Bank & Innovation: the CBDC

The session was chaired by *Piroska Nagy-Mohácsi*, Visiting Professor at the LSE and previously Policy Director at the European Bank for Reconstruction and Development (EBRD) and co-creator of the Vienna Initiative. She emphasised that cryptocurrencies were a huge technological innovation that had created entirely new forms of money and made financial transactions and payments more secure.

Priscilla Koo Wilkens, Senior Economist, Innovation and Digital Economy at the BIS and previously head of the Pix Management Division at the Central Bank of Brazil, gave a presentation entitled "*Central banks & innovation: The CBDC*". She explained that Brazil's recent experience with the Pix retail instant payment system illustrates the potential gains. In a little over one year since its launch in November 2020, Pix has signed up 67% of adults in Brazil, with free payments between individuals and low charges for merchants. In December 2022, the average transactions number per day was 93 million. The two key ingredients in the success of Pix are: 1) the mandatory participation of large banks to kick-start network effects for users, and 2) the central bank's dual role as infrastructure provider and rule setter (see *Duarte et al.* 2022). Wilkens claimed that the role of the regulator is twofold: (i) from

a technology perspective it is a platform operator, while (ii) from a governance perspective it is a rule setter. She also mentioned the important role of the private sector.

As Chief Digital Officer and Executive Director at the MNB, *Anikó Szombati* is responsible for (i) increasing the efficiency and stability of the financial system via fostering digital transformation, (ii) supporting the domestic FinTech ecosystem, and (iii) fostering digitalisation within the central bank and analysing opportunities in CBDCs. In her presentation "*The MNB's approach to financial innovation and to CBDC*", she introduced the MNB's pilot projects, which may provide an opportunity for testing within a secure framework. The MNB's first retail CBDC was the *Digital Student Safe* pilot project. This was launched in September 2020 with a dual purpose: (i) to support digital financial inclusion of students; and (ii) to gain hands-on experience on a potential operational model of a future CBDC system (see *Fáykiss et al*. *2022*). Based on its success, further expansion is also being considered in the form of Digital Student Safe 2.0 to raise financial awareness among families and younger generations. The MNB also launched blockchain testing via the so called "*Money Museum Digital coin register*" application, which was released in 2022 with two main functionalities: (i) a new channel for displaying useful content related to the Money Museum and finances in order to enhance the interactive museum experience; and (ii) an innovative opportunity to test blockchain based technology as the MNB had created a dedicated platform for NFT issuance and digital coin registration. The third way is wholesale CBDC testing with domestic and international projects (e.g. the MNB has observer status in Project Dunbar).

Andrei Kirilenko is a professor of Finance at the Cambridge Judge Business School, the Founding Director of the Cambridge Centre for Finance, Technology and Regulation, and a Research Fellow in the Asset Pricing/Financial Economics Programme of the Centre for Economic Policy Research (CEPR). Prior to joining Cambridge, he served as chief economist of the US Commodity Futures Trading Commission (CFTC) where he contributed to designing and enforcing an effective regulatory regime for financial markets in the aftermath of the global financial crisis. The title of his presentation was "*A Primer on CBDCs*". According to Kirilenko, CBDCs are digitally-native bearer instruments that can be used to pay for any good, service or financial asset in one transaction. Their technological advantage is being digitally-native, i.e. they are created and used in a technologically efficient and secure digital form. Their economic advantage is access to a central bank-regulated payment system. Kirilenko explained the history from Bitcoin to Ethereum to Libra/Diem to CBDC, while he also shared the results of a 2021 BIS Survey (*Kosse – Mattei 2022*), which proved that most central banks were exploring CBDCs, and more than one quarter of them are now developing or running specific pilots. Finally, he showed

pilot projects from the United Kingdom, the United States of America and China (for these case studies, see *Müller – Kerényi 2022*).

