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The Systemic Risks and Regulation of BigTech – "Too Big(Tech) to Fail?"*

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When it comes to systemically important financial institutions, people usually think of banks, insurers or financial holding companies, but large technology firms (so-called BigTech) are increasingly part of this category. This paper examines regulatory approaches with which the systemic importance of BigTech firms in financial services could be addressed. According to the analysis, of the three regulatory frameworks identified in the literature ("restriction", "segregation", "inclusion"), when a balanced approach is used, the segregation of financial and non-financial activities seems to be the most promising regulatory solution, as this model works best for taking account of the practical aspects of operation, regulation and supervision.

1. Introduction

When it comes to systemically important financial institutions, people usually think of banks, insurers or financial holding companies, but recent developments have increasingly pushed large technology firms (so-called BigTech) into this category. Technological innovation has brought about various new challenges in the past decade. Besides new products, services and access channels, new players have also appeared, and so-called FinTech and BigTech firms are more and more active in the financial services market (see *Arner et al. 2016; FSB 2017; Fáykiss et al. 2018; Frost et al. 2019*).

Although the literature does not offer a single, widely accepted definition of FinTech (financial technology) services, in the interpretation of the Financial Stability Board (FSB),[1] FinTech solutions can include any technologically enabled innovation in financial services that could result in new business models, services or products with an associated significant effect on financial markets and institutions and the provision of financial services. FinTech firms are becoming increasingly important in the financial system, but from a policy perspective their case is somewhat different from BigTechs. Their customer base is currently much smaller than that of BigTechs, although it is expanding dynamically, along with their activities. On the other hand, the FinTech/neobank players with retail customers typically conduct their financial service activities in some kind of regulated framework within the EU (for example as e-money issuers or credit institutions), and thus if their activities become systemically important, the currently existing regulatory framework for other systemically important institutions (O-SIIs) would also be applicable to them.[2] Finally, it should also be noted that they currently rarely provide services to financial institutions related to some major technology infrastructure. Accordingly, this study mainly focuses on the systemic risks arising in financial services related to BigTech firms, and the systemic risk issues that may emerge in connection with FinTechs are not discussed in detail. Of course, from a regulatory perspective, if these businesses wish to provide financial services, they must comply with the applicable financial regulations, irrespective of whether they are FinTech or BigTech. If they do not offer financial services, their operation should be regulated by the rest of the legislative environment.

BigTech firms can be systemically important for various reasons. First, they are almost impossible to ignore in connection with their non-financial services: their huge customer base and database on user activities can give them a major competitive edge due to network effects. Moreover, BigTechs are increasingly active in offering technological services to financial institutions (e.g. cloud services, payment technology solutions), which can increase financial stability risks in the financial infrastructure. Finally, they also provide financial services or some kind of service directly related to finance or by incorporating the services of other financial institutions into their value chain, which can also raise the issue of systemic importance (see *ESMA 2020; Crisanto et al. 2021; Müller – Kerényi 2021; Ehrentraud et al. 2022*). It is important to note in the latter case that if they provide such services directly, the subsidiary offering the services in question is of course subject

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[1] http://www.fsb.org/wp-content/uploads/R270617.pdf
[2] To paint a somewhat more nuanced picture, unlike credit institutions, e-money issuers are currently not subject to O-SII regulations and are not assessed for systemic importance. This is basically because the current regulatory framework and the established supervisory practice both consider the potential systemic risks arising from their operation to be much lower than in the case of credit institutions, because the range of services they can provide is highly limited; for example, they cannot collect deposits and may only extend credit under very strict conditions (therefore, liquidity and credit risk are not applicable in their case).

to the financial regulatory requirements and thus also, after reaching a specific size and complexity, the regulatory provisions on systemic risk.

Another important factor when it comes to the regulation of BigTech firms is that these institutions operate in complex structures, with a complicated ownership and governance system both in an institutional and a geographical sense. If a BigTech group has a subsidiary offering financial services, the group obviously has the necessary operating licence in the given country, but it only applies to that individual member firm, and there are typically no comprehensive regulatory requirements for the whole group, as the main activities of the group are usually outside financial services (*Frost et al. 2019; Ehrentraud et al. 2022*). This is often further complicated if these institutions provide financial services that do not require a licence, such as technological solutions related to payment services, solutions related to cryptoassets or even lending in some countries (for more details, see *EC 2021* or *EBA 2022*).

Most countries have no comprehensive, dedicated requirements in relation to the technology services that BigTech firms provide to financial institutions, and thus one might wonder whether the systemic risks are managed appropriately. Although critical services are subject to some indirect requirements (e.g. managing operational risk), both comprehensive and service-specific requirements are rare in these cases (but in connection with service-specific requirements one should mention the Hungarian[3] and EU[4] recommendations on cloud services or, in a winder context, the EU DMA regulation[5] and the DORA[6] regulation that entered into force on 16 January 2023 and becomes applicable from 17 January 2025, even though the latter will apply to financial services and not specifically to BigTech firms, similar to earlier practices). In connection with market-distorting practices, requirements can be identified that can pertain to technology services provided to financial institutions (e.g. in competition law), but this is still not a comprehensive regulation related to the systemic importance of BigTechs. As no comprehensive systemic risk requirements can be identified on a national, EU or global level that would apply to whole BigTech groups, the current framework is unable to address the major systemic risk factors, such as the interaction between financial and non-financial services as well as the related group-wide interdependencies (*ESMA 2020*; *Adrian 2021; Ehrentraud et al. 2022*).

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[3] https://www.mnb.hu/letoltes/4-2019-felho.pdf
[4] https://www.eba.europa.eu/regulation-and-policy/internal-governance/recommendations-on-outsourcing-to-cloud-service-providers
[5] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32022R1925
[6] https://www.consilium.europa.eu/en/press/press-releases/2022/11/28/digital-finance-council-adopts-digital-operational-resilience-act/

In the following, a brief overview is presented of the basic activities of BigTech firms in the financial services market. The analysis then turns to the interpretation of systemic importance in the case of BigTech and the areas where it can appear. After presenting the possible channels for systemic importance, the discussion focuses on potential regulatory approaches that are emerging in connection with BigTech firms active in financial services, mostly based on *Ehrentraud et al.* (*2022*), and the related advantages and disadvantages are summarised. In the final section, the authors draw the conclusions.

2. BigTech in the financial services market

Similar to FinTech, BigTech still has no single, widely accepted definition in the literature. In short, BigTech basically refers to large technology companies with huge customer networks (*FSB 2019*). According to a more detailed definition, BigTech means large technology conglomerates with extensive customer networks and core businesses in social media, telecommunications, internet search and e-commerce (*Adrian 2021*). Based on this, five technology corporations, the so-called Big Five, are usually identified as BigTech, namely Apple, Amazon, Google (Alphabet), Facebook (Meta) and Microsoft (for more information on the significant spread of these firms, see *Figure 1*). However, as in many other areas of the economy and business, emerging Asian companies such as Alibaba, Tencent and Baidu are also increasingly claiming their place on these lists. Interestingly, there are typically no European BigTech firms. A detailed discussion of the underlying reasons behind this is beyond the scope of the present paper, but the lack of strong technological and geographical concentration, the absence of a completely uniform market in many cases, linguistic heterogeneity and the underdeveloped venture capital ecosystem may all be part of the absence of a European technology player with a truly global reach. The European Innovation Council (EIC) launched the "EIC Scale-Up 100" initiative partly to encourage European technology firms to become global, and the main goal is to create genuine tech "champions" in the EU.[7]

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[7] https://eic.ec.europa.eu/news/european-innovation-council-launches-scale-100-call-2022-05-16_en

Figure 1
Acquisitions by the "Big Five"

Note: Acquisitions of USD 1 billion or more until 2020.
Source: CB Insights (2021)
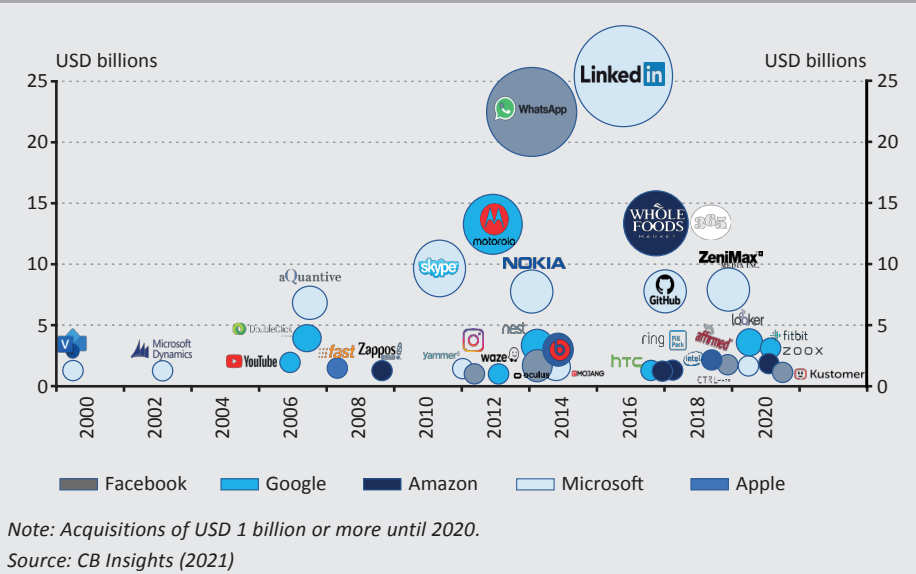
BigTechs operate in a fundamentally different manner than earlier corporations. To understand this, one needs to dig deeper and examine what makes BigTechs special and what the "BigTech DNA" consists of. According to *BIS* (*2019*), the BigTech business model has three key factors ("DNA"): (i) **d**ata analytics, (ii) **n**etwork externalities, and (iii) interwoven **a**ctivities. Network externalities attract more and more users to the platform, which leads to more and more data, and by analysing that data the platform can offer better and more services, which in turn leads to stronger network effects, further increasing the number of users.

Many new products, services, access channels and players have appeared in financial services, thanks to digitalisation and new technological solutions. In this context, BigTech players have increasingly started to provide solutions related to financial services. Novel solutions first appeared in relation to payment services: one need only think of Amazon Pay launched in 2007 or Google Wallet (currently Google Pay) that went live in 2011 or Apple Pay from 2014. This later grew into a wider range of services, now encompassing not only payment services but also retail and corporate lending and cryptoasset services.[8] It should be noted that not all of these services are provided directly by the BigTech groups, as they often offer them

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[8] For a few relevant BigTech activities from recent years, see, for example, *Ehrentraud et al.* (*2022*).

through a third party, for example a bank (e.g. lending, bank card issuance). There are two major types of BigTech payment platforms. BigTechs may operate a system built on an existing external infrastructure (e.g. the platform of card companies). This is used by Apple Pay and Google Pay. In the second case, the transactions and settlements are conducted within the BigTech company's own system, such as in the case of Alipay (see *BIS 2019*). Even though BigTech firms often compete with banks, they still rely on them (directly in the first case mentioned, and when the payments go in and out of the system in the second case).

Interestingly, the rise of BigTech in finance may reverse a process launched with the appearance and growing popularity of FinTechs (*Adrian 2021*). In contrast to traditional banking, FinTech services typically focus on a small section of financial services, and this has started to unbundle financial services. In practice, this means that users do not turn to a single service provider (e.g. a commercial bank) for all of the financial services they use, but rather to several providers (e.g. FinTech firms) for different services. However, the entry of BigTech firms to the financial market may rebundle these services by allowing users to access and use more and more financial services within the BigTech ecosystem.

The current financial regulatory framework is not really suitable for managing the potential systemic risks related to BigTech, as there is no all-encompassing and dedicated regulation of large technology corporations when it comes to financial and infrastructure services. Of course, if they provide financial services directly, the financial regulations apply to them as well, but this cannot address the externalities arising from their network structure. Due to this regulatory problem, one recent idea is to move regulation away from focusing on institutions and sectors and towards an activity-based approach (see *ESMA 2020; Restoy 2021; Borio et al. 2022*). However, activity-based regulation is usually less comprehensive than the current framework covering financial institutions, which would be more effective from a financial stability perspective (e.g. restricting activities at the institution level, strict corporate governance requirements, potential dividend payment limits). Moreover, activity-based regulation would fail to address the main issue, namely that due to the special business model of BigTech firms, financial and non-financial services are often interconnected (*Ehrentraud et al. 2022*). Even if a BigTech company's financial service complies with activity-based regulation, the requirements are not applicable to the whole corporate family, and so this in itself does not create a level playing field for incumbent players and BigTech companies. There are promising initiatives in competition law (see *Crisanto et al. 2021*), but financial regulation does not address the systemic importance of technology giants in a manner consistent with their structural complexity.

Another difficulty related to activity-based regulation is that it is often hard to distinguish activities in the rapidly changing world of finance; one need only mention the difficulty when attempting to give a detailed definition of certain FinTech services. The job of regulators is further complicated by the fact that BigTechs typically provide cross-border services, creating an opportunity for regulatory arbitrage, in other words for exploiting the regulatory shortcomings and the differences in various jurisdictions (e.g. relocating certain services to a more favourable jurisdiction, tax issues, data protection and storage requirements). From a systemic risk perspective, this could lead to the build-up of cross-border systemic risks. This may necessitate the international harmonisation of regulations, which could significantly reduce such risks (*Adrian 2021*).

Due to the shortcomings of activity-based regulation, the IMF believes that a hybrid regulatory framework should be established, blending an activity-based system with an institution- or entity-based regulatory approach (*Adrian 2021*). This would create a regulatory framework with an entity-based core, but the requirements that institutions would need to meet would be activity-based. The activity-based requirements would be mixed with supervision at the institution level, allowing the risks building up at the corporate group level to be monitored and the business model to be understood by regulators (in connection with the hybrid regulatory framework of BigTechs, see, for example, *MNB 2022*).

3. Systemic risks and BigTech

The operation of tech giants may pose serious challenges for regulatory authorities. Their functions and special business model may give rise to risks in relation to competition law, privacy, consumer protection and financial stability (*BIS 2019*). In the context of financial services, the potential systemic importance of these institutions is high, both at the global and the regional level, as the current framework cannot manage these institutions in a manner consistent with their size and complexity. The financial stability risks arising from the operation of BigTechs are partly due to the huge amounts of data they handle, the interconnection between financial and non-financial services, the resulting network effects and the often unique technological solutions they offer.

Based on the relevant literature, there are two direct and two somewhat indirect interconnection channels related to the systemic importance of tech giants in the financial sector (see, for example, *BIS 2019; Borio et al. 2022; Ehrentraud et al. 2022*):

- *Directly provided financial services*: BigTech firms often provide financial services directly, usually through a subsidiary or a joint venture established with a financial institution. Transparency is reduced considerably because in the latter case responsibilities are difficult to distinguish, as these financial services are often provided embedded into value chains and customer processes, so the BigTech company itself is only responsible for a smaller section of the value chain in question. In connection with such services, dependence on other member firms of the BigTech group may cause operational risk, in terms of data management and storage and technology. Financial services established through this channel may be considered systemically important, simply due to the huge user base of BigTech firms[9] (e.g. their role in the financial system, difficult substitutability).

- *Provision of technology services to financial institutions*: Financial institutions often make strong use of BigTech technology infrastructure services, especially cloud services. The provision of such services creates a significant cybersecurity exposure for BigTech companies, and when the risks are realised it can create major privacy and reputation risks for financial institutions if they store their data at these firms. Another problem is that there are relatively few tech companies that offer these services at a suitable scale, and this increases concentration risk in this critical infrastructure. Finally, a further exposure is created if financial institutions run not only a subsystem but also their accounting system in this technology infrastructure. The systemic risk dimensions arising from this large concentration may be slightly reduced by hybrid solutions (a mix of so-called on-premise and cloud services), but these technology services always entail a level of systemic importance that should be addressed from a policy perspective. This is because most countries currently lack a comprehensive, dedicated regulatory framework for such services.

- *Risk of market concentration due to the interconnection between financial and non-financial services provided to users*: In order to exploit network effects, tech giants provide more and more services to more and more users, and the resulting data is used for cross-selling. While a BigTech company provides financial services, it can use the data collected from its non-financial services along with the related technology infrastructure, which could give it a competitive edge and distort market competition (see, for example, *Padilla – de la Mano 2019; Ehrentraud et al. 2022*). This could be relevant not only from a competition law perspective, but also from a systemic risk aspect, as high market concentration

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[9] It should be noted here that BigTechs' asset tokenisation and stablecoin solutions may entail major risks in relation to financial stability, consumer protection, privacy, money laundering or even monetary policy and monetary sovereignty, if only because of the potential size of their customer base (see, for example, the Libra (Diem) initiative by Facebook (currently Meta)).

could produce systemically important institutions. It should be noted that this risk mostly captures the interconnection of financial and non-financial services, and it should mainly be treated separately from the risk channel in the first point.

• *Concentration risks arising due to the interconnection between financial services and technology infrastructure services:* As noted above, BigTechs are increasingly active in providing technology services to financial institutions. However, this could be systemically important not only because these firms operate a critical technology infrastructure (e.g. cloud services, payment technology solutions) for financial institutions, but also because these players offer their own financial services (see the first point above); thus, they are suppliers and competitors to the financial institutions at the same time. Moreover, cloud services may entail further problems, as the customer databases of the financial institutions concerned may be stored on the servers of the BigTech firm, even though they compete in certain financial services.[10] This interconnection may entail major risks, which should be addressed in a future regulatory framework. The risks are further heightened by the fact that certain BigTech companies have considerable market dominance on the supplier side in finance. For example, in cloud services, Amazon and Microsoft have a market share of over 50 per cent, and two thirds of the market is covered by the top five players (*Statista 2022*).

4. Potential regulatory approaches for technology corporations active in financial services

As shown above, there are several major, systemic risk factors related to large technology companies in the current regulatory framework, mostly due to their special operating model. However, any new, dedicated financial regulation framework focusing on tech giants may include several potential regulatory shortcomings arising from technological progress. First, it is often not straightforward which services are considered financial services and which are non-financial (this differentiation can sometimes be difficult due to technological solutions and their integration into the value chains). Many other affected areas may also be relevant during the establishment of the basic regulatory principles and the specific regulations (e.g. data protection, consumer protection, competition law), and the interactions among these areas should also be addressed. Moreover, the organisational structure of BigTech groups is also highly complex, so managing institutional and corporate governance issues may be challenging for regulation and

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[10] It is worth mentioning that the cooperation between financial institutions and BigTech firms also includes situations where financial institutions provide financial services to or through a BigTech company. In such a scenario, the financial player partly creates its own competition.

monitoring as well. Finally, these institutions are global players, and they need to comply with numerous different local and regional provisions, which also increases the complexity of regulation.