Radován Jelasity has been the Chairman and CEO of Erste Bank Hungary since 2011 as well as President of the Hungarian Banking Association since 2020. He was previously Governor of the National Bank of Serbia. Jelasity emphasised the role of the trust and safety if the money is introduced and issued by the central banks, but he also mentioned the traditional banking system reflecting financial inclusion and promotion alternatives and competition. There is a *growing need for a digital safe asset*. A central bank could be a provider, but there should be an ecosystem, not just one player. By way of analogy, this is like soccer: somebody should be the referee, but the referee should not be omnipotent in the game. Jelasity mentioned that CBDCs could have an impact on monetary policy as well. Sovereignty will remain an important issue even in the digital sphere. He made reference to a paper published by the US Fed, which highlighted the US dollar's role as global key currency, which may continue in the CBDC competition era as well.

Closing remarks

In his closing remarks, Rector *Előd Takáts* expressed his hopes to welcome the distinguished guests again on the occasion of next year's conference to continue the collaboration between policymakers and academia. He noted that the main takeaway was that the inflation would remain and central banks should focus on that challenge. In an exchange of views at the conference on the emergence of global inflation and the fight against it, according to Takáts, the participants underlined the need for determined, strict monetary policy. This is because monetary tightening is reducing demand, easing upward pressure on prices in the economy and moderating price increases. Takáts highlighted the autonomy of the central banks, which should be safeguarded, especially in emerging economies. The future is open to change, but new technologies face challenges. He emphasised that CBDCs will emerge, but this technology is associated with risks. Modern IT has a Janus face, and while ChatGPT can write an essay at the university, this is not necessarily in the best interests of the students.

References

Borio, C. – Lombardi, M. – Yetman, J. – Zakrajšek, E. (2023): *The two-regime view of inflation*. BIS Papers No 133, March. Downloaded https://www.bis.org/publ/bppdf/bispap133.pdf

Chen, J. – Espinoza, R.A. – Goncalves, C. – Gudmundsson, T. – Hengge, M. – Jakab, Z. – Lindé, J. (2022): *Effective Fiscal-Monetary Interactions in Severe Recessions*. IMF Working Papers, Volume 2022: Issue 170. https://doi.org/10.5089/9798400218880.001

Duarte, A. – Frost, J. – Gambacorta, L. – Wilkens, P.K. – Shin, H.S. (2022*): Central banks, the monetary system and public payment infrastructures: lessons from Brazil's Pix*. BIS Bulletin. No 52, March. https://www.bis.org/publ/bisbull52.htm

Fáykiss, P. – Nyikes, Á. – Szombati, A. (2022): *CBDC – an opportunity to support digital financial inclusion: Digital Student Safe in Hungary*. https://www.bis.org/publ/bppdf/bispap123_i.pdf

Kosse, A. – Mattei, I. (2022): *Gaining momentum – Results of the 2021 BIS survey on central bank digital currencies*. BIS Papers No 125, May. https://www.bis.org/publ/bppdf/bispap125.htm

Müller, J. – Kerényi, Á. (2022): *The Rise of Central Bank Digital Currencies*. Financial and Economic Review, 21(3): 122–148. https://doi.org/10.33893/FER.21.3.122

Report on the 13th Annual Financial Market Liquidity Conference*

Erzsébet Teréz Varga – Ágnes Vidovics-Dancs

On 10–11 November 2022, Corvinus University of Budapest (CUB) hosted the 13th edition of the Annual Financial Market Liquidity Conference (AFML),[1] one of Hungary's most important international financial conferences. As in previous years, the conference was jointly organised by the CUB Institute of Finance and the Momentum Game Theory Research Group of the Centre for Economic and Regional Studies. In addition to the Foundation of the Department of Finance as the gold sponsor, KELER CCP, Morgan Stanley and OTP Bank acted as silver sponsors. In 2022, the conference was held in a hybrid format for the second time, allowing around 130 registered participants to take part online, while the majority were on campus in person. The AFML conference offers a unique opportunity to refresh and further develop the research network of participants from around the world, many of whom are regular speakers and attendees of this conference, providing an interactive atmosphere.

Both days of the conference started with plenary presentations, followed by parallel sessions focusing on different topics, and the first day also ended with a plenary presentation. The first day's parallel sessions covered the following topics: Market and Funding Liquidity; Banking and Counterparty Risk; Asset Management; Banking, Disasters and Systemic Risk; and Environment, Social and Governance (ESG). The topics in the parallel sessions on the second day were: Liquidity and Derivative Markets; Banking and Credit Risk; Market Quality; Empirical Asset Pricing; and Market Microstructure. For the parallel sessions, the scientific committee accepted 40 longer (30 minutes) and 15 shorter (15 minutes) talks. In addition, there were three keynote presentations, and invited experts also gave five presentations. Almost two thirds of the speakers came from abroad.