In a paper addressing a longstanding problem, *Ehrentraud et al.* (*2022*) describe three main potential models for modifying the existing regulatory framework for tech giants which are active in financial services and for managing the identified shortcomings. The following sections build on this classification.

4.1. "Restriction"

In this approach, the principle of a "clear profile" would be applied, in the sense that institutions active in financial services would not be able to pursue certain other commercial activities. This is fairly strict, especially compared to the prevailing regulatory environment, but it is not completely unheard of: several countries have introduced legislation to prevent financial institutions from engaging in certain activities (e.g. those related to gambling).

Although the restrictive model promises relatively simple and quick implementation, and its introduction would practically prevent BigTech firms from engaging in financial activities and ultimately eliminate the above-mentioned financial stability risks, it would "throw the baby out with the bathwater": an outright ban may cause undesired disadvantages, for example a significant reduction in service diversity in the long run, or even the hampering of future innovation in the sector. The authors of the present paper believe that due to these disadvantages, regulation based on the restrictive model should be avoided.

4.2. "Segregation"

The segregation model would transform the internal group structure of BigTech companies to segregate financial and other commercial activities, so that the institution providing financial services is appropriately separated in its operation from the other entities in the group engaged in other commercial activities. For example, the Glass–Steagall Act that took effect in 1933 contained a similar requirement related to the separation of investment and commercial banking activities,[11] and comparable regulation has been outlined in China for financial holding corporations, which also applies to BigTech firms in certain cases.

The model assumes a financial entity or subgroup (a holding company of subsidiaries performing financial activities) separated from the other members of the BigTech group in a legal sense as well. This entity can provide financial services by complying with the regulatory provisions pertaining to it, or to the subgroup at the consolidated level, while ensuring that its relationship with the other members

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[11] From a certain aspect, the Glass–Steagall Act can be construed as "restriction".

of the BigTech group and its dependencies are consistent with the regulatory framework, thereby shielding the financial subgroup from the risks associated with the other activities of the BigTech group.

The basic goal of this regulatory approach is to manage the internal dependencies within the BigTech group and thus eliminate and ban undesired dependencies while ensuring transparency in the group's operation, minimising the spillover of internal risks to the financial entity, ensuring operational resilience and regulating data management and data and technology sharing within the group.

The degree of separation is up to the legislators, and it may involve complete segregation. This means that in the strictest version of the segregation model, the part of the BigTech group providing financial services is completely isolated from the other commercial activities, financial transactions between the two parts are prohibited, and the financial subgroup is fully prevented from enjoying the benefits of the group-wide technology and data sharing platforms. *Ehrentraud et al. (2022)* therefore argue that this model has its drawbacks, too. As mentioned above, BigTech firms have secured a competitive edge due to the large customer base and by exploiting the network externalities attributable to the related huge amounts of data, and severely limiting or prohibiting the use of the common technology and data sharing platforms within the group, reducing these companies' competitive advantage and basically undermining their business model may be a disincentive for them to provide financial services. Therefore, an overly strict application of the segregation approach may ultimately yield drawbacks similar to the restriction model. The authors of the present paper believe that this may not necessarily be true, as with an appropriate framework the "segregation" model would not considerably hamper innovation. For example, in the case of BigTech payment solutions (e.g. Apple Pay, Google Pay), a framework segregated at the institutional and operational level and similar to what now applies to card companies could be established, which would not hinder the incorporation of innovative solutions. In the case of data sharing, the new data available at BigTech firms could also be used appropriately, but only in a much more regulated operating framework, modelled after that of "credit bureau" providers.

4.3. "Inclusion"

According to the third approach, a new, dedicated regulatory category taking into account the characteristics of tech giants' unique operating model should be established for the BigTechs active in financial services. This is because the existing regulatory framework is usually not suitable for regulating corporate groups that are active in financial services but have a business model which is not dominated by "traditional", regulated financial activities. BigTech firms are like that. As stated above, the current regulatory framework does offer partial solutions for mitigating

the risks entailed by certain financial conglomerates, but it has several shortcomings that prevent it from addressing all the risks created by BigTech, because it was not created to do so.

In contrast to the segregation model, the inclusion approach would create a comprehensive framework tailored to BigTech without making any radical intervention in their business models and thus hindering service diversity and innovation in the market. The framework takes a joint, group-wide approach to the parent company and all its subsidiaries, whether engaged in licensed financial activities or ones not requiring a permit, to understand and manage the intragroup interdependencies as well as the risks involved.

Similar to the segregation model, financial activities can be organised into separate entities (a subgroup or holding company) to ensure transparency under this approach as well. However, instead of completely ring-fencing these entities from the rest of the group, regulatory requirements applicable at the consolidated subgroup level are introduced, and instead of an outright ban on the interactions between financial and non-financial activities and intragroup interdependencies, these are monitored and managed with controls pertaining to the BigTech group as a whole and fine-tuned at the group level (with provisions for corporate governance, conduct of business, operational resilience and financial solvency requirements).

In this model, regulation is organised at three levels: first, it defines requirements for the whole BigTech group (parent company); second, it introduces rules at the individual subsidiaries engaged in financial activities; and third, it regulates the entity (holding company) merging the subsidiaries performing various (licensed) financial activities (*Ehrentraud et al. 2022*). Under the model, this would create a clearly defined boundary between the financial and non-financial activities within the BigTech group, and the appropriate detailed rules could help mitigate the risk of a spillover of undesired effects within the group.

It should be noted that the inclusion model does not wish to replace the existing rules pertaining to financial institutions but rather to complement them, as it would include additional provisions that go beyond traditional financial regulation.

This model undoubtedly involves a more complex approach than segregation, and thus its implementation could pose serious challenges due to the complex, global business model of BigTech firms, and it could require unprecedented international cooperation in regulation and supervision as well. With all its advantages, the inclusion model may create undue regulatory burden for certain companies if, for example, financial activities are not significant within the BigTech group as a whole. It is therefore especially important to carefully choose the regulatory criteria based on which the financial engagement of BigTech groups is considered significant, thus

allowing the planned framework to apply to them (such criteria could include the amount of assets or a predetermined level of revenue in the financial sector, or the combination of several similar indicators).

Table 1 gives a brief overview of the advantages and disadvantages of the three potential regulatory models. The European Union currently has no dedicated regulation for managing the systemic importance of large technology companies active in financial services, but a new regulation would probably be most promising if it was geared towards "segregation" or "inclusion".

Table 1			
Potential regulatory models for large technology companies active in financial services			
	"Restriction"	**"Segregation"**	**"Inclusion"**
Pros	• Relatively simple implementation • Risks clearly identified and managed	• Sheltering of financial activities from non-financial risks • Transparency	• Comprehensive, group-wide approach • Enables innovation and increased efficiency
Cons	• May impede innovation • May severely constrain provider and service diversity	• May lead to underestimation of group-wide risks • Requires limits on interdependencies that may discourage participation in finance, and if the limits are defined too strictly, the disadvantages presented in the "restriction" model may ultimately arise	• May lead to complex practical implementation and difficult monitoring • May lead to disproportionate regulatory burdens • Practical implementation of regulations may be difficult, due to large institutional heterogeneity

Source: Based on Ehrentraud et al. (2022)

5. Conclusion

The paper presents a quick overview of the typical activities of BigTech firms in financial services. The areas where larger systemic risk factors can arise were then examined, along with the emerging potential regulatory approaches. Finally, the main advantages and disadvantages of the three regulatory models ("restriction", "segregation", "inclusion") were presented.

In *Ehrentraud et al.* (*2022*), these benefits and drawbacks were mostly identified theoretically, even though the practical issues may be just as important in informing policy. In theory, the third option, "inclusion" seems to be the most promising regulatory approach, as it can manage most of the potential risks while supporting innovation at BigTech firms. However, there are numerous concerns regarding the implementation of the model.

First, the establishment of the necessary regulatory framework could be very difficult and costly. One need only consider the high degree of heterogeneity in BigTech firms in terms of business models, organisational structure and fields of activity. Consequently, a general framework taking into account vastly different business models would have to be established. Another factor making regulators' job difficult is that BigTechs typically include many business lines at the group level, and thus if balanced regulation is sought to be achieved, a deep understanding of business models and industries would be necessary to examine and accurately interpret internal interactions and interdependencies, which is usually outside financial supervisory authorities' fields of expertise, and they could hardly be expected to be intimately familiar with such matters.

Another potential problem faced by supervisors is that the members of the corporate family engaged in financial and non-financial activities are usually in different jurisdictions. This geographical and legal fragmentation (in data protection, financial activities, competition law, etc.) can make the job of supervisors very hard, and it would require a strong willingness for cooperation and heavy use of resources, far beyond what can currently be seen in the supervision of financial groups.

Finally, according to the authors of this paper, "inclusion" may not be the only approach that supports innovation and growing efficiency, as this can also be achieved with the "segregation" model in an appropriate framework. For example, in the case of BigTech payment solutions (e.g. Apple Pay, Google Pay), a framework segregated at the institutional and operation level could be established, similar to that of card companies, which would not hinder the incorporation of innovative solutions, but could increase the currently low level of regulation (e.g. while card companies face provisions capping so-called interchange fees in several countries, BigTech players can price their BigTech payment solutions completely freely, as these can currently be classified as technology services). Another example would be the issue of data sharing: the better risk assessment solutions of BigTech firms are usually attributable to the much larger amount of more granular data, which could be made available, at the institution level, to all financial service providers based on a regulatory framework (in a somewhat similar manner to how "credit bureau" providers currently operate).

Overall, when a balanced approach is used, the second regulatory model, the separation of financial and non-financial activities seems to be the most promising regulatory solution in the short run. With this approach, most truly innovative BigTech financial solutions could be incorporated into financial services through various channels, all while keeping the process easier to manage from a financial stability, data protection and competition law perspective.

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Household Loan Repayment Difficulties after the Payment Moratorium – Hungarian Experience from the Covid-19 Pandemic*

Ákos Aczél – Nedim Márton El-Meouch – Gergely Lakos – Balázs Spéder

We examine the relationship between the widespread, long-lasting debt forbearance on household loans introduced in Hungary at the outbreak of the coronavirus pandemic and subsequent loan repayment difficulties. We estimate linear probability and logit models at the contract level. Although our method is not suitable for identifying causal effects, participation in the moratorium proves to be a strong predictor of subsequent defaults. This is true even if we take into account the wide range of relevant factors observed at the end of the general moratorium period (October 2021). Our main results show that contracts which left the general moratorium at the end of the moratorium and, within this, those that took full advantage of the programme, were on average 3.2 and 4.2 percentage points more likely to become non-performing in September 2022 than those that never participated in the moratorium. This relationship can explain almost half of the differences in default rates between the respective groups.

Journal of Economic Literature (JEL) codes: D12, D14, G28, G51

Keywords: payment moratorium, household loans, credit risk, non-performing loans, credit registry, coronavirus pandemic

1. Introduction

Immediately after the outbreak of the coronavirus pandemic, many countries introduced temporary, but widespread relief of household loan repayments[1] to contain the anticipated large liquidity shocks during the pandemic that could lead

[1] The IMF has compiled the economic responses of 197 countries during the coronavirus pandemic until July 2021: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19. More detailed ESRB collection for European countries: https://www.esrb.europa.eu/home/search/coronavirus/countries/html/index.en.html.

to systemic household debt repayment difficulties. The payment difficulties of indebted households can have large-scale, negative external effects on the real economy (*Mian – Sufi 2014*). As a result of the Global Financial Crisis, the level of non-performing household loans also increased significantly in Hungary from 2009 onwards (*Figure 1*), which has greatly restrained and prolonged economic recovery (*Verner – Gyöngyösi 2020*).

The payment moratorium was not a widespread macroeconomic crisis management tool in the past, so only a few empirical studies have been carried out to measure its effects. The first widespread, international use of this kind of payment moratorium was justified by the following circumstances. First, the crisis was not triggered by an economic shock (but by a pandemic), and thus it was expected that economic actors would face liquidity challenges rather than solvency problems. In the case of an economic crisis caused by a pandemic (not an overwhelming one), there was hope that once the pandemic had passed, the previous economic processes could be restored relatively quickly, without major systemic changes. Second, there was no fear that the moratorium would encourage irresponsible indebtedness in the future (moral hazard), as the crisis was not caused by excessive financial risk-taking. Third, by that time there were both theoretical and empirical arguments that the adverse spill-over effects of household debt problems are better avoided by temporary, but immediate payment relief (liquidity support), rather than by permanent but not necessarily immediate relief (debt relief).[2]

Studying the Hungarian household payment moratorium can provide useful insights, as it was considered a significant intervention even by international standards. Based on a comparison of moratoria introduced in 23 EU countries, *Drabancz et al.* (*2021*) found that, like in many other countries, Hungary introduced a programme that was mandatory for banks and covered both principal and interest payments, whereas few countries introduced an unconditional, long-lasting programme like the Hungarian one, and it was only in Hungary that contracts were automatically included (opt-out logic).[3]

In this study, we use data from Hungary to explore whether participation in the general payment moratorium is relevant to the subsequent development of household loan repayment difficulties. A well-functioning payment moratorium effectively supports managing the liquidity shock to households, after which the programme can be terminated without significant debt repayment difficulties. In Hungary, household loans disbursed until 18 March 2020 were unconditionally eligible for the moratorium until 31 October 2021, which then became conditional from November 2021. After the general payment moratorium period, the ratio of

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[2] See, for example: *Eberly – Krishnamurthy* (*2014*)*, Ganong – Noel* (*2020*)*, Campbell et al.* (*2021*) *and Boar et al.* (*2022*).
[3] For more details, see: *EBA* (*2020*) and *ESRB* (*2021*).

non-performing loans increased significantly, from 2.8 per cent in Q3 2021 to 4.2 per cent in Q4 2021 (*Figure 1*). This is nowhere near the level of the corresponding period after the outbreak of the Global Financial Crisis, i.e. roughly in 2010–2011.

Figure 1
Ratio of non-performing household loan portfolio in the credit institution sector
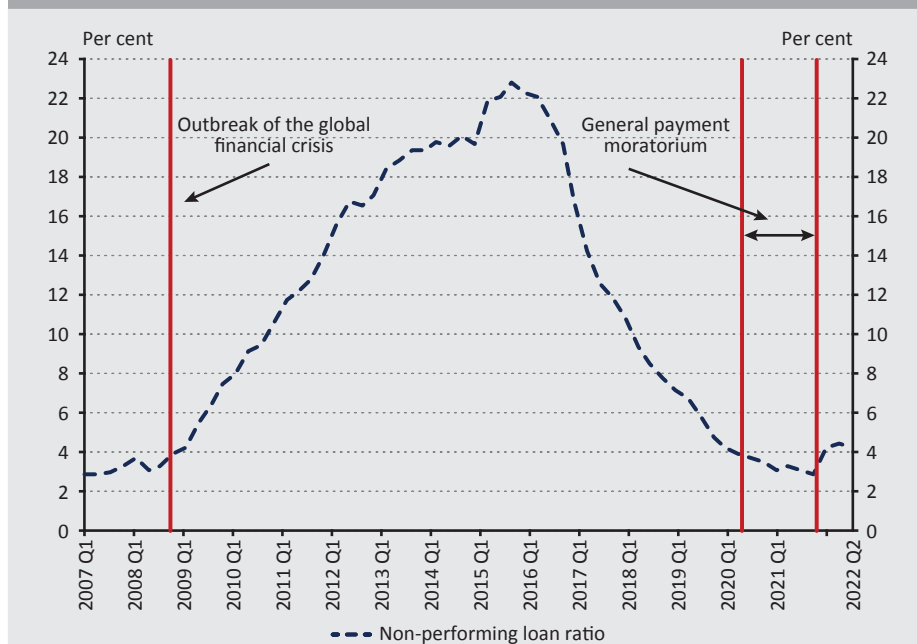
Note: The definition of non-performing loans changed in 2015. From then on, in addition to loans over 90 days past due, loans less than 90 days past due where non-payment is likely are also classified as non-performing. Calculated by clients until 2010 and by contracts from 2010.
Source: MNB (2022): Figure 48

The strength of our approach is that we can use detailed monthly observations of loan contracts at the individual level. Our main result is that the moratorium track record is non-linearly related to non-performance in September 2022, even when we take into account numerous relevant individual loan and debtor characteristics observed in October 2021. Our estimation using a linear probability model suggests that contracts which participated in the general moratorium for a moderate length of time at most, or exited before the end of the programme have on average roughly the *same* probability to become non-performing later on as contracts that opted out of the moratorium altogether. However, the probability of non-performance for contracts that left the general moratorium at the end, and within this group, for loans that took full advantage of the programme, is on average 3.2 and 4.2 percentage points *higher*, respectively. These latter values are significant because they can explain almost half of the differences in non-performing ratios between the respective groups.

It is important to stress that the method we use is not suitable for identifying the causal effect of the general payment moratorium on payment problems after the end of the programme. Indeed, we cannot be sure that participation in the moratorium and subsequent default are not related to other relevant circumstances that are difficult to observe. Partly for this reason, we cannot determine exactly why the described correlation between moratorium participation and subsequent credit risk exists. One possibility is that intensive participation in the moratorium is the result of self-selection, which is more likely to be chosen by debtors with poorer liquidity or solvency. Another possible explanation is that the moratorium weakens incentives to maintain or restore the ability to repay debts.

The public policy relevance of our results is the following. After systemic, voluntary, and temporary payment relief programmes, an increase in the ratio of non-performing loans associated with the programme can be expected, although to a limited extent. Prudential regulation of credit institutions, as well as loan loss provisioning at individual credit institutions, should also take into account that participation in the programme is itself a strong predictor of defaults within one year.