At the opening plenary session, the first presentation was given by *Darrell Duffie*, Professor at Stanford University Graduate School of Business, who addressed

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Erzsébet Teréz Varga: Corvinus University of Budapest, Assistant Professor.
E-mail: erzsebet.varga@uni-corvinus.hu
Ágnes Vidovics-Dancs: Corvinus University of Budapest, Associate Professor.
E-mail: agnes.dancs@uni-corvinus.hu

[1] https://www.uni-corvinus.hu/contents/uploads/2022/11/AFML_book_of_abstracts_final3.804.pdf

the liquidity of US Treasury securities and other government bond markets. As a motivation, he recalled that in March 2020, after the World Health Organization (WHO) declared Covid a global pandemic, all liquidity measures dropped dramatically in these markets. The problem was so serious that we had to admit that these markets had become dysfunctional. But how was it possible that the world's most liquid market, the US Treasury market, had become dysfunctional? Duffie mentioned several possible reasons, including the market structure and regulatory issues. One important feature was a difference between demand and supply developments. The outstanding Treasury amounts had been growing continuously. However, the amount of balance sheet space available in terms of total assets of the largest dealers had declined due to regulatory changes after the great financial crisis. An efficient supply-demand equilibrium can be obtained on a day of normal liquidity. However, this equilibrium cannot be achieved on a dash-for-cash day, because the quantity exceeds the amount the dealers' balance sheets can absorb. After the WHO's declaration, the Fed purchased vast amounts of Treasuries, but this might not have been an optimal solution, since it raised the question of moral hazard and might have raised tensions with monetary policy actions. The talk proposed several policies for improving the stability and capacity of government bond markets. For example, central clearing would eliminate daisy-chains in the Treasury bond market. Furthermore, the leverage ratio rule of banks could be revised without jeopardising the sector's stability. Making price information available to the public could increase the transparency and efficiency of these markets. Finally, central banks should distinguish quantitative easing purchasing (i.e. monetary policy) from market-function purchase programmes.

The afternoon sessions of the first day featured two invited speakers. *Thomas Walker*, Professor at Concordia University, joined the session on Banking, Disasters and Systemic Risk online. He presented a joint paper with *Yixin Xu*, *Dieter Gramlich* and *Yunfei Zhao*. Using a sample of 187 large-scale natural disasters in the United States between 2000 and 2014 and a sample of 2,891 banks, they examined whether and how disaster damage affects various indicators of bank profitability and solvency. Distinguishing between different types of banks (local, regional and national), a breakdown of their deposits at the state level was used to examine how these banks respond to damage, weighted by the GDP of the states in which they operate. They found that natural disasters have a pronounced effect on the net-income-to-assets and the net-income-to-equity ratio of banks, as well as on their impaired loans and return on average assets. A significant impact was also observed on the equity and tier-1 capital ratios (two solvency ratios). Interestingly, the latter was positive for regional banks, which appear to benefit from increased customer deposits related to safekeeping, government payments for post-disaster recovery, insurance payouts and decreased withdrawals. At the same time, disasters have a significant negative impact for banks that operate locally or nationally.

Rose Liao, from Rutgers University, also joined online for a Thursday afternoon session focusing on ESG.[2] She presented a joint contribution with *Xiaoxue Hu* and *Dongxu Li*, examining how multinational companies may propagate ESG practices through subsidiaries in foreign countries with stricter ESG policies. Using regulatory changes in a foreign country's ESG strictness as an exogenous shock, they find that multinational firms with subsidiaries in countries with stricter ESG policies significantly increased their R&D investments, created more green inventions in domestic operations and had higher ESG ratings. Cities with more multinationals exposed to foreign ESG regulatory changes experience a larger reduction in air pollutant emissions. Their results are consistent with the argument that multinationals promote and propagate ESG practices across countries, which phenomenon is likely to sustain access to finance in a foreign country with high ESG standards.

As in the previous year, the evening plenary session started with a presentation by *Yakov Amihud*, Professor at the Stern School of Business at New York University, who has more than 42,000 Google Scholar citations. He gave an online presentation on his study with *Viral V. Acharya*, *Heitor Almeida* and *Ping Liu*. The research covers the evaluation of corporate financial policies, mergers and acquisitions, initial public offerings, objectives of corporate mergers, and dividend policy. He discussed the corporate choice between operational hedging (such as avoiding a failure to deliver on obligations to customers) and financial hedging and explained how this relates to liquidity. It is important to note that financial hedging here refers to corporate liquidity in terms of cash, as opposed to capital market liquidity, which refers to facilitating the trading of securities. A firm with higher default risk, reflected in higher credit spreads, spends less on operational hedging. Thus, there is competition for liquidity between averting financial risk or operational risk. According to their results, there is a positive relationship between the operational spread (markup) of the firm and its financial leverage; and also between the markup and the credit spread. The latter relationship is stronger for financially constrained firms. He presented empirical evidence supporting the relationship by employing two proxies for operational hedging, namely inventory and supply chain diversification, exploiting recessions and the global financial crisis as exogenous correlated shocks to operational and credit risks.

Similarly to last year's conference, the second day started with a presentation by *Jonathan Batten*, Professor of Finance at RMIT University in Australia. He called attention to a recent Nature editorial which argued that the topic of UN Social Development Goals (SDGs) was still not a priority research area in developed economies. Batten gave an overview of the key trends in financial markets over the last few years. These issues are discussed and analysed widely. However,

[2] Environmental, Social and Governance

he emphasised the need to reposition this research with broader implications, including the SDGs. The number of published papers mentioning the SDGs is increasing rapidly, but the share of economics, econometrics and finance is still very low. An illustrative case study of recent research trends on green bonds provided an example of how problematic the identification, the methods and the data can be in these novel fields. His presentation concluded by listing some SDG-related topics in finance that might, and hopefully will, motivate researchers to address.

The opening presentation in the plenary session was followed online by the final keynote speaker, *Mariassunta Giannetti*, Professor of Finance at the Stockholm School of Economics. She presented her research with *Nickolay Gantchev* and *Rachel Li*, which focused on the trade-off between sustainability and performance. She noted that investors often considered sustainability an indicator of good future performance. The Morningstar sustainability ratings (also called globe ratings) were used to analyse this aspect. Earlier studies had also found that funds with the highest globe ratings attracted an increased capital flow after the introduction of these ratings. Consequently, asset managers increased the proportion of sustainable equities in their portfolios to achieve a higher rating, which resulted in decreasing returns in this sector. This is the point where the trade-off between sustainability and performance becomes salient. Since, in the long run, performance seems to be more relevant for investors, asset managers' incentive to improve their globe rating diminished. As Professor Giannetti concluded, sustainability ratings might become irrelevant in investment decisions.

The plenary session was also followed by three parallel sessions on Friday. The Banking and Credit Risk session in the morning included two invited speakers. The first speaker was *Igor Lončarski*, Associate Professor of Finance at the University of Ljubljana, who presented his work with *Ursula Slapnik* using text-based evidence from credit rating reports. Looking at the literature on the determinants of sovereign ratings, these can be divided into two components. There is a part of the rating that quantitative data cannot explain. Is this a kind of bias because these ratings are given by people or rating committees? Or is it basically soft information that quantitative data from other sources cannot capture? Earlier research indicated that these biases manifest in two directions: developed or advanced economies are positively biased in terms of credit ratings, while developing economies are penalised and negatively biased. Two of the most important contributions of Lončarski's analysis to the financial literature are the methodology, textual sentiment analysis (this has been applied to credit ratings before, but not at the sovereign level) and a better understanding of the determinants of sovereign ratings. Data were collected from all three rating agencies, Moody's, S&P and Fitch. Using an ordered logit with random effects for 35 developed and 63 emerging countries ranging from investment to speculative ratings over the period 1996–2018, evidence

was found that the subjectivity score provides additional information that was not captured by previously identified determinants of sovereign ratings, even after controlling for political risk, institutional strength and potential biases. The results of the bivariate and multivariate analyses confirm the differences in textual sentiment and subjectivity between emerging and advanced economies, before and after the 2008 global financial crisis.