The topic of our study is most closely related to the nationwide experiment in India by *Fiorin et al.* (*2022*), starting in late 2020, in which they investigate the effects of a payment moratorium on delinquent consumer loans and find that the moratorium does not worsen the chances of loan repayment after the programme. To our knowledge, none of the studies examining the effects of the household payment moratoria introduced during the coronavirus pandemic have looked in detail at the relationship between the programme and subsequent difficulties in repaying loans so far. *Noel* (*2021*) argues that such measures in the US were better designed than similar measures during the Global Financial Crisis. Looking at individual loan data, *Cherry et al.* (*2022*) find that the programmes were successful in limiting household loans from becoming non-performing during the pandemic and complemented other crisis management measures well. *Capponi et al.* (*2021*) estimate the effect of these measures on household lending (specifically mortgage refinancing). *Kim et al.* (*2022*) estimate causal effects using loan-level household mortgage data and find that the moratorium mostly reached those in need, without serious unintended side effects. The effect of the pandemic and the household payment moratorium on inequality is examined by *An et al.* (*2022*). *Gerardi et al.* (*2022*) comprehensively assess all pandemic-related measures that targeted the US mortgage market, focusing primarily on minorities. The moratorium on student loans significantly increased consumption in the short run, but also increased indebtedness in the longer run by taking out other types of household loans, as found by *Dinerstein et al.* (*2023*). *Katz* (*2023*) compares the effects of the student loan moratorium and fiscal stimulus payments during the pandemic on consumption and savings.

Albuquerque – Varadi (*2022*) estimate the effect of the UK's mortgage payment holidays on consumption from transaction-level spending data. *Allen et al.* (*2022*) look into the reasons for low participation in the Canadian loan deferral programmes and emphasise the role of awareness and easy access. Based on survey data, *Allinger – Beckmann* (*2021*) analyse household enrolment in payment moratoria in ten Central European countries (including Hungary) and the relationship of the moratorium to payment difficulties. The initial experience of the payment moratorium on household loans in Hungary is described by *Drabancz et al.* (*2021*), while the factors that make participation more likely are analysed by *Dancsik – Fellner* (*2021*) and *Berlinger et al.* (*2022*).

The paper is structured as follows: *Section 2* describes the data. In *Section 3* we present a linear probability model examining the relationship between moratorium track record and subsequent non-performance. We show our results in *Section 4* and their robustness in *Section 5*. The final section concludes.

2. Data

2.1. The database

We needed loan-level observations of all existing credit and leasing contracts of Hungarian households at the end of October 2021.[4] These were obtained from four data sources. We narrow our analysis to loans granted by Hungarian credit institutions, which is not a significant simplification, as the vast majority of Hungarian household loans are of this type. The variables used are presented in *Table 3* in the *Appendix*.

Most of the characteristics of loans are taken from the credit registry of the Magyar Nemzeti Bank (HITREG), which has been operational since 2020 and contains detailed monthly data on all outstanding household loans of credit institutions. Older characteristics related to loans (e.g. whether the debtor was previously delinquent, whether the loan was previously foreign currency denominated) are obtained from a data report to the central bank that has the same data content as the Central Credit Information System. We can identify credit history characteristics for more than 90 per cent of the contracts.

Income data are derived from two sources. First, we use one twelfth of the gross annual income of debtors included in the consolidated tax base in the personal income tax returns of the National Tax and Customs Administration, which can be identified for roughly 70 per cent of loans. We use this income data only for the imputed debt service-to-income ratio for loans taken out before 2015, as this indicator is not

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[4] For simplicity, all contracts are referred to as loans in the following.

available before the introduction of the debt cap rules.[5] We calculate other income data from the pension contributions database of the Hungarian State Treasury. Derived gross monthly incomes are less accurate on an annual basis, but measure more precisely the evolution of incomes at the beginning of the pandemic, i.e. between March and December 2020. ISCO codes describing tasks and duties of the debtor's job are also derived from here, and are used with only single-digit precision, as more detailed classifications give very similar results. Data from the pension contributions database can be matched with varying success to our other data by loan type: roughly 70 per cent for housing loans and prenatal baby support loans, just under 60 per cent for personal loans, and for less than half of overdrafts and credit cards.

Table 1

Development of outstanding debt between October 2021 and September 2022 by loan type

		2021			2022								
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Housing	(HUF bn)	4,556	4,540	4,486	4,413	4,355	4,289	4,231	4,169	4,095	4,042	3,987	3,953
	(thsnd pcs)	694	686	678	667	659	648	639	631	620	613	605	600
Home equity	(HUF bn)	799	791	777	752	740	725	712	698	678	667	656	658
	(thsnd pcs)	187	184	181	177	174	170	168	165	161	159	157	157
Prenatal baby support	(HUF bn)	1,501	1,496	1,490	1,416	1,411	1,405	1,399	1,393	1,387	1,380	1,373	1,431
	(thsnd pcs)	160	160	160	152	152	152	152	152	152	152	151	158
Personal	(HUF bn)	1,138	1,111	1,080	1,016	986	958	931	904	879	855	832	844
	(thsnd pcs)	804	787	770	730	715	697	682	667	652	638	624	633
Vehicle	(HUF bn)	157	151	146	141	135	128	124	119	114	110	106	102
	(thsnd pcs)	94	92	90	87	85	81	79	77	75	72	71	68
Hire purchase	(HUF bn)	27	25	23	21	19	18	16	15	13	12	11	10
	(thsnd pcs)	240	230	212	199	188	178	168	158	148	138	129	121
Overdraft	(HUF bn)	196	190	185	191	162	170	171	177	180	171	168	175
	(thsnd pcs)	1,769	1,689	1,679	1,662	1,652	1,641	1,630	1,621	1,603	1,590	1,570	1,566
Credit card	(HUF bn)	159	158	158	148	143	139	137	140	137	134	134	132
	(thsnd pcs)	1,364	1,346	1,325	1,296	1,275	1,248	1,224	1,204	1,184	1,165	1,134	1,118
Other	(HUF bn)	556	538	516	490	465	408	399	393	363	348	329	314
	(thsnd pcs)	36	35	33	32	32	31	30	30	29	28	28	27
Total	(HUF bn)	9,089	8,999	8,863	8,587	8,417	8,240	8,120	8,007	7,848	7,720	7,596	7,619
	(thsnd pcs)	5,347	5,209	5,128	5,003	4,932	4,846	4,771	4,706	4,623	4,556	4,470	4,449

Note: In a given month, only loans with data for outstanding debt, which can be as low as zero, are included. Lombard loans make up a significant part of the other category, with HUF 260 billion outstanding debt in October 2021.

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[5] For more on the debt cap rules, see Footnote 16.

We exclude contracts for which it cannot be determined whether they remained in moratorium after October 2021, as well as those contracts that existed between March 2020 and October 2021 but lacked a moratorium classification at some point during that period. We also disregard the very small number of contracts where the primary borrower is not a resident in Hungary or does not live in Hungary. For a small number of the remaining contracts, there are no observations on the outstanding debt from October 2021 to September 2022, which are also ignored. For many other variables, we use slightly cleaned data. Altogether, data cleaning operations exclude 1–2 per cent of observations from the analysis.

Due to the initial uncertainties in the data reporting on moratorium status, we disregard the March 2020 classifications, which excludes the time spent in moratorium in the second half of March. In the end, we cover 5.3 million contracts with credit institutions, to which a total of HUF 9,089 billion (around EUR 25.2 billion at the time) of outstanding debt was linked in October 2021. This stock has steadily decreased over time, due to maturing loans (*Table 1*).[6]

2.2. Participation in the general payment moratorium

Participation in the general payment moratorium could be varied, so after describing the programme, we first look at which debtors took advantage of the moratorium, when and for how long, for which loans. In *Section 2.3*, we follow the development of payment difficulties of loans from June 2021 to September 2022 for three subgroups: debtors who voluntarily left the general moratorium, debtors who exited the programme at the end of the moratorium and debtors who never participated in the moratorium.[7] The methodology and results of the detailed analysis of the relationship between the moratorium track record and subsequent payment difficulties are presented in *Sections 3* and *4.*

All principal, interest and fees on household loans disbursed by 18 March 2020 were automatically granted debt forbearance, initially until 31 December 2020 and, after several extensions, until 31 October 2021.[8] Debtors could simply indicate their intention to leave the moratorium and were also free to opt in and out again. From November 2021, only clients with permanently reduced income, those who were unemployed, were employed in public work scheme, raised children or were retired could remain in the programme, and this had to be requested. If a debtor had exited a contract after October 2021, it could no longer be re-admitted to

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[6] On one or two occasions, the number of loans and the total outstanding debt for certain types of loans may increase slightly over time rather than decrease. This is due to missing observations in the database and is of negligible importance for our analysis.

[7] The remaining contracts are those that have also opted in to the conditional moratorium from November 2021.

[8] In the study, the eligible households are identified by the more precisely observable contracting date rather than by the date of disbursement. In this way, we classify a slightly larger stock than the actual eligible loan stock as eligible.

the programme, which ran up until 31 December 2022. During the period in the moratorium, the debt continued to accrue interest, but repayment of this interest only had to be started after exiting the moratorium, in equal annual instalments over the remaining term. The main rule, however, was that the total monthly instalment to be paid could not increase after leaving the moratorium; instead, the remaining maturity of the loan could be extended.

36 per cent of household loans existing in October 2021 (47 per cent of eligible loans) participated in the general payment moratorium, representing 41 per cent of the outstanding debt stock (66 per cent for eligible loans). The aggregate utilisation of the general payment moratorium has declined monotonically over time (*Figure 2, left panel*).[9] 12 per cent of the loan contracts existing in October 2021 had exited the moratorium earlier, followed by a further 21 per cent at the end of October, leaving not even 3 per cent in the conditional moratorium.[10] Not even a tenth of all contracts spent at least two separate periods in the general moratorium, both in terms of number of loans and volume of outstanding debts. We think that the actual ratio is even lower, because in some months, for some credit institutions and for some loan types, there are outliers in the number of loans opting out or in, which suggests some minor inaccuracy in the measurement of the time spent in moratorium. This happens occasionally for more than 10,000 contracts, in total affecting only a few per cent of the roughly 1.9 million contracts that were subject to the moratorium.[11]

We see that there is a significant group of debtors who decided themselves to leave the general moratorium, and a more numerous group left in October 2021, many of them involuntarily, after participating for a fairly long period. Although the number of early exits is much smaller, their outstanding debt stock in October 2021 is close to that of those who exited in October: HUF 1,493 billion vs. HUF 1,714 billion (*Figure 2, right panel*). The distributions of their outstanding debt by loan type show significant differences. Among those exiting before the end of the programme, the proportion of housing loans is significantly higher, while personal loans are more common in the other group.

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[9] The different development of the curves in *Figure 2* is not only influenced by the different development of the participation but also by the different development of the denominators: The outstanding debt of eligible contracts decreases over time due to the amortisation of the part not in moratorium, while the debt stock of all contracts increases due to the expansion of the loan disbursements after 18 March 2020 in excess of the amortisation of loans outstanding.

[10] Considering volumes, 16 per cent, 19 per cent and almost 6 per cent are obtained if the outstanding debt as of October 2021 is used for the weighting.

[11] In the regression analyses in *Section 4*, we also use the indicator variable of multiple opting in the general moratorium, which we interpret at least partly as a sign of measurement error of the time spent in the moratorium.

The outstanding debts of those who did not participate in the moratorium are three to four times higher than these, and prenatal baby support loans in particular are over-represented, in part due to the fact that a significant proportion of them are relatively new loans and thus not eligible for the moratorium.

Figure 2
Loans in payment moratorium: ratio and composition by loan type
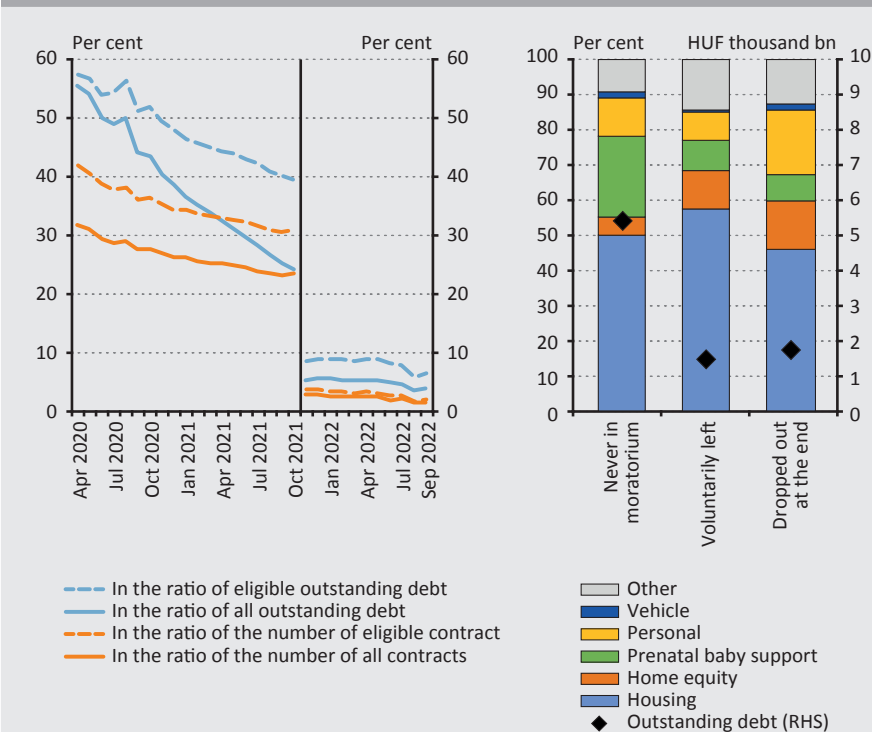
Note: The left panel shows the ratios within the contracts existing in October 2021, always calculated with the current outstanding debt. The right panel shows the distributions of the outstanding debt in October 2021 of contracts existing in October 2021 by loan type for groups with different moratorium track records. Never in moratorium: They have never been in moratorium. Voluntarily left: They left the moratorium before October 2021. Dropped out at the end: They dropped out of the moratorium at the end of October 2021.

A more accurate classification of moratorium history can also be constructed, which takes into account the length of time the primary borrower has been in moratorium with different loans having different instalments. To measure the intensity of participation in the general payment moratorium, we use the following definition: For each debtor *j*, we assign a value between 0 and 100 per cent by taking into

account all their contracts indexed by *i* according to whether there was a debt forbearance in force for the instalments of that contract in month *t*:

$$Moratorium\ intensity^j = \frac{\sum_{t=Apr.\,2020}^{Oct.\,2021} \sum_i instalment_{i,t}^j * in\ moratorium_{i,t}^j}{\sum_{t=Apr.2020}^{Oct.2021} \sum_i instalment_{i,t}^j}$$

30 per cent of the primary borrowers of contracts participating in the general moratorium at most who have positive moratorium intensity have almost fully taken advantage of the moratorium, while roughly half of them have a utilisation rate below 50 per cent (*Figure 3, left panel*). More than half of the primary borrowers exiting the programme at the end of October 2021 were in moratorium almost throughout, while those who voluntarily left earlier have a typical intensity of less than 50 per cent (*Figure 3, right panel*).

Figure 3
Distribution of contracts that participated in the general moratorium at most by intensity of participation of the primary borrower
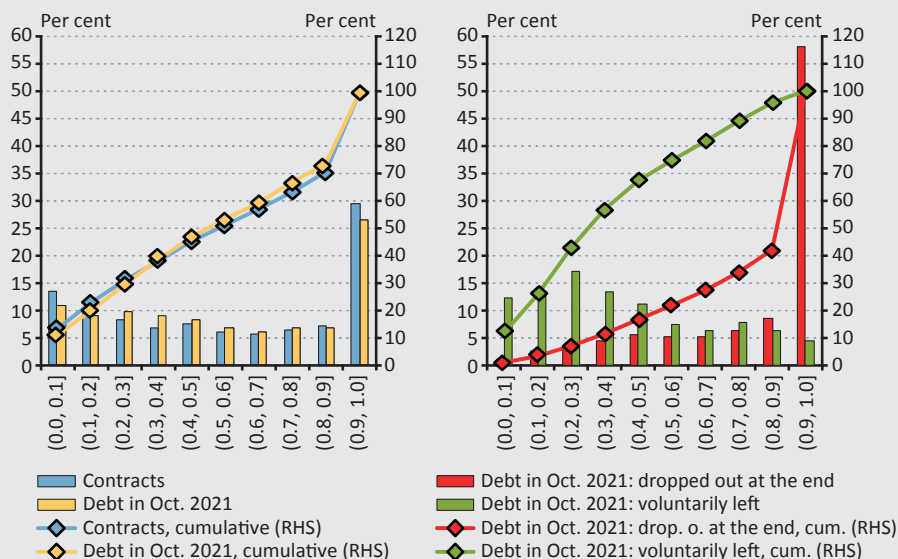
Note: The left panel shows the distribution of the contracts that participated in the general moratorium or never participated, but have a main debtor with positive moratorium intensity. For the primary borrower of a contract, the intensity of participation in the moratorium is measured by the proportion of his/her total payment obligations during the general moratorium period deferred by the moratorium. Voluntarily left: They left the moratorium before October 2021. Dropped out at the end: They dropped out of the moratorium at the end of October 2021.

2.3. Defaults at the end of the general payment moratorium

Debt service obligations of the contracts subject to the moratorium were temporarily suspended, which also ruled out the possibility of becoming delinquent. However, the accounting rules continued to require credit institutions to classify contracts into different categories (stages) for loan loss provisioning purposes, depending on the foreseeable future loss they may incur in relation to the contracts. They could also assign a non-performing status if they had reasonable grounds to believe that, without the protection of the moratorium, the debtor would be unlikely to pay. The delinquency of clients that entered into moratorium with pre-existing delinquency remained unchanged for the duration of the moratorium and could only increase after exiting the programme.

In this paper, we consider the non-performing classification (performing vs. non-performing) of credit institutions as the main indicator of payment difficulties. In our view, this rating makes the most accurate use of the wide range of relevant circumstances, as credit institutions seek to use a variety of information in the rating process, including information that is not available to outsiders.

One of the possible alternatives is the extent of delinquency. This is not used because delinquency per se is insensitive to other relevant elements of payment difficulties, such as the size of delinquent amount. Another possibility could be some version of probability of default, but such a probability is difficult to define accurately, and the credit registry does not reliably contain such data for all institutions. Nevertheless, the non-performing classification has the disadvantage that a loan can be removed from the non-performing status even if the debtor's solvency has not actually improved (for example, by selling the loan). We do not have good enough data to identify such outflows, but we try to mitigate their impact. Therefore, for any loan maturing after September 2022 that was missing a September 2022 non-performing classification, we impute the classification for each of the months missing until September that was contained in the last data observed in a previous month.[12] The change does not substantially alter the results of the regression analysis.

Among all contracts existing in October 2021, the ratio of non-performing loans jumped from 2.8 per cent at the end of the general payment moratorium in October to 4.0 per cent in November, and then rose slightly further (*Figure 4, left panel*). The increase was mostly related not to contracts that left the general moratorium but to those that remained in the moratorium. In November, banks classified 28 per cent of outstanding debts of loans that remained in moratorium as non-

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[12] We do not make changes to overdraft and credit card loans. Without them, there are 230,000 loans that have some kind of non-performing classification in October 2021, but do not have one in September 2022, even though the loan will not mature until later.

performing, up from 9 per cent in October. This was presumably due to the fact that the rules had extended the programme only for vulnerable groups, and that they had to apply for it, which may have indicated poorer solvency. The non-performing ratio excluding those who remained in the moratorium barely increased after the general moratorium (2.4 per cent in October 2021 and 2.9 per cent in September 2022) and thus remained much lower than for those opting for the conditional moratorium.[13] The non-performing stock in this group was around HUF 200 billion in the months after the end of the general moratorium, half of which was delinquent beyond 90 days. Behind this broadly unchanged stock over time, there was a larger inflow and outflow in 11 months than in the 19 months of the general moratorium (*Figure 4, right panel*). This suggests that a significant amount of meaningful additional information may have been used in the non-performing classifications after the general moratorium ended.

Figure 4
Non-performing household loan portfolio by delinquency and migration
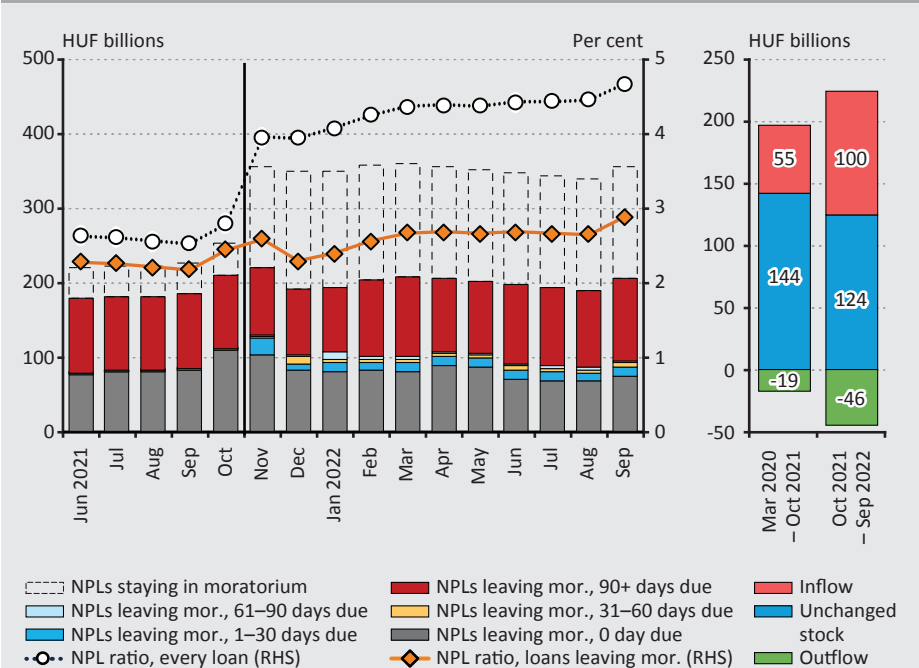
Note: The left panel shows the volume and the share of non-performing loans within the outstanding debt at the given date of loans existing also in October 2021. The right panel shows the transitions between March 2020 and October 2021 and between October 2021 and September 2022 of the stock of non-performing loans within the loans that left the moratorium in October 2021 at the latest. It takes into account only the loans with observable non-performance classifications both at the beginning and at the end of the given period, and it calculates with the outstanding debt in October 2021.

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[13] A credit institution classified a portfolio of HUF 26 billion as non-performing in October and then reclassified most of it as performing in December. Without this, the temporary increase in the ratio of non-performing loans observed in October and November would disappear.

Both the typical levels of non-performing ratios and their evolution around the end of the general payment moratorium differ significantly depending on whether and, in particular, how loans have previously participated in the moratorium. Interestingly, the non-performing ratio among those that did not participate in the moratorium and those that exited the general moratorium before its end were similarly low, between 1.5 and 2.0 per cent around the end of the programme (*Figure 5, left panel*). The non-performing ratio was much higher among those that dropped out of the general moratorium in October 2021. This group is so overrepresented in the stock of non-performing loans that it accounts for more than half of it (*Figure 5, right panel*).[14]

Figure 5
Non-performing household loan portfolio by delinquency and participation in the general payment moratorium
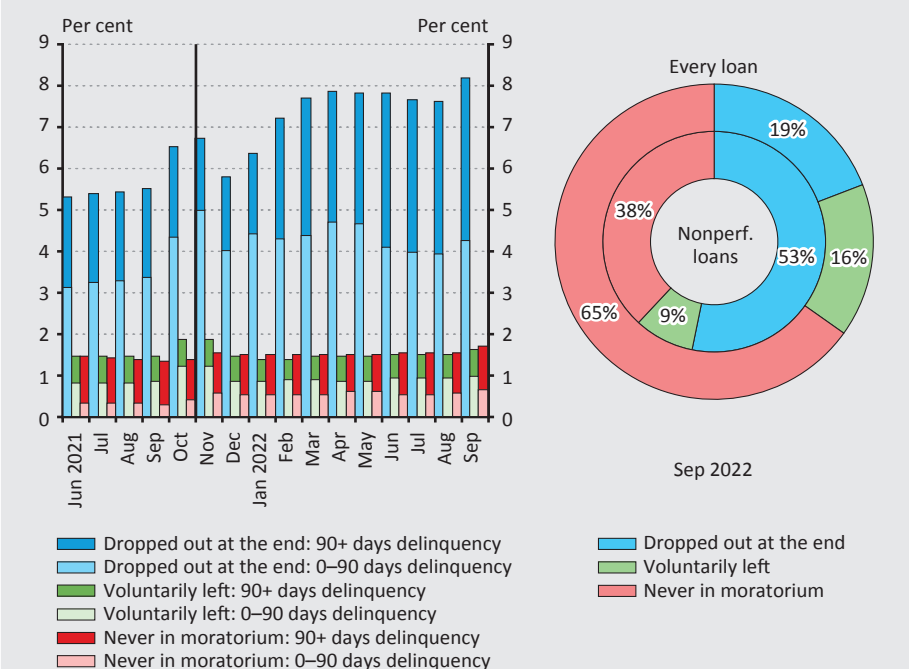
Note: Only household contracts existing in October 2021 are shown. Dropped out at the end: They dropped out of the moratorium at the end of October 2021. Voluntarily left: They left the moratorium before October 2021. Never in moratorium: They have never been in moratorium. In the left panel, ratios of non-performing loans are shown within outstanding debts at the given date, the non-delinquent but non-performing stock is classified as "0–90 days delinquency". The right panel calculates with outstanding debts in September 2022.

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[14] In the following, we regress the September 2022 non-performing classifications of individual contracts; therefore, in addition to the usual volume-based assessment of non-performance, the contract number-based one may be of interest. Having done this, the results obtained are very similar to the ones seen in *Figure 4* and *5*.

The positive correlation between the intensity of participation in the moratorium and subsequent non-performance is also observed at the district level. The correlation coefficient is relatively high: 47 per cent (*Figure 6*). In larger cities, moratorium intensity and non-performance rates in September 2022 are also typically among the lower ones. At the other extreme are the least urbanised districts of the south-western and eastern part of the country, where both indicators typically take high values. It is also noticeable that in almost all of the country's north-western districts, the ratio of non-performing loans is typically relatively low.

Figure 6
Participation in the general payment moratorium and subsequent ratio of non-performing household loan stock by district
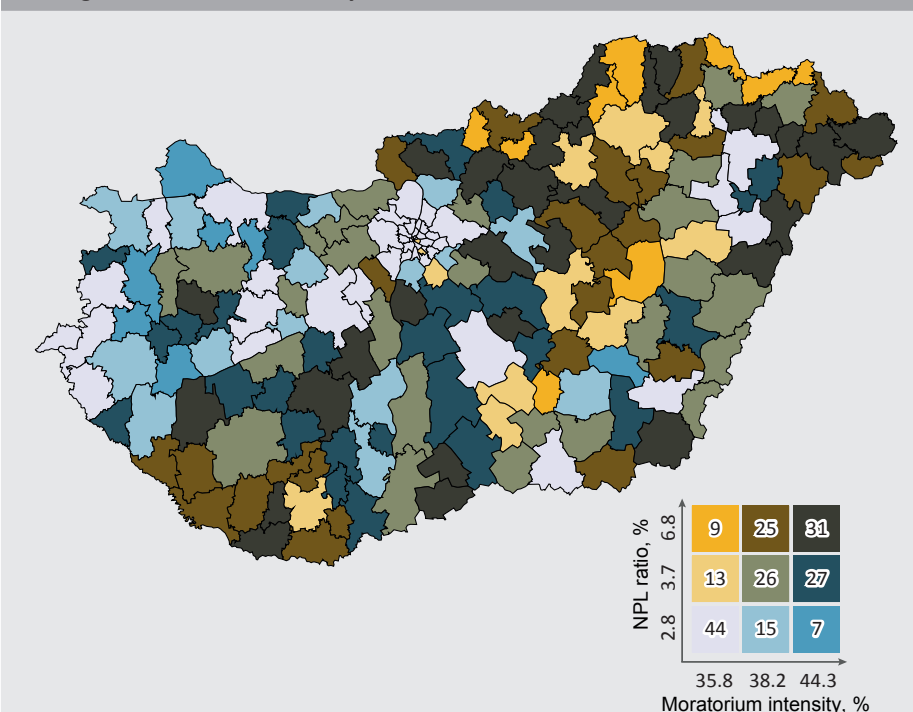
Note: The map does not take into account household loan contracts existing in October 2021 that remain in moratorium in November, nor does it take into account those contracts where the primary borrower could have applied the moratorium on a total instalment of more than HUF 20 million (around EUR 56,000 at the time) on all loans during the general moratorium. The horizontal axis of the legend shows moratorium intensity aggregated at district level. The vertical axis shows the non-performing share of the district-level outstanding debt in September 2022. The numbers on the axes are the tercile values separating each category and the maximum. The squares contain the number of districts in each category.

3. Method

We use regression analysis to examine how much of the correlation between more intensive participation in the moratorium and a higher probability of subsequent non-performance can be explained by usual risk factors that contribute to defaults. For ease of interpretation, simple linear probability models are estimated at the contract level. For the estimations, we use household loans that existed in October 2021 and left the programme until the end of the general payment moratorium or never participated in it.

The dependent variable is always the binary variable encoding the non-performing classification in September 2022, which takes the value 0 if the given loan is performing and 1 if it is non-performing. Our main explanatory variable is participation in the moratorium, which is measured in two ways as discussed in the previous section. First, we use a threefold classification (those who dropped out of the general moratorium in October 2021, exited earlier or never participated in the moratorium) and second, we apply a category variable composed of 11 values from the moratorium intensity, which divides the possible values by 10 per cent in addition to zero. The explanatory variables include a number of characteristics of the contract and the primary borrower, a detailed list of which is provided in *Table 3* in the *Appendix*. We use observations of the explanatory variables in October 2021, i.e. we examine the extent to which these variables at the end of the general payment moratorium can predict non-performance in September 2022. The estimation results do not allow us to identify *casual effects* between the moratorium and subsequent non-performance, as we cannot be sure that participation in the moratorium and subsequent default are not related to other important circumstances that cannot be observed.[15]

In total, we estimate eight model specifications, four with the threefold moratorium participation variable and four with the moratorium intensity variable. In both groups, we include the same explanatory variables in several waves. Each model is estimated on the same subsample, which is as extensive as possible containing observations on all explanatory variables applied. This covers nearly half of the observations in the database. In order not to reduce our sample too much, the explanatory variables with the fewest observations are omitted from the baseline analysis. However, robustness checks also include an analysis with these variables.

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[15] Examples include risks regarding private life and health, time preferences, the extent of bounded rationality, or efforts to maintain or improve solvency.

4. Results

Table 2 presents the main results. The explanatory variables that are included step by step reduce the estimated coefficients of the participation in the general moratorium. However, these coefficients remain significant even after applying all of the control variables, regardless of the measure for moratorium participation [regressions (4) and (8)]. According to regression (4), contracts that exited from the general moratorium at the end of the programme are on average 3.2 percentage points more likely to become non-performing in 11 months compared to those that never participated in the moratorium. This relationship can explain almost half of the difference in non-performing ratios between the two groups. However, leaving the general moratorium earlier predicts 0.1 percentage points lower probability of non-performance on average compared to loans that never participated in the moratorium.

Table 2

Main results of the estimated linear probability models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-performance in September 2022				
Moratorium type (reference: never in morat.)								
Dropped out at the end	0.0992***	0.0824***	0.0473***	0.0315***				
Voluntarily left	0.0141***	0.0072***	0.0031***	−0.0010***				
Moratorium intensity (reference: 0%)								
0–10%					0.0245***	0.0070***	0.0018***	−0.0004
10–20%					0.0273***	0.0107***	0.0050***	0.0032***
20–30%					0.0249***	0.0100***	0.0065***	0.0047***
30–40%					0.0302***	0.0131***	0.0065***	0.0042***
40–50%					0.0305***	0.0136***	0.0047***	0.0022***
50–60%					0.0414***	0.0244***	0.0138***	0.0080***
60–70%					0.0503***	0.0318***	0.0183***	0.0137***
70–80%					0.0586***	0.0390***	0.0226***	0.0175***
80–90%					0.0715***	0.0506***	0.0305***	0.0224***
90–100%					0.1190***	0.0941***	0.0569***	0.0420***
Sample size (thousand pcs)	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384
R^2	0.064	0.068	0.169	0.321	0.068	0.068	0.170	0.322
Fixed effects: year of contr., bank, district, settlement type	N	Y	Y	Y	N	Y	Y	Y
Debtor and loan characteristics	N	N	Y	Y	N	N	Y	Y
Non-performance in October 2021	N	N	N	Y	N	N	N	Y

*Note: We use household loans existing in October 2021, exited the payment moratorium until the end of October 2021 permanently or never participated in it, and including observations for each of the variables in each model specification. The dependent variable in each specification is the September 2022 non-performing classification (non-performing: 1, performing: 0). The fixed effects, debtor and loan characteristics used as explanatory variables are detailed in Table 3 in the Appendix. The detailed estimation results are shown in Table 7 in the Appendix. Standard errors are clustered at the client level. *p<0.10, **p<0.05, *** p<0.01.*

Using moratorium intensity, the non-linear relationship is also apparent *(Figure 7)*. In the broadest specification (8), the probability of non-performance in September 2022 for contracts with a moratorium intensity of up to 50 per cent is only at most one half a percentage point higher on average than for the group with moratorium intensity 0. Once the 50 per cent threshold is passed, the coefficients increase more and more, reaching 4.2 per cent for moratorium intensities close to 100 per cent. This value can explain about half of the difference in non-performing ratios between the groups that took almost full advantage of the general moratorium and that did not participate at all.

Figure 7
Estimated coefficients of moratorium intensity and the ratio of non-performing loans in September 2022
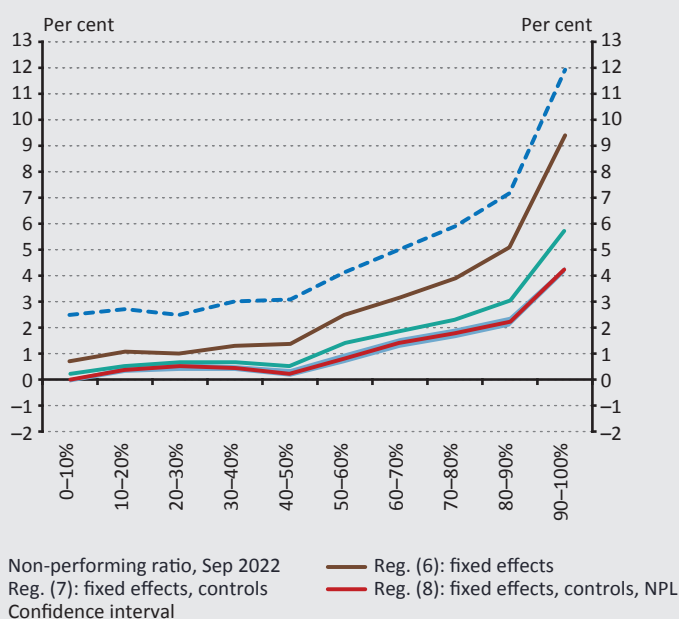
Note: The figure shows the estimated parameters of regressions (6) to (8) of Table 2 for each category of moratorium intensity (the reference group includes the loans with primary borrowers with moratorium intensity 0 per cent), and the share of the non-performing part within the outstanding debt in September 2022 of the loans that also existed in October 2021 and participated only in the general moratorium at most.

The inclusion of explanatory variables adds a lot of accuracy to the models' ability to identify subsequent non-performances. Regression (1), which uses only participation in the general moratorium as an explanatory variable, produces an AUROC value of 0.70, while the full specification (4) yields an AUROC value of 0.90. Non-performing classifications at the end of the general moratorium were included last in the analysis. A comparison of regressions (3) and (4), as well as (7) and (8),

shows that the model's explanatory power improves significantly, but even this does not render the moratorium track record redundant. Based on *Figure 8*, we can add that the predictive power of end-of-programme non-performing classifications for subsequent non-performance steadily decreases over time, while the role of the moratorium track record does not weaken. This finding suggests that relevant information that could be acquired again after the programme has continuously overwritten the knowledge used to identify non-performing loans at the end of the moratorium. However, it seems that in this process, "intensive" participation in general moratorium does not count as information that quickly becomes obsolete.