The next invited speaker for the Banking and Credit Risk session was *Alexander Szimayer*, Professor of Finance at the University of Hamburg, who also chaired the session. He presented a joint working paper with *Antje Berndt* and *Mick Schaefer*. In Szimayer's opinion, crises always bring something positive since they teach us how to avoid something similar happening again. From the government's point of view, one temporary forced solution to bank failures is to bail out the banks in trouble in order to preserve the stability of the financial system. Another option is early intervention, leading to a more resilient financial system. Of course, the measures must also be acceptable to the public, and thus the costs associated with the actions must be controlled, possibly limited or minimised in some sense. The 'too big to fail' principle would lead to the wrong incentives. The fundamental aim of the research is to find a solution to bank failure, not just with a bailout, but basically with early intervention. The key question is the appropriate policy for an early intervention system. The authors proposed a dynamic structural model for valuing bank debt and equity that allows for the possibility of government intervention both before and in the case of insolvency. They derive closed-form solutions for the optimal insolvency threshold level of bank assets and characterise the intervention scheme that minimises the cost to the government associated with potential pre-insolvency capital injections and bailouts at insolvency. Certain regulatory requirements, such as the capital ratio, must always remain above a given level. What happens if this is breached? Then early intervention can kick in and restrictions can be imposed: dividend payments can be reduced or even suspended. The authors documented that early intervention schemes, especially those requiring cost sharing between existing shareholders and the government, can lower the government's cost of bailing out an insolvent bank. Their model is basically suitable for characterising specific variants of intervention systems. The next step is to determine the optimal intervention system in which there is a balance between cost and benefit.

The 14th Annual Financial Market Liquidity Conference will be held on 9 and 10 November 2023 (http://afml.uni-corvinus.hu). This year, the Corvinus University of Budapest will host the conference offline only. The conference brings together financial professionals from around the world in Budapest, providing an exceptional opportunity to present and discuss research, generate and develop new ideas and solutions.

INSTRUCTION FOR AUTHORS

Manuscripts should be submitted in accordance with the following rules:

- The length of the manuscripts should be limited to 40,000 characters (including spaces) but a ± 50 per cent deviation is accepted. Manuscripts should be written in Hungarian and/or English.
- The unnumbered footnote of the author's name contains his/her position, the institution the author works at, his/her email address and any other relevant information and acknowledgment regarding the article.
- Papers always begin with an abstract which should not exceed 800–1,000 characters. In the abstract a brief summary is to be given in which the main hypotheses and points are highlighted.
- Journal of Economic Literature (JEL) classification numbers and keywords should be given (three at least).
- Manuscripts should be written in clear, concise and grammatically correct Hungarian and/or English. Chapters and subchapters should be bold.
- Manuscripts should contain the list of references with the first and surname of the authors (in case of non-Hungarians the initials of the first name is required), the year of publication, the exact title of the book, the publisher, the place of publication. In case of papers, the exact title of the journal, the year, the volume, and the pages should be indicated. References in the text should contain the surname and the year. When citing the exact page should be indicated.
- Tables and figures are to be numbered continuously (chapters and subchapters should not contain restarted the numbering). Every table and figure should have a title and the units of quantitative values are to be indicated. Tables are to be made in Word, while figures must be edited in Excel. Notes and sources are to be put directly at the bottom of the tables, figures.
- Equations should be aligned to the right and should be numbered continuously in parenthesis. (Chapters and subchapters should not contain restarted the numbering.)
- Manuscripts are to be sent to the Editorial Office of the FER only. Papers are peer-reviewed by two independent and anonymous reviewers.
- Manuscripts should be sent as attachment by email in MS Word file. Figures should be sent in MS Excel file both in Hungarian and English.
- In case of further questions related to the manuscript visit the following website: *https://en-hitelintezetiszemle.mnb.hu/authors-guide*

Thank you!

The Editorial Office of the Financial and Economic Review
H-1013 Budapest, Krisztina körút 55.
Phone: +36-1-428-2600
E-mail: szemle@hitelintezetiszemle.hu

Financial and Economic Review