Figure 8
Estimated coefficients for the group of contracts exited at the end of the general moratorium

Note: The curve shows the estimated coefficients of the indicator variable for the group exited the general moratorium at the end of the programme in regression (3) of Table 2, using the values of the dependent variable in different months. The heights of the green columns correspond to the values of the same coefficient derived from the analogous estimates in regression (4).
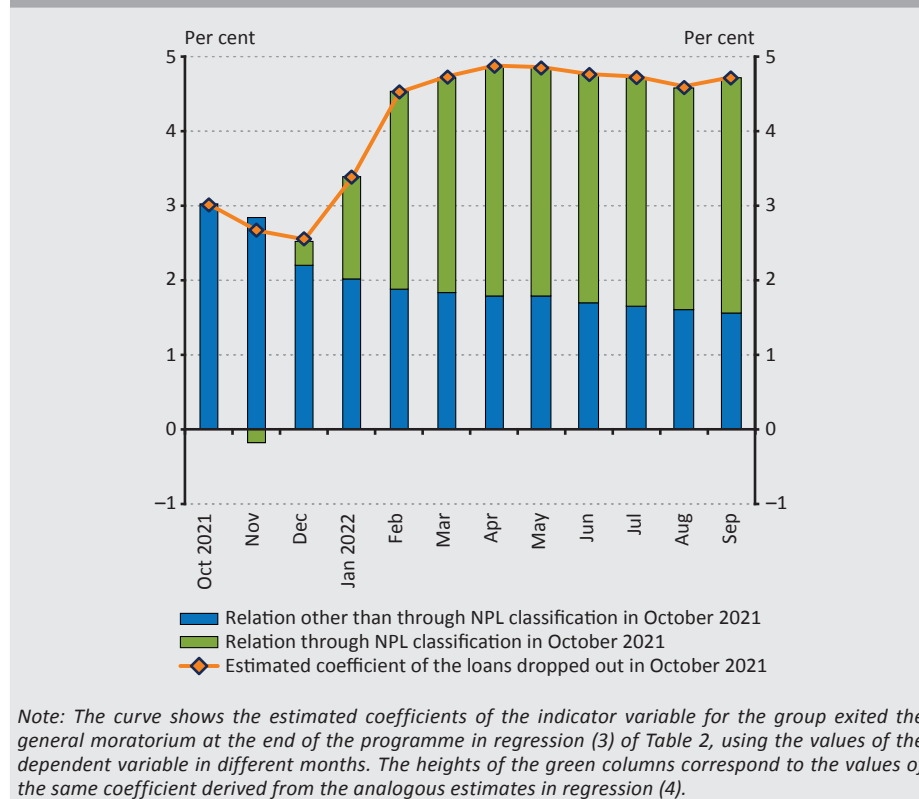
For all other explanatory variables, it is generally true that their estimated coefficients are significant in all regressions (*Table 7* in the *Appendix*). Furthermore, some variables have significant predictive power. As shown in *Figure 9*, current delinquency, primary borrower's past delinquencies, differences in loan types and

number of loans held by the primary borrower are the characteristics that most strongly decrease the estimated coefficient of the indicator variable for the loans left the general moratorium at its end. These variables are therefore most closely associated with intensive participation in the moratorium and subsequent credit risk.

Figure 9
Impact of omitting certain explanatory variables on the estimated coefficient of participation in the moratorium
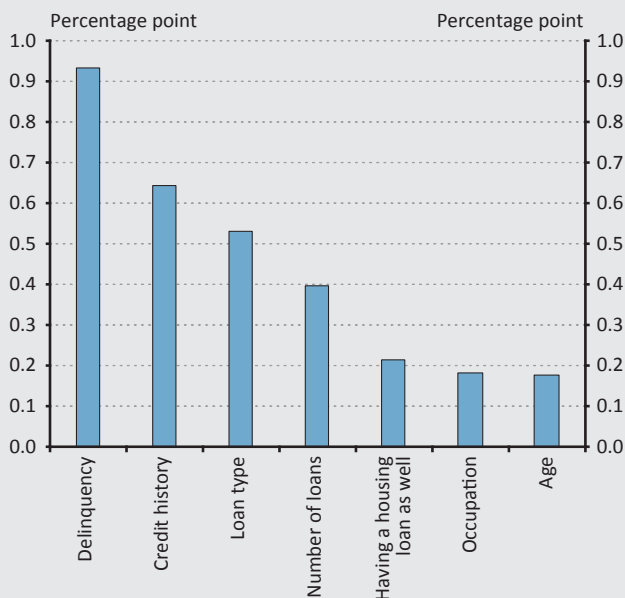
Note: Credit history: Whether the primary borrower has ever been delinquent on any previous loans. Having a housing loan as well: Whether the primary borrower also has a housing loan in addition to the particular loan. Occupation: First digit of the ISCO code of the primary borrower's occupation. The columns show the differences between the values of the coefficients of the indicator variable for the loans exiting the general moratorium at the end obtained by the two estimations of regression (3) in Table 2. The value obtained from the original estimate of regression (3) is subtracted from the estimated value obtained by omitting an explanatory variable from regression (3). The variables with the largest differences are shown in the figure.

According to the estimated coefficients of the fixed effects, which are often significantly different from one another, further unobserved but relevant region-, time- and bank-specific factors also play a role. Contracts signed between 2006 and 2009, the years of the financial cycle that accumulated excessive systemic risk, have higher additional probabilities of non-performance (*Figure 10, left panel*). Contracts concluded in 2015 and 2016 have particularly low values, partly, we think, due to

the debt cap rules that came into force at the time.[16] The fixed effects of credit institutions also show significant variability, suggesting the presence of unobserved institution-specific factors in the credit supply that can be associated with credit risk (*Figure 10, right panel*).

Figure 10
Estimated fixed effects
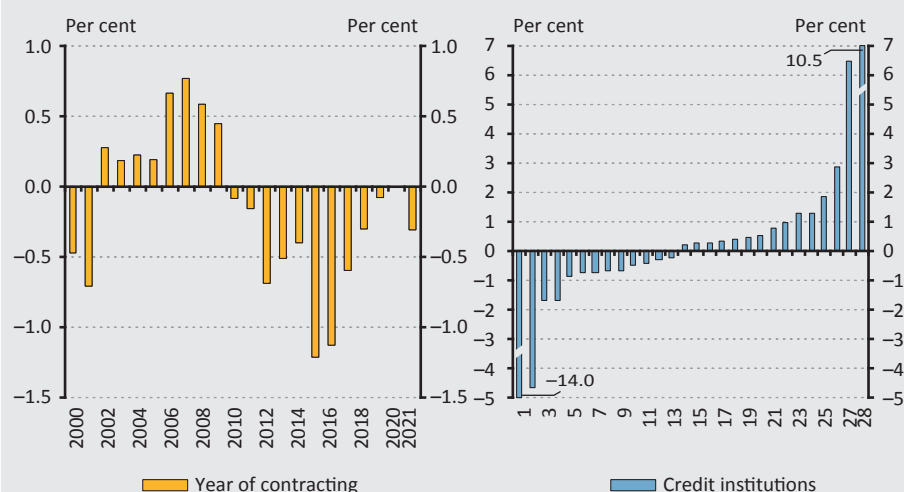
Note: Based on estimation results of regression (4) in Table 2. The reference year is 2020 in the left panel. Individual institutions are anonymised. There are 32 credit institutions in the database, but only 28 in the smaller sample of the regression, because for some of the smaller institutions, due to the large number of explanatory variables used, there are no contracts for which values for all variables are available. Institutions are treated individually in the regressions, rather than consolidating those belonging to the same group of institutions.

5. Robustness checks

Different loan types serve significantly different consumer needs, and therefore the interaction between the moratorium track record and loan type is also worth examining. Incorporating these into model (4), we get a significant heterogeneity according to loan types (*Figure 11*). For consumer loans, the average probability of subsequent non-performance is much higher for loans that left the programme at the end of the general moratorium, compared to the average for loans that

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[16] In line with international developments, a comprehensive macroprudential toolkit was developed in Hungary in the 2010s to mitigate systemic financial risks. One particularly important step was the introduction of the so-called debt cap rules on 1 January 2015 to prevent the over-indebtedness of households (*Fáykiss et al. 2018*). These limit the loan amount that can be borrowed in proportion to the collateral and the monthly instalment that can be undertaken in proportion to income. The former is done by regulating the so-called loan-to-value ratio and the latter by regulating the so-called debt service-to-income ratio.

never participated in the moratorium. This additional probability is close to 18 percentage points for hire purchase loans, nearly 8 percentage points for personal loans and only 1 percentage point for housing loans. These values are considerable because their magnitudes are comparable to the respective non-performance ratios observed in September 2022.

Figure 11
Estimated coefficients of participation in the moratorium for each loan type
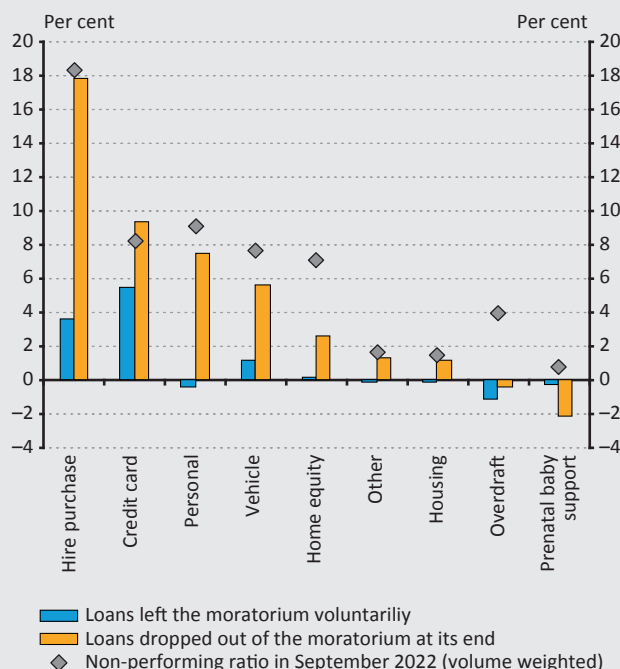
Note: The results were obtained from a version of model (4) in Table 2 including additional explanatory variables, which were the indicator variables for loan types multiplied by the indicator variables for the moratorium track record. The figure shows the estimated coefficients for the subgroups by loan type and moratorium track record, so that for each loan type, the reference group is composed of loans that did not participate in moratorium from that loan type.

If we also use the contract and debtor characteristics that significantly decrease the number of observations that can be used in the analysis, we obtain the results in *Table 4* and *5* in the *Appendix*. These variables characterise the income situation of the primary borrower at the beginning of the pandemic, between March and December 2020.[17] They also include the remaining maturity and the interest rate

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[17] These variables are: (1) average monthly income before the pandemic, i.e. between March and December 2019, (2) annual change in income between March and December 2020 compared to the same period in 2019, (3) whether income decreased by at least 10 per cent during this period, (4) whether income was missing for at least 6 months between March and December 2020.

period of the loan and the net financial transfer that can be achieved by opting for the general moratorium.[18] These variables collectively reduce sample size from 2.38 million to 0.88 million. *Table 4* shows the estimates obtained with this smallest sample, and *Table 5* shows the estimates obtained with the largest samples that can be used for the respective model specifications. Models using as many explanatory variables as possible give estimates very similar to those of the baseline analysis.

The ratio of non-performing loans is generally very low, and therefore linear probability models may not properly capture the typically small, non-negative probabilities of non-performance. To potentially improve the alignment, regressions are also estimated using a logit model. According to the broadest models in *Table 6* of the *Appendix*, loans that left the general moratorium at its end, and within that, those that took full advantage of the programme, were on average 3.6 and 4.3 percentage points more likely to become non-performing than those that never participated in the programme. These are very similar to the values obtained in the baseline analysis (3.2 and 4.2 percentage points). However, logit models provide less support for the nonlinearity of the relationship between moratorium participation and subsequent non-performance. This is because there is a minor additional probability (0.3 percentage points) estimated for loans that voluntarily left the programme before its end, and the relationship between moratorium intensity and subsequent non-performance is closer to linear than in the baseline analysis.

6. Conclusion

We find a close and, according to the available information, non-linear relationship between participation in the general household loan repayment moratorium introduced in March 2020 to cushion the economic shocks of the coronavirus pandemic in Hungary and the debt servicing difficulties observed after the end of the programme in October 2021. The analysis using contract-level data shows that spending a short time in the moratorium and especially exiting voluntarily are associated with roughly the same subsequent probability of non-performance as no participation at all, while a long time in the moratorium and an involuntary exit at the end of the programme are associated with a significantly higher probability. By taking into account a number of characteristics for debtors, loans and credit institutions, we can conclude that the moratorium track record itself has significant predictive power for non-performance even in the 11th month after the general moratorium. We can explain almost half of the difference between the non-performing ratios in September 2022 among the loans that make the most and

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[18] The difference between the net present values of the cash flows from the loan contract under the full utilisation of the general moratorium and under the full opt-out, calculated at a discount rate of 3 per cent, and expressed as a percentage of the outstanding debt in October 2021.

those that make the least use of the payment moratorium with the correlation shown.

Non-performing classifications by credit institutions at the end of the general moratorium are less and less predictive of non-performances more distant in time. By contrast, sustained participation in the general moratorium is a continuously strong predictor of subsequent non-performance. There are likely to exist additional explanatory variables not included in the analysis, that are difficult to observe, but are related to the loan repayment difficulties after the general moratorium. This is suggested by the fact that even in our most extensive model specifications, a number of fixed effects for years of contracting, districts and banks are significant.

There are several possible explanations for the link between the moratorium track record and subsequent non-performance. First, the fact that the debtors are more aware than others of the labour market, private life or health risks affecting their ability to repay their debts may play a role. Debtors worse off were more in need of the general moratorium, and if they stayed in the programme as long as possible, this may indicate that their ability to pay did not improve sufficiently. By contrast, those who left the programme voluntarily could assess that their situation had improved significantly. Second, the differences in preferences and bounded rationality between individuals, which are also difficult to observe, may also account for the correlation shown. The less one takes into account longer-term expenditures, the more likely one is to have both a worse ability to pay and due to necessity, a higher moratorium intensity. Third, the payment moratorium itself may cause a rise in the subsequent credit risk if it erodes the hardly observable efforts exerted by debtors to maintain or improve their solvency. Overall, therefore, it is not possible from our results to determine the extent to which the moratorium causes subsequent non-performance.

As seen, despite the correlation between the moratorium track record and subsequent payment difficulties, it was not the loans exited the general moratorium that mainly increased the share of non-performing loans after the end of the programme. Credit institutions classified slightly less than 3 per cent of household loans as non-performing at the end of the programme, a figure that rose to above 4 per cent after the programme. This change mainly related to loans remaining in conditional moratorium reserved for certain vulnerable groups of borrowers. Access to the conditional moratorium, unlike the general moratorium, was not automatic, so the initiation of entry could in itself indicate higher risks around the debtor's solvency, which could have played a significant role in classifying these loans as non-performing in an increased number.

Our results suggest that intensive participation in any systemic, voluntary, and temporary payment relief scheme may in itself be an important indicator of

persistently higher credit risk of the loan after the programme. Any economic actor seeking to predict the probability of future default on a household loan based on observable circumstances should consider taking into account this characteristic of debtors. It could, for example, help commercial banks to make their loan loss provisioning practices more accurate and simultaneously more prudent. It can also improve the effectiveness of micro- and macroprudential policy by enhancing the accuracy of supervisory and system-wide stress tests and other risk monitoring models.

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Appendix

Table 3
Variables used for regression analysis

Name	Content	Type	Application
Characteristics of the primary borrower			
Moratorium intensity	The 11 categories formed from moratorium intensity: (1) 0 per cent, (2) more than 0 per cent and at most 10 per cent, ... (11) more than 90 per cent and at most 100 per cent.	cat.	basel. an.
Natural person	Can the primary borrower classified as a natural person?	cat.	basel. an.
Age	The age of the primary borrower measured in years.	disc.	basel. an.
ISCO_1	Occupation of the primary borrower according to the first digits of the ISCO codes.	cat.	basel. an.
Previous delinquency	Has the primary borrower ever been delinquent on any loan repayment?	cat.	basel. an.
ln(income 2019)	The logarithm of the average monthly income of the primary borrower between March and December 2019. The unit of measure of the income is HUF thousand.	cont.	rob. ch.
Large income decrease	Did the total income of the primary borrower between March and December 2020 decrease by at least 10 per cent compared to the same period of 2019?	cat.	rob. ch.
Income decrease	By what percentage did the total income of the primary borrower between March and December 2020 decrease compared to the same period of 2019?	cont.	rob. ch.
Job loss	Did the primary borrower have zero income for at least 6 months between March and December 2020?	cat.	rob. ch.
DSTI	Debt service-to-income ratio, expressed as a percentage. Its values are imputed before 2015 on the basis of all instalments of the debtor at the beginning of 2020 and the average monthly income in 2019.	cont.	basel. an.
Debt cap	Indicator for the existence of the debt cap rules in Hungary. It takes the value of 0 before 2015, and 1 from 2015.	cat.	basel. an.
No. of add. loans	Number of additional loans of the primary borrower, its highest value is 7.	cat.	basel. an.
Add. loan: housing	Does the primary borrower also have a housing loan in addition to the given loan?	cat.	basel. an.
Add. loan: personal	Does the primary borrower also have a personal loan in addition to the given loan?	cat.	basel. an.
Add. loan: vehicle	Does the primary borrower also have a vehicle loan in addition to the given loan?	cat.	basel. an.
Add. loan: hire purchase	Does the primary borrower also have a hire purchase loan in addition to the given loan?	cat.	basel. an.
Add. loan: overdraft	Does the primary borrower also have an overdraft in addition to the given loan?	cat.	basel. an.
Add. loan: credit card	Does the primary borrower also have a credit card loan in addition to the given loan?	cat.	basel. an.

Name	Content	Type	Application
Characteristics of the loan contract			
NPL Sept-2022	Is the loan non-performing in September 2022?	cat.	basel. an.
Moratorium type	Participation of the loan in the general moratorium: left before the end of the programme, left at the end of the programme, did not participate in the programme	cat.	basel. an.
Morat. spells	Has the loan entered the general moratorium at least twice? (We only apply the products of this variable with the bank fixed effects.)	cat.	basel. an.
NPL Oct-2021	Is the loan non-performing in October 2021?	cat.	basel. an.
Previous FX loan	It takes the value of 1 if the loan was foreign currency denominated previously, 2 if the debtor ever had another foreign currency denominated loan, 3 if the loan was foreign currency denominated previously and the debtor had another foreign currency denominated loan, 0 otherwise.	cat.	basel. an.
Net transfer	Difference in net present values of cash flows regarding the loan contract from full participation and no participation in the general moratorium using a 3 per cent discount rate, as a percentage of the outstanding debt in October 2021.	cont.	rob. ch.
Remaining maturity	Remaining maturity in October 2021, unit of measure is month	disc.	rob. ch.
Loan type	Loan type: housing, home equity, prenatal baby support, personal, vehicle, hire purchase, overdraft, credit card, other	cat.	basel. an.
Delinquency	Delinquency in October 2021, unit of measure is day	disc.	basel. an.
No. of debtors	Number of debtors in the loan contract, its highest value is 11.	disc.	basel. an.
Int. rate period	Interest rate period, its values are the following. 1: below 12 months, 2: 12 months, 3: between 12 and 60 months, 4: 60 months, 5: between 60 and 120 months, 6: 120 months, 7: between 120 and 240 months, 8: 240 months, 9: above 240 months	cat.	rob. ch.
Debt	Outstanding debt in October 2021, unit of measure is HUF million	cont.	basel. an.
Interest rate	Applicable interest rate in October 2021, unit of measure is per cent	cont.	basel. an.
Fixed effects			
Year of contr.	Year of contracting	disc.	basel. an.
Bank	Credit institution ID	cat.	basel. an.
District	District of the primary borrower's residence	cat.	basel. an.
Settlement type	Settlement type of the primary borrower's residence. There are 5 categories: communities, large communities, towns and districts in the capital, county seats and cities with county rights, other.	cat.	basel. an.

Note: Abbreviations: category: cat.; discrete: disc.; continuous: cont.; baseline analysis: basel. an.; robustness check: rob. ch. Category variables are discrete variables whose finite values are used to construct indicator variables with two possible values. The variable takes the value of 1 if the answer to the yes-or-no question in the column "Content" is "yes" and 0 if the answer is "no".

Table 4

Main results of extended linear probability models estimated on the same sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Non-performance in September 2022			
Moratorium type (reference: never in morat.)								
Dropped out at the end	0.0787***	0.0686***	0.0386***	0.0233***				
Voluntarily left	−0.0060***	0.0014***	−0.0019***	−0.0068***				
Moratorium intensity (reference: 0%)								
0–10%					0.0190***	0.0052***	0.0010	−0.0018***
10–20%					0.0221***	0.0083***	0.0042***	0.0010
20–30%					0.0185***	0.0058***	0.0048***	0.0013*
30–40%					0.0236***	0.0109***	0.0068***	0.0018**
40–50%					0.0302***	0.0144***	0.0080***	0.0038***
50–60%					0.0370***	0.0203***	0.0122***	0.0041***
60–70%					0.0452***	0.0271***	0.0167***	0.0113***
70–80%					0.0514***	0.0318***	0.0194***	0.0136***
80–90%					0.0619***	0.0399***	0.0239***	0.0163***
90–100%					0.1020***	0.0762***	0.0438***	0.0301***
Sample size (thousand pcs)	876	876	876	876	876	876	876	876
R^2	0.037	0.109	0.180	0.298	0.063	0.107	0.179	0.298
Fixed effects: year of contr., bank, district, settlement type	N	Y	Y	Y	N	Y	Y	Y
Debtor and loan characteristics	N	N	Y	Y	N	N	Y	Y
Non-performance in October 2021	N	N	N	Y	N	N	N	Y

Note: We use household loans existing in October 2021, exited the payment moratorium until the end of October 2021 permanently or never participated in it, and including observations for each of the variables in each model specification. The dependent variable in each specification is the September 2022 non-performing classification (non-performing: 1, performing: 0). In addition to the debtor and loan characteristics used in Table 2, we include also the following: (1) average monthly income before the pandemic, i.e. between March and December 2019, (2) annual change in income between March and December 2020 compared to the same period in 2019, (3) whether income decreased by at least 10 per cent during this period, (4) whether income was missing for at least 6 months between March and December 2020, (5) the remaining maturity of the loan, (6) the length of the interest rate period, (7) the amount of the net financial transfer that can be achieved by participating in the general moratorium. Standard errors are clustered at the client level. *p<0.10, **p<0.05, *** p<0.01.

Table 5

Main results of extended linear probability models estimated on the largest possible samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-performance in September 2022				
Moratorium type (reference: never in morat.)								
Dropped out at the end	0.0660***	0.0590***	0.0386***	0.0233***				
Voluntarily left	−0.0054***	−0.0021***	−0.0019***	−0.0068***				
Moratorium intensity (reference: 0%)								
0–10%					0.0059***	0.0027***	0.0010	−0.0018***
10–20%					0.0109***	0.0083***	0.0042***	0.0010
20–30%					0.0085***	0.0059***	0.0048***	0.0013*
30–40%					0.0122***	0.0078***	0.0068***	0.0018**
40–50%					0.0136***	0.0079***	0.0080***	0.0038***
50–60%					0.0232***	0.0175***	0.0122***	0.0041***
60–70%					0.0309***	0.0248***	0.0167***	0.0113***
70–80%					0.0397***	0.0320***	0.0194***	0.0136***
80–90%					0.0529***	0.0444***	0.0239***	0.0163***
90–100%					0.0854***	0.0730***	0.0438***	0.0301***
Sample size (thousand pcs)	4,456	4,456	876	876	4,456	4,456	876	876
R^2	0.022	0.056	0.180	0.298	0.024	0.058	0.179	0.298
Fixed effects: year of contr., bank, district, settlement type	N	Y	Y	Y	N	Y	Y	Y
Debtor and loan characteristics	N	N	Y	Y	N	N	Y	Y
Non-performance in October 2021	N	N	N	Y	N	N	N	Y

Note: We use household loans existing in October 2021 exited the payment moratorium until the end of October 2021 permanently or never participated in it. The dependent variable in each specification is the September 2022 non-performing classification (non-performing: 1, performing: 0). We always use the largest sample available for a given model. In addition to the debtor and loan characteristics used in Table 2, we include also the following: (1) average monthly income before the pandemic, i.e. between March and December 2019, (2) annual change in income between March and December 2020 compared to the same period in 2019, (3) whether income decreased by at least 10 per cent during this period, (4) whether income was missing for at least 6 months between March and December 2020, (5) the remaining maturity of the loan, (6) the length of the interest rate period, (7) the amount of the net financial transfer that can be achieved by participating in the general moratorium. Standard errors are clustered at the client level. *p<0.10, **p<0.05, *** p<0.01.

Table 6

Main results of the estimated logit models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-performance in September 2022				
Moratorium type (reference: never in morat.)								
Dropped out at the end	0.0760***	0.0751***	0.0446***	0.0362***				
Voluntarily left	−0.0092***	−0.0020***	0.0025***	0.0029***				
Moratorium intensity (reference: 0%)								
0–10%					0.0049***	0.0063***	0.0041***	0.0046***
10–20%					0.0077***	0.0098***	0.0092***	0.0101***
20–30%					0.0053***	0.0083***	0.0100***	0.0106***
30–40%					0.0106***	0.0126***	0.0125***	0.0130***
40–50%					0.0109***	0.0130***	0.0117***	0.0121***
50–60%					0.0219***	0.0244***	0.0209***	0.0202***
60–70%					0.0307***	0.0319***	0.0251***	0.0234***
70–80%					0.0390***	0.0385***	0.0290***	0.0263***
80–90%					0.0519***	0.0492***	0.0343***	0.0295***
90–100%					0.0996***	0.0864***	0.0507***	0.0428***
Sample size (thousand pcs)	2,384	2,381	2,381	2,381	2,384	2,381	2,381	2,381
Fixed effects: year of contr., bank, district, settlement type	N	Y	Y	Y	N	Y	Y	Y
Debtor and loan characteristics	N	N	Y	Y	N	N	Y	Y
Non-performance in October 2021	N	N	N	Y	N	N	N	Y

Note: We use household loans existing in October 2021 exited the payment moratorium until the end of October 2021 permanently or never participated in it, and including observations for each of the variables in each model specification. The dependent variable in each specification is the September 2022 non-performing classification (non-performing: 1, performing: 0). The explanatory variables are the same as those used in the baseline analysis (see Table 3). Standard errors are clustered at the client level. *p<0.10, **p<0.05, *** p<0.01.

Table 7

Detailed results of the estimated linear probability models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-performance in September 2022				
Moratorium type (reference: never in moratorium)								
Dropped out at the end	0.0992***	0.0824***	0.0473***	0.0315***				
	(0.0004)	(0.0005)	(0.0005)	(0.0004)				
Voluntarily left	0.0141***	0.0072***	0.0031***	−0.0010***				
	(0.0002)	(0.0003)	(0.0003)	(0.0003)				
Moratorium intensity (reference: 0%)								
0–10%					0.0245***	0.0070***	0.0018***	−0.0004
					(0.0005)	(0.0006)	(0.0005)	(0.0005)
10–20%					0.0273***	0.0107***	0.0050***	0.0032***
					(0.0006)	(0.0006)	(0.0006)	(0.0006)
20–30%					0.0249***	0.0100***	0.0065***	0.0047***
					(0.0006)	(0.0007)	(0.0006)	(0.0006)
30–40%					0.0302***	0.0131***	0.0065***	0.0042***
					(0.0007)	(0.0008)	(0.0008)	(0.0007)
40–50%					0.0305***	0.0136***	0.0047***	0.0022***
					(0.0007)	(0.0008)	(0.0008)	(0.0007)
50–60%					0.0414***	0.0244***	0.0138***	0.0080***
					(0.0009)	(0.0009)	(0.0009)	(0.0008)
60–70%					0.0503***	0.0318***	0.0183***	0.0137***
					(0.0010)	(0.0010)	(0.0010)	(0.0009)
70–80%					0.0586***	0.0390***	0.0226***	0.0175***
					(0.0010)	(0.0010)	(0.0010)	(0.0009)
80–90%					0.0715***	0.0506***	0.0305***	0.0224***
					(0.0010)	(0.0010)	(0.0010)	(0.0009)
90–100%					0.1190***	0.0941***	0.0569***	0.0420***
					(0.0006)	(0.0006)	(0.0006)	(0.0005)
NPL Oct-2021				0.5230***				0.5230***
				(0.0020)				(0.0020)

Table 7

Detailed results of the estimated linear probability models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-performance in September 2022				
ISCO_1								
1			−0.0025***	−0.0019***			−0.0030***	−0.0022***
			(0.0006)	(0.0005)			(0.0006)	(0.0005)
2			−0.0074***	−0.0059***			−0.0077***	−0.0059***
			(0.0004)	(0.0004)			(0.0004)	(0.0004)
3			−0.0083***	−0.0068***			−0.0085***	−0.0069***
			(0.0005)	(0.0004)			(0.0005)	(0.0004)
4			−0.0078***	−0.0071***			−0.0081***	−0.0072***
			(0.0008)	(0.0007)			(0.0008)	(0.0007)
5			−0.0035***	−0.0030***			−0.0040***	−0.0033***
			(0.0006)	(0.0006)			(0.0006)	(0.0006)
6			0.0044	0.0064**			0.0038	0.0059**
			(0.0030)	(0.0028)			(0.0030)	(0.0028)
7			−0.0035***	−0.0023***			−0.0042***	−0.0029***
			(0.0006)	(0.0006)			(0.0006)	(0.0006)
8			−0.0012**	−0.0006			−0.0018***	−0.0010*
			(0.0006)	(0.0005)			(0.0006)	(0.0005)
9			0.0236***	0.0197***			0.0229***	0.0192***
			(0.0008)	(0.0008)			(0.0008)	(0.0008)
Natural person			0.0008	−0.0574***			0.0075	−0.0529***
			(0.0053)	(0.0053)			(0.0053)	(0.0053)
Previous FX loan								
1			−0.0167***	−0.0123***			−0.0173***	−0.0127***
			(0.0003)	(0.0003)			(0.0003)	(0.0003)
2			0.0375	0.0253			0.0374	0.0255
			(0.0380)	(0.0175)			(0.0375)	(0.0170)
3			0.0054*	−0.0043**			0.0035	−0.0055***
			(0.0028)	(0.0020)			(0.0028)	(0.0020)
Previous delinquency			0.0811***	0.0500***			0.0812***	0.0499***
			(0.0007)	(0.0006)			(0.0007)	(0.0006)

Table 7

Detailed results of the estimated linear probability models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-performance in September 2022				
Delinquency								
31–60 days			0.2070***	0.2010***			0.2060***	0.2010***
			(0.0065)	(0.0065)			(0.0065)	(0.0065)
61–90 days			0.2310***	0.2110***			0.2310***	0.2120***
			(0.0089)	(0.0087)			(0.0089)	(0.0087)
91–180 days			0.2610***	0.0986***			0.2610***	0.0990***
			(0.0065)	(0.0062)			(0.0065)	(0.0062)
181–360 days			0.2690***	0.0982***			0.2700***	0.0987***
			(0.0053)	(0.0046)			(0.0053)	(0.0046)
361 days or more			0.2830***	0.1220***			0.2840***	0.1220***
			(0.0022)	(0.0020)			(0.0022)	(0.0020)
DSTI			0.0142***	0.0049***			0.0138***	0.0045***
			(0.0005)	(0.0004)			(0.0005)	(0.0004)
Debt cap * DSTI			0.0037***	0.0254***			0.0011	0.0232***
			(0.0011)	(0.0010)			(0.0011)	(0.0010)
No. of debtors								
2			0.0009**	−0.0008**			0.0003	−0.0012***
			(0.0004)	(0.0003)			(0.0004)	(0.0003)
3			−0.0010	−0.0006			−0.0023***	−0.0016***
			(0.0007)	(0.0006)			(0.0007)	(0.0006)
4			−0.0027**	−0.0014			−0.0041***	−0.0025**
			(0.0014)	(0.0011)			(0.0014)	(0.0011)
5			0.0039	0.0020			0.0016	0.0002
			(0.0047)	(0.0035)			(0.0047)	(0.0035)
6			−0.0006	−0.0043			0.0003	−0.0037
			(0.0085)	(0.0051)			(0.0085)	(0.0051)
7			−0.0035	−0.0062			0.0008	−0.0030
			(0.0261)	(0.0128)			(0.0261)	(0.0128)
8			−0.0426**	−0.0291***			−0.0436**	−0.0301**
			(0.0182)	(0.0109)			(0.0215)	(0.0132)
9			−0.1270***	−0.0796***			−0.1330***	−0.0860***
			(0.0043)	(0.0040)			(0.0043)	(0.0041)
10			−0.0314	−0.0176			−0.0413	−0.0241
			(0.0526)	(0.0383)			(0.0597)	(0.0440)
11			−0.0355***	−0.0140***			−0.0365***	−0.0127***
			(0.0016)	(0.0013)			(0.0016)	(0.0013)

Table 7

Detailed results of the estimated linear probability models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Non-performance in September 2022					
Age			−0.0007***	−0.0005***			−0.0007***	−0.0005***
			(0.0000)	(0.0000)			(0.0000)	(0.0000)
Debt			−0.00007***	−0.0002***			−0.00004**	−0.0002***
			(0.00002)	(0.00002)			(0.00002)	(0.00002)
Loan type								
home equity			0.0051***	0.0033***			0.0059***	0.0036***
			(0.0006)	(0.0005)			(0.0006)	(0.0005)
prenatal baby support			0.0051***	0.0014***			0.0064***	0.0024***
			(0.0005)	(0.0004)			(0.0005)	(0.0004)
personal			0.0258***	0.0192***			0.0247***	0.0179***
			(0.0006)	(0.0005)			(0.0006)	(0.0005)
vehicle			−0.0149***	−0.0192***			−0.0147***	−0.0189***
			(0.0012)	(0.0011)			(0.0012)	(0.0011)
hire purchase			0.0353***	0.0395***			0.0355***	0.0391***
			(0.0013)	(0.0012)			(0.0013)	(0.0012)
overdraft			0.0033***	0.0077***			0.0088***	0.0115***
			(0.0007)	(0.0007)			(0.0007)	(0.0007)
credit card			−0.0213***	−0.0057***			−0.0193***	−0.0038***
			(0.0010)	(0.0009)			(0.0010)	(0.0009)
other			−0.0122***	0.0033			−0.0031	0.0093**
			(0.0045)	(0.0040)			(0.0045)	(0.0040)
Interest rate			0.0341***	0.0223***			0.0322***	0.0203***
			(0.0029)	(0.0027)			(0.0029)	(0.0027)
Add. loan:								
housing			−0.0241***	−0.0156***			−0.0280***	−0.0180***
			(0.0005)	(0.0005)			(0.0005)	(0.0005)
personal			−0.0102***	−0.0021***			−0.0156***	−0.0059***
			(0.0005)	(0.0005)			(0.0005)	(0.0005)
vehicle			−0.0235***	−0.0137***			−0.0246***	−0.0142***
			(0.0011)	(0.0010)			(0.0011)	(0.0010)
hire purchase			−0.0310***	−0.0139***			−0.0308***	−0.0136***
			(0.0007)	(0.0007)			(0.0007)	(0.0007)
overdraft			−0.0069***	0.0006			−0.0087***	−0.0006
			(0.0006)	(0.0005)			(0.0006)	(0.0006)
credit card			−0.0096***	−0.0041***			−0.0096***	−0.0037***
			(0.0005)	(0.0005)			(0.0005)	(0.0005)

Table 7

Detailed results of the estimated linear probability models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-performance in September 2022				
No. of add. loans								
1			0.0621***	0.0374***			0.0653***	0.0390***
			(0.0007)	(0.0005)			(0.0007)	(0.0005)
2			0.0780***	0.0465***			0.0823***	0.0488***
			(0.0009)	(0.0007)			(0.0009)	(0.0007)
3			0.0953***	0.0560***			0.1030***	0.0604***
			(0.0012)	(0.0010)			(0.0012)	(0.0010)
4			0.1110***	0.0639***			0.1210***	0.0703***
			(0.0017)	(0.0015)			(0.0017)	(0.0015)
5			0.1250***	0.0710***			0.1380***	0.0791***
			(0.0029)	(0.0027)			(0.0030)	(0.0027)
6			0.1450***	0.0810***			0.1570***	0.0890***
			(0.0100)	(0.0096)			(0.0099)	(0.0095)
7			0.1980***	0.1280***			0.2130***	0.1370***
			(0.0340)	(0.0340)			(0.0341)	(0.0341)
Settlement type								
county seats		−0.0077***	0.0008	0.0005		−0.0076***	0.0007	0.0006
		(0.0006)	(0.0006)	(0.0005)		(0.0006)	(0.0006)	(0.0005)
large communities		0.0000	0.0017**	0.0016**		−0.0001	0.0017**	0.0016**
		(0.0009)	(0.0008)	(0.0007)		(0.0009)	(0.0008)	(0.0007)
towns		−0.0066***	−0.0014***	−0.0014***		−0.0066***	−0.0014***	−0.0014***
		(0.0005)	(0.0004)	(0.0004)		(0.0005)	(0.0004)	(0.0004)
other		−0.0004	−0.0051	−0.0032		0.0001	−0.0046	−0.0028
		(0.0042)	(0.0040)	(0.0039)		(0.0042)	(0.0040)	(0.0039)
Sample size (thousand pcs)	2,384	2,384	2,384	2,384	2,384	2,384	2,384	2,384
R^2	0.064	0.068	0.169	0.321	0.068	0.068	0.170	0.322
Fixed effects: year of contr., bank, district, settlement type	N	Y	Y	Y	N	Y	Y	Y
Debtor and loan characteristics	N	N	Y	Y	N	N	Y	Y
Non-performance in October 2021	N	N	N	Y	N	N	N	Y

Note: Details of the results in Table 2. Standard errors in parentheses are clustered at the client level.
*$p<0.10$, **$p<0.05$, *** $p<0.01$.*

Measuring Climate Risks with Indirect Emissions*

Orsolya Szendrey – Mihály Dombi

Climate change poses completely new challenges for the financial markets, and thus the consideration of green aspects is becoming explicitly required by regulators and investors. Most of the reports which influence the market in this way evaluate the climate or environmental impact of a product or process based on their alignment with a regulatory standard. However, the methods applied for measurement do not always provide a proper description of the relationship between the investments and the natural resources. Most analyses evaluate investments related to economic sectors based exclusively on direct emissions, while indirect impacts, which represent a substantial part of total emissions, are not taken into account. In the study, the methods and results which are currently applied are compared to calculations including indirect impacts as well.

1. Introduction

In addition to the decrease in biodiversity, one of the modern world's most serious problems is air pollution and climate change caused by the increasing amount of harmful emissions, which fundamentally threaten the preservation of viable environmental conditions for the future generations. As a result of human activity, the average temperature of the Earth has increased by 1 degree Celsius compared to the average temperature before the industrial revolution. In order to avoid a global environmental disaster and decrease adaptation costs, the average temperature increase should be limited to 1.5 degrees Celsius (*IPCC 2022*), which would require the reduction of greenhouse gases by 7 per cent annually (*Friedlingstein et al. 2020; Tokarska – Matthews 2021*) and the fundamental restructuring of economies.

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It can be rightly claimed that climate change is reshaping every segment of the economy and society, thus posing completely new challenges for the financial markets. The emergence or reinforcement of green aspects and the tendency to move towards operations respecting ESG (Environment, Social, Governance) principles present the greatest business challenge for banking, investment and insurance services in the coming years. At the same time, international and national legislation will also impose more and more specific regulatory requirements in this regard. From the taxation of CO_2 emissions through to the support of research and investment in developing sustainable technologies, fiscal and monetary political interventions can also greatly contribute to the success of initiatives aiming to protect our environment (*Hansen 2022; Boneva et al. 2021; Boneva et al. 2022*). According to a study by *Dikau and Volz* (*2021*), 52 per cent of the 135 central banks they examined are working to promote sustainable growth, either directly or by supporting governmental policies that target sustainability objectives. The importance of the latter lies in the fact that monetary policy measures that take green aspects into account can help the financial system and the economy as a whole to become sustainable (*Kolozsi et al. 2022a*).

The Magyar Nemzeti Bank (Central Bank of Hungary, MNB) launched its Green Programme in 2019 (*MNB 2019*), with the aim of supporting the sustainability of the Hungarian financial intermediary system and strengthening Hungary's competitiveness by means of financial products and services. With its Green Capital Requirement Allowance Programme[1] (*MNB 2021*), which was announced in 2020, the central bank aimed to improve the energy efficiency of the domestic housing stock. As part of the Green Monetary Policy Toolkit Strategy, the launch of the Green Home Programme of the FGS (Funding for Growth Scheme) also resulted in stimulation of the green housing loan market (*Matolcsy 2022; MNB 2022b*). Moreover, other MNB initiatives also contributed to the spread of corporate green bonds and green government securities to a great extent.

In the capital market segment, top priority areas now include complying with ESG directives, financing innovative, green technologies, and thus realising investments while considering the aspects of environmental protection, as well as establishing investment and capital funds related to the environment. In the case of the insurance sector, it can be stated that the number of unit-linked products tied to sustainability objectives has increased significantly in recent years, posing extraordinary challenges for market players and the regulatory authority

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[1] *Zöld vállalati és önkormányzati finanszírozásra vonatkozó tőkekövetelmény kedvezményt vezet be az MNB* (*MNB introduces preferential capital requirements for green corporate and municipal financing*). Press release, Magyar Nemzeti Bank, 2020. https://www.mnb.hu/sajtoszoba/sajtokozlemenyek/2020-evi-sajtokozlemenyek/zold-vallalati-es-onkormanyzati-finanszirozasra-vonatkozo-tokekovetelmeny-kedvezmenyt-vezet-be-az-mnb. Downloaded: 21 October 2022.
https://www.mnb.hu/letoltes/tajekoztato-lakascelu-zold-toke-kedvezmeny.pdf. Downloaded: 21 October 2022.

(*Deák et al. 2022*). Regarding the bond markets, green bonds are becoming more and more popular among both investors and issuers, with the purpose of directly or indirectly financing the investments of environmental protection projects.

More and more financial market players are recognising the importance of managing environmental and climate risks and are working to improve their processes and methodologies related to ESG risks. Due to the lack of a standard methodology and regulatory requirements, many market players are unable to properly integrate environmental aspects into a risk management framework according to the actual risks, and therefore, the process gets bogged down with the initial application of oversimplified approaches (*Gyura 2020*).

With the dynamic transformation of financial markets, the burden on supervisory bodies to formulate an appropriate regulatory framework is also increasing; cf. the study by *Campiglio et al.* (2018) for further details in this regard. We must also highlight that one of the challenges central banks face is the development of national and international green financial standards to better identify and measure sustainability and climate risks, and to set real environmental objectives and achieve real impacts with their application. The latter needs to be emphasised as commercial banks, for example, are less interested in financing alternative industries with low carbon intensity, due to specific aspects of the credit market and the regulatory requirements currently in place (*Málits et al. 2022*). Hence, it is no wonder that in the past few years, the number of laws, recommendations, strategies and standards related to green finance has risen significantly as part of the adaptation to market changes (*Bhandary et al. 2021*).

In its action plan on financing sustainable growth (*European Commission 2020*), the European Commission presents a comprehensive strategy with three objectives and ten action plans to ensure that capital flows towards sustainable investments, to integrate sustainability considerations into risk management frameworks and to promote long-term transparency. In order to establish a single conceptual framework, the so-called EU Taxonomy Regulation on the establishment of a framework for promoting sustainable investments[2] has also established a definition of sustainable economic activity and its compliance criteria. Regarding investment products, the concept of sustainability risk and the obligation to report it were introduced in the EU regulation on sustainability disclosures[3] (Sustainable Finance Disclosures Regulation – SFDR). The European Commission's proposal package on banking regulation includes the requirements for market players in the

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[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019XC0620(01)&from=EN
[3] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R2088&from=EN

banking sector, supplemented with detailed sustainability[4] aspects. According to the MNB's updated green recommendation[5] published in August 2022, the central bank expects Hungarian credit institutions to switch to green operations, and to manage, report and disclose climate change-related and environmental risks by 2025.

With respect to the corporate sector, many recommendations and draft guidelines related to green aspects have been published. For instance, the disclosures of large companies covering environmental issues are laid down in the Non-Financial Reporting Directive (NFRD),[6] while the principles of corporate sustainability reporting are laid down in the CSRD proposal[7] (Corporate Sustainability Reporting Directive). In order to monitor the adaptation to specific recommendations and legislation and to provide transparency on the green transformation of the financial markets, national and international supervisory authorities regularly publish related studies, as well as green finance and sustainability reports.

Most of the reports affecting the market in this way evaluate the effects and significance of a certain product or economic activity on the climate and the environment based on their compliance with criteria set out by the regulator. However, the methods applied for measurement do not always provide a proper description of the relationship between a certain investment/economic activity to be evaluated and the natural resources. This may be due to the fact that indirect impacts are not or are only inadequately represented in the measurements of environmental exposure quantified by certain indicators and models.

In this study, based on current regulatory standards, we examine how the measurements of risk exposure determined by the methods of industry classification and applied to quantify climate risks can be affected if the calculations are carried out taking into account different levels of emissions in the supply chains of products and services. This assessment is of particular importance, as regulatory standards typically require supervised institutions to quantify only the direct and, in some cases, the indirect impacts of the operations of their proprietary entities, whereas a true assessment of the assets, investments and financial institutions financed would require a comprehensive quantification of the direct and indirect environmental impacts. The importance of properly measuring climate risks is further underlined by the new regulation of the European Banking Authority (EBA) (*EBA 2022*), which sets out a number of new reporting and methodological

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[4] https://eur-lex.europa.eu/resource.html?uri=cellar:14dcf18a-37cd-11ec-8daf-01aa75ed71a1.0023.02/DOC_1&format=PDF
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0663&from=EN
[5] *Megújított MNB-ajánlás: 2025-ig minden bank működése váljék zölddé* (Updated MNB Recommendation: all bank operations should be green by 2025). Press release, Magyar Nemzeti Bank, 5 August 2022 https://www.mnb.hu/sajtoszoba/sajtokozlemenyek/2022-evi-sajtokozlemenyek/megujitott-mnb-ajanlas-2025-ig-minden-bank-mukodese-valjek-zoldde. Downloaded: 18 October 2022.
[6] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0095&from=EN
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0189&from=EN

requirements for institutions issuing securities which are traded on regulated markets. The institutions in question will have to report their ESG risks through qualitative disclosures from 2024 and quantify their transition and physical risks using quantitative methods and indicators. Furthermore, quantitative methods are also required to be able to quantify the total amount of (direct and indirect) CO2 emissions of the funded instruments.

In our analysis, we quantify the values of greenhouse gas emissions (GHG emissions) of each economic sector taking into account different emission categories and then rank the environmental impact of the sectors. We compare the results of the quantification of direct impacts with the calculations defined by environmentally extended input-output tables,[8] which involve indirect impacts as well. Applying this form of input-output tables of sectoral relations, we are able to examine the environmental effects of the final demand using several different environmental indicators (*Gáspár 2020*).

2. Current methodology for measuring climate risks

The quantification of sustainability risks and the potential for climate risk reduction in financial markets has recently also received increasing attention from both researchers and practitioners. Nonetheless, despite the emergence of a number of new recommendations and regulations, there is still no standard methodology for measuring sustainability and climate risks and the related regulatory environment also keeps changing. The lack of a methodology to quantify and compare climate risks for different asset classes further complicates the task of supervisory bodies, both within institutions and at the sectoral level. In terms of practices in Hungary, the MNB has been supporting market players with a number of reports, methodological guidelines, studies and recommendations, as the resulting "greening" of the financial market offers significant environmental benefits.

In order to understand the new risk management framework that integrates environmental aspects as well, it is important to clarify what the terminology defined by the legislator really means in terms of risk management, as it is vital for the proper assessment and management of climate risks that the risks actually be identified and measured. Pursuant to Article 1 of the SFDR, a sustainability risk is considered to be any environmental, social or management event or circumstance, the occurrence or existence of which may have an actual or potentially significant negative impact on the value of the investment. Among all sustainability risks, climate risk can be considered one of the most significant risks, and we can distinguish between physical and transition risks within this group. Transition risks

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[8] Environmentally extended multiregional input-output tables, EE-MRIOT

include all risks arising from the transition to a carbon-neutral and climate change resilient economy. The main focus of our study is on transition risks, while physical risks are detailed in the study of *Baranyai and Banai* (*2022*).

A simple method to quantify climate risks can be the quantification of the GHG emissions contribution of economic sectors and/or companies. Before choosing the right methodology, it is also important to clarify which level of the corporate value chain (Scope 1,2,3) generates the emissions we would like to measure with the methodology. In practice, three emission categories can be distinguished (*GHG Protocol 2004*). Direct emissions are listed in the category of Scope 1, which compiles the emissions of units under the direct influence of companies. The category of Scope 2 includes indirect emissions that are created during the generation of electricity used for a company's own purposes but not owned by the company. All other direct emissions generated during the full lifecycle of the corporate value chain that cannot be listed among Scope 1 or Scope 2 emissions belong to the Scope 3 category.

Determining individual sector exposure using the methodology of Climate Policy Relevant Sectors (CPRS) created by *Battiston et al.* (*2017*) has become widespread in the financial sector and is applied by many supervisory authorities. The advantage of the methodology lies in its easy implementation as it completely relies on the classification of economic activities applied by the EU (*Eurostat 2008*) for the classification and identification of risks.

When applying the CPRS methodology, economic activities are classified and listed with NACE Rev2 codes. Assuming that the economic activity of certain sectors may contribute more to greenhouse gas emissions, corporate exposures are classified as follows: (1) fossil fuel, (2) utilities, (3) energy intensive, (4) housing, (5) transport, (6) agriculture, (7) finance, (8) scientific research and development, and (9) other. Based on the CPRS methodology, sectors that are potentially affected by transition risks due to their nature are listed in sectors 1–6, and the ones with negligible climate risk exposure are listed in sectors 7–9.

Based on the CPRS methodology, the MNB (*MNB 2022d*) classified 57 per cent of the total credit exposure of the Hungarian banking system (manufacturing industry and real estate activities) into the categories potentially affected by transition risks. *Figure 1* shows the sectoral distribution of Hungarian credit exposures.

Figure 1
Breakdown of the Hungarian banking system's CPRS 1–6 exposures by sectors
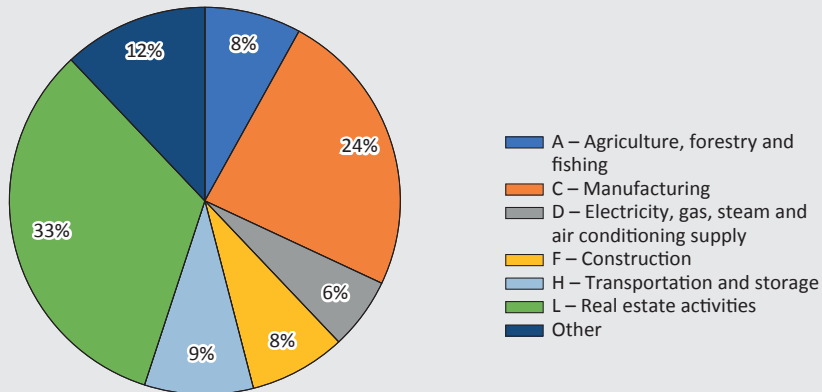
Source: Edited on the basis of MNB (2022c) data

Based on the methodology applied by the European Banking Authority (*EBA 2021*) and the available data on GHG intensity, the MNB classified the credit exposures of the Hungarian banking system in GHG group 6 (*Table 1*). The corresponding GHG intensity values are assigned to certain company exposures based on the Eurostat NACE Rev2 sector codes and are then classified into the corresponding GHG groups according to the criteria based on the GHG intensity data.

Table 1
GHG intensity groups and the classification of corporate loans in the Hungarian banking system

GHG group	Entry criterion	Exposure amount (HUF billions)	Distribution (%)
Very low	GHG ≤ P10	2,056.63	20.11
Low	P10 < GHG ≤ Q1	1,391.49	13.61
Medium	Q1 < GHG ≤ Median	1,404.49	13.74
Medium/High	Median < GHG ≤ Q3	3,657.28	35.77
High	Q3 < GHG ≤ P90	1,265.27	12.37
Very high	GHG > P90	450.15	4.40

Source: MNB (2022c)

Ritter (*2022*) created five risk categories by jointly applying the methodologies of CPRS and the European Banking Authority and evaluated the transition risks of the Hungarian banking system. Based on this analysis, 1.2 per cent of the Hungarian institutions were classified in the high transition risk category, while 55 per cent

of the Hungarian institutions were classified in the upper-middle quartile, which is also significantly exposed to climate risks.

The Task Force on Climate-related Financial Disclosures (TCFD) of the Financial Stability Board[9] proposes five different indicators to quantify climate risks (carbon footprint and carbon exposure), which only take into account Scope 1 and Scope 2 GHG emissions.

In line with the TCFD recommendation,[10] the MNB quantifies the Weighted Average Carbon Intensity (WACI) metric and the ratio of carbon-intensive assets, in order to measure the climate transition risks of the asset portfolios of the central bank. For each portfolio, the WACI metric used by the MNB quantifies the GHG emissions along with the added value per unit, according to the following relationships (*Kolozsi et al. 2022b; MNB 2022a*):

For corporate asset portfolios:

$$\text{WACI} = \sum_i \frac{MV_{Si}}{MV_{Pi}} * I_{GHGi} \tag{1}$$

where:

• MV_{Si} is the market value of the sector,

• MV_{Pi} is the market value of the portfolio,

• I_{GHGi} is the GHG intensity of the sector.

For sovereign asset portfolios:

$$\text{WACI} = \sum_i \frac{E_i}{MV_{Pi}} * \frac{GHG_i}{nGDP_i} \tag{2}$$

where:

• E_i is the exposure value,

• MV_{Pi} is the market value of the portfolio,

• GHG_i is the country's GHG emissions,

• $nGDP_i$ is the country's nominal GDP value.

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[9] Financial Stability Board: https://www.fsb.org/
[10] https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf;
https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Annex-Amended-121517.pdf;
https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Guidance-Risk-Management-Integration-and-Disclosure.pdf.

The ratio used to identify the carbon-intensive industries in Hungary is determined based on the Hungarian TEÁOR (NACE) codes according to the following relationship:

$$CI = \frac{MV_{CIS}}{MV_P} \tag{3}$$

where:

• MV_{CIS} the market value of the carbon intensive sector

• MV_P is the market value of the portfolio

Methodologies based on sectoral classification can generally be claimed to lead to distortions in certain cases, as corporations may have several profiles that involve completely different sectors of industry.

In the case of products with a basic design linked to sustainability objectives, the application of the aforementioned methodologies requires due care. Regarding green bonds, *Mihálovits and Tapaszti* (*2018*) provided a comprehensive description on the difficulties and possibilities of quantifying the environmental benefits of this design. The authors also suggested that the environmental impact related to a specific project could be measured by quantifying the reduction of pollutant emissions, but a generally accepted indicator has not been published yet, despite several initiatives.

In addition to individual financial instruments, climate change also has a significant impact on the financial system as a whole. Climate risk stress tests simulated for complex scenarios are able to clearly demonstrate the effects of climate risks on the stability of the financial system. Climate risk stress tests can be carried out by means of macroeconomic models based on statistical-econometric methods, as it is essential to consider the complex interactions between environmental considerations, energy use and economic processes in the analyses (*Boros 2020*). Furthermore, according to *Battison et al.* (*2017*) and *Roncoroni et al.* (*2021*), the CPRS classifications mentioned above may be easily applied as input data in climate risk stress tests.

The analyses and methodologies mentioned above share the common feature of quantifying the climate risk exposure of sectors/portfolios based on the GHG intensity data published by Eurostat. Due to the fact that during the production of the data, emissions are accounted for in the sector where they actually enter the atmosphere, the results only include emissions that belong to the category of Scope 1. Therefore, it may occur that the approaches do not provide a comprehensive

quantification of transition risks and thus distort reality, as they ignore indirect emissions created during the whole course of the supply chain. The real estate development sector may serve as a good example for this: it has insignificant current emissions as the resources and emissions are used at an earlier stage of the supply chain, starting from the extraction of raw materials to produce cement (*Resch et al. 2020*).

3. Indirect and direct emissions in the measurement of climate risks

3.1. Data used

In our analysis, the ranking of sectors was primarily carried out based on their direct (Scope 1) GHG emissions. To set up the ranking, we relied on Eurostat's database widely applied in regulatory practice, which commonly classifies economic activities into sectors based on the NACE Rev2 code (*Eurostat 2008*). Based on the NACE Rev2 classification, 21 sectoral categories with different letter codes were created. The GHG emissions of each sector were quantified using Eurostat's GHG emission data[11] available since 2008 in an annual breakdown for each sector. Since during the compilation of Eurostat data, GHG emissions are accounted for in the sectors they are actually released into the atmosphere, direct emissions were quantified based on these data. GHG emissions were quantified for Hungary (in tons) based on the data published in the first quarter of 2022.

In order to quantify indirect impacts, we used the EORA26 database, which publishes input-output tables and environmental indicators for the period 1990–2015, with regard to 189 countries and 26 sectors. EORA26 derives data on final demand from the national accounts of each country, the gross value of output, intermediate consumption data and value added from the national accounts of the UN database, and commercial data from the UN ComTrade database (*Lenzen et al. 2012, 2013*).

Table 2 presents an overview of the sectoral activities that were taken into account during the sectoral ranking in the analysis. 19 sectors were compared based on the sectoral classification of Eurostat, and 26 sectors based on EORA26.

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[11] GHG= CO2 + N2O(CO2eq) + CH4(CO2eq) + HFC(CO2eq) + PFC(CO2eq) + NF3(CO2eq) + SF6(CO2eq)

Table 2
Summary table of sectors used in the analysis

Sector (Eurostat)	Sectors (EORA26)
A – Agriculture, forestry, fishing (agriculture)	Agriculture
B – Mining and quarrying	Fishing
C – Manufacturing	Mining and quarrying
D – Electricity, gas, steam and air conditioning supply	Food industry
	Electricity
E – water supply; sewerage, waste management and remediation activities	Wood and paper industry
	Manufacturing of textiles and wearing apparel
F – Construction	Metal industry
G – Wholesale and retail trade; repair of motor vehicles and motorcycles	Manufacture of machinery
	Vehicle manufacturing
H – Transportation and storage	Repair and Maintenance
I – Accommodation and food service activities	Construction
J – Information and communication	Retail
K – Financial and insurance activities	Wholesale
L – Real estate activities	Petroleum refining industry
M – Professional, scientific and technical activities	Public administration
N – Administrative and support service activities	Transportation
O – Public administration and defence, compulsory social security	Education
	Financial intermediation and Business activities
P – Education	Post and telecommunications
Q – Human health and social work activities	Recycling
R – Arts, entertainment and recreation	Catering industry
S – Other service activities	Other manufacturing
	Households
	Reexport & Reimport
	Other

Source: Eurostat, EORA26

It is necessary to highlight that the sectoral classification of the EORA26 database and the NACE Rev2-code-based Eurostat database cannot be considered identical, but each sector's contribution to GHG emissions can be quantified with both databases, and so the comparison of results can be carried out based on the ranking of their share of emissions.

3.2. Methodology

The direct and indirect resource requirements of each product and service were calculated with the help of EE-MRIOT (*Tukker et al. 2013; Wood et al. 2015; Stadler et al. 2018; Dombi et al. 2018*). By converting the intermediate production matrix of the EE-MRIOT to a Leontief inverse, the aggregate resource requirement and emissions of all final demands (consumption, investment, public purchasing, exports) can be calculated, leading to a so-called footprint indicator, which can be matched to Scope 3 emissions regarding GHG emissions.

This step identifies the values of total emissions associated with the products and services of each sector, regardless of the stage in the supply chain that they are

generated at. Comparing these values with direct emissions also reveals indirect GHG emissions that are essential to the creation of a sector's outputs but cannot be measured directly in that sector. Several databases of these types are freely available. For our calculations, we used the EORA26 tables available disaggregated for 26 sectors, with global coverage for the period 1990–2015.

$$x = (I - A)^{-1} \cdot y \tag{4}$$

$$M = L_{GHG} \cdot y_i \tag{5}$$

where:

• x is the gross value of output,

• I is the identity matrix,

• A is a matrix describing the direct relationship among the sectors,

• y_i is the type of final demand (consumption, gross fixed capital formation, changes in inventories, government purchases and exports),

• L_{GHG} is the Leontief inverse matrix.

The Leontief inverse matrix comprises both direct and indirect monetary relations among the sectors. The next step is the calculation of the total emissions (M) of the sectors by including any environmental indicator. We chose GHG emissions for our analysis, which was multiplied by the final demand (*Steen-Olsen et al. 2016; Schaffartzik et al. 2014*). Among others, environmental indicators include the use of water, land and natural resources, measured in mass. In our calculations, the total final demand was taken into consideration.

3.3. Results

In order to identify potential differences arising from the application of various methodologies, we first quantified the GHG emissions of each sector based on Eurostat's GHG emissions data. The climate risk of each sector was measured by the ratio of the respective sector's contribution to total GHG emissions.

The ranking of the sectors based on their direct emissions is presented in Figure 2. If we take only the direct (Scope 1) emissions into account, the results show that sector D – Electricity, gas, steam and air conditioning supply sector contributes the most to the total GHG emissions with 12.09 Mt emissions (24 per cent), followed by sector C – Manufacturing industry with emissions of 11.64 Mt (23 per cent). The three largest emitters (D-C-A sectors) account for 66 per cent of total direct emissions.

Figure 2
Share of each sector in direct (Scope 1) GHG emissions based on annual data for 2021

Source: Edited on the basis of Eurostat data
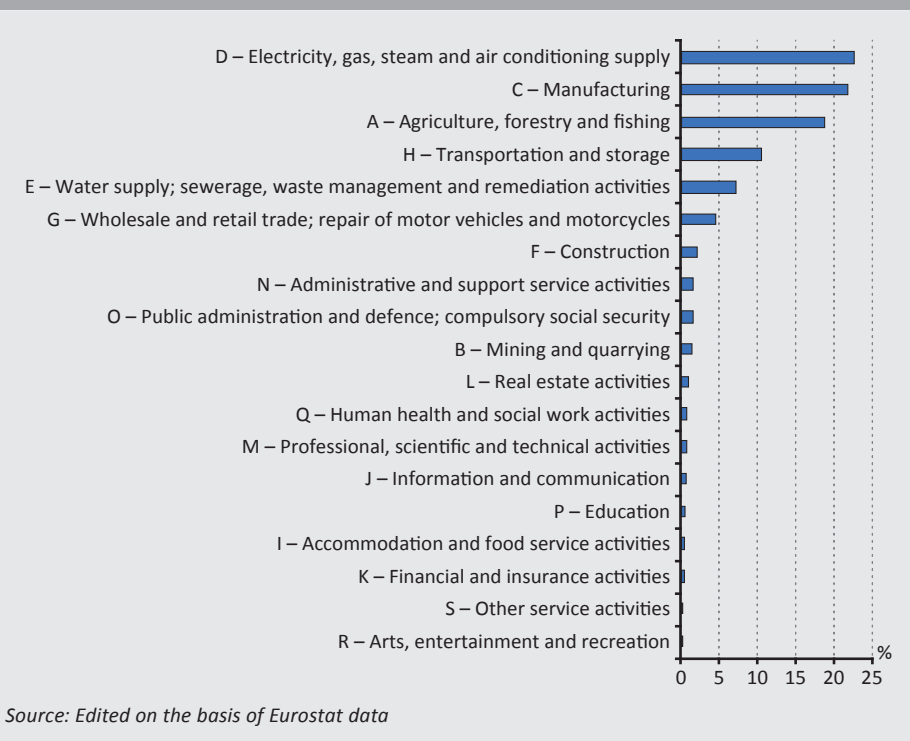
After the quantification of direct impacts, we applied EE-MRIOT based on the EORA26 database to quantify the total (direct and indirect) GHG emission of the sectors and we determined their contribution to total emissions. The ranking of the sectors based on our calculations is presented in *Figure 3*. Examining the overall ranking of emissions by sector, the food & beverages is responsible for the largest emission, followed by the electrical and machinery, agriculture, petroleum and the construction industry. The five largest emitters account for 60 per cent of the total emissions. Although the years of the results, which include indirect emissions as well, do not match with the ones observed in the MNB report, the economic structure has not changed in essence. Among the sectors significant in terms of total emissions, the share of agriculture and the manufacturing industry was each 10 per cent lower in GDP in 2021, while the share of trade and automotive manufacturing increased by 15 per cent. The sectors involving high climate risks are not affected at all by the seasonal effect.

Figure 3
Total share of each sector (Scope 1, 2, 3) in GHG emissions based on annual data for 2015
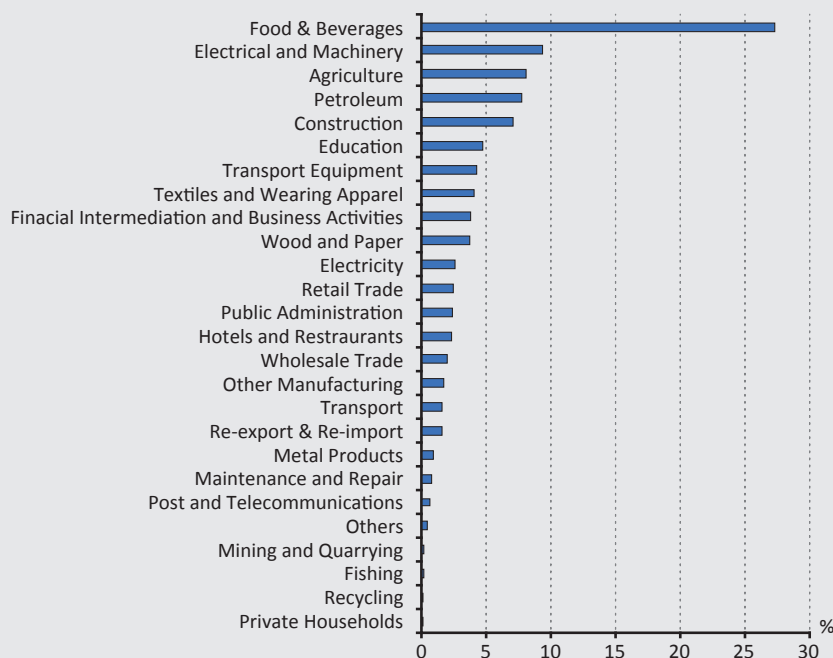
Source: Edited on the basis of EORA26

The agriculture is considered major emitter based on both the direct and total emission rankings. Regarding the construction industry, the contribution to direct GHG emissions of 2.15 per cent (1.1 Mt) is combined with a total emission share of 7 per cent.

In addition to ranking sectors, it is worth examining the sectoral distribution of Hungarian financial asset portfolios, which provides a comprehensive picture of the transition risks of existing portfolios. Based on the MNB's TCFD report (*MNB 2022a*), regarding the Funding for Growth Scheme, about HUF 540 billion was related to trade and vehicle repair, around HUF 420 billion to real estate activities and roughly HUF 370 billion to the manufacturing industry, out of the loan portfolio of HUF 2,535 billion outstanding at the end of 2021. With respect to the Bond Funding for Growth Scheme, out of the total portfolio of HUF 1,550 billion, some HUF 370 billion of exposure can be identified in the manufacturing industry, approximately HUF 200 billion of exposure in the construction industry, and about HUF 150 billion of exposure in the category of real estate activities. The MNB also carried out the carbon footprint analysis of the fiscal expenditure (Scope) of the general

government (*MNB 2022a*). Sectors characterised by high direct expenditure typically do not receive significant central funding, but based on our results, the climate exposure of education, trade and housing activities is presumably higher than their exposure reported by the MNB.

Based on the currently applied methodologies, the transition risks of asset portfolios and the carbon intensity classification of the sectors are quantified using direct emissions data, so that exposures related to real estate, construction and machinery manufacturing and repair are assigned to lower risk categories, even though they may incur significant risks based on their total emissions. Therefore, it is reasonable to assume that if we take indirect GHG emissions into account in the calculation of the currently applied WACI metric weighted with exposure, the carbon intensity value and risk classification of the respective asset portfolios will change significantly.

It should be noted that emissions created from sectoral operations can be identified by ranking total emissions, and with their application, respective risk assessment methodologies may provide a more comprehensive picture of each sector's contribution to the actual environmental impact. For the methodologies used to assess the climate risk of each sector, and thus to support or penalise economic activities through supervisory or governmental support, it is recommended to extend the calculations beyond direct impacts to indirect emissions created during the whole operation.

4. Summary

Adequate management of climate risks in the financial markets is receiving more attention from both market players and supervisory authorities. Our study provides an overview of methodologies currently applied to identify and measure climate risk exposures. With respect to Hungarian and international practices, it can be said that the MNB supports the market adoption of international regulatory requirements and recommendations in several ways, and it analyses the potential effects of the measures in its reports, which are published regularly. In this dynamically changing regulatory environment, it is essential to publish analyses related to the methodologies applied, as due to the lack of a commonly accepted practice, the current aim is to create the best market practices.

Regarding the methodologies measuring transition risks, we can claim that they typically take direct emissions into account, or indirect emissions created by the operation or proprietary units at most. The importance of taking the total of indirect impacts into account is further underlined by the regulation of the European Banking Authority issued in 2022, which requires the market players involved to measure and disclose Scope 3 emissions from 2024. However, when

quantifying GHG emissions, it is often difficult to access the data, especially in the case of Scope 3 emissions. At the moment, 36 per cent of Hungarian banks quantify emissions belonging to the category of Scope 1, 32 per cent of them quantify emissions in Scope 2 category, and less than 10 per cent of them quantify emissions in Scope 3 category. However, in order to provide sustainable operations, establish strategies and reduce climate risks, it is imperative for institutions to be able to appropriately measure emissions created during their own operations, and the climate risks of instruments and investments funded by them. In addition to the proper measurement of emissions, moving in the direction of carbon neutrality also requires the disclosure and publication of information. Hungarian institutions, however, only publish emission data related to their own operations, and the introduction of emission-related disclosures of funded instruments and investments has not been carried out. Nonetheless, the EORA26 database, which was used in our analysis and is available to the public free of charge, and the methodology presented may provide help and serve as a starting point for market players to develop disclosures and thus comply with regulatory requirements.

In the next step of the research, we need to recalculate certain indicators together with indirect impacts, in order to properly identify carbon intensive sectors and exposures, and thus point out the differences created by the application of various emissions categories with respect to several asset classes. In the future, the results of further analyses may serve as a basis for the development of methodologies that supervisory authorities apply, and the expansion of the Green Monetary Policy Toolkit Strategy and the Green Capital Requirement Allowance Programme. Prospectively, we also suggest analysing indirect emissions at a corporate level, establishing and promoting the so-called hybrid LCA-IO models, which combine the advantages of the two approaches (corporate, product, service and macro-level sectoral analysis).

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Fair Value of Retail Loans: Are We Following IFRS9 or Misinterpreting It?*

Éva Gulyás – Márton Miklós Rátky

This study examines the accounting treatment applied to retail loans using a multiplication factor of 1.3. Answers are sought to the following questions: What is the correct IFRS accounting treatment of loans with a 1.3 multiplication factor in their interest rate, which have appeared in the Hungarian banking sector since 2016? Does the sector report these loans correctly? Is there a possibility for substance-based accounting treatment? How does the different accounting treatment of identical loan types affect the comparability of banks' financial statements? After discussing the results from the literature and presenting the main features of the loans under review, the methodology of the study is described, before turning to the dilemmas and consequences of the accounting treatment. In this context, the IFRS requirements applicable when choosing the measurement principle for the loans concerned are also analysed. After drawing the conclusions, the paper argues in favour of measurement at amortised cost.

1. Introduction

This study examines the possible accounting treatment applied to retail loans using a multiplication factor of 1.3 in their interest rate, proposing a solution for the method that is considered correct by the authors.

The problem can be attributed to the introduction of IFRS 9[1] in 2018, the requirement to use IFRS for standalone financial statements and the proliferation of such loans in Hungary. This is because IFRS 9 abandoned the requirement of the

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[1] IFRS 9 – *Financial Instruments.* https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02008R 1126-20220101&from=EN. Last downloaded: 5 August 2022.

previous accounting standard (IAS 39) that the originated loans be measured at AC,[2] where the accounting treatment reliably reflected the characteristics of a basic loan agreement as well as the related estimates of the managers. The new standard introduced a requirement to classify these assets, and today the measurement of financial instruments can only occur on the basis of the measurement principle, either AC or FVTPL,[3] which depends on the outcome of the classification, and even loans with the same characteristics may be recognised with a different measurement principle in financial statements, which can alter the range of conclusions that can be drawn from the statements as well as their interpretation.

The entry into force of IFRS 9 in itself would not have affected the entire Hungarian banking sector, but according to Section 9/A of the Accounting Act[4], all credit institutions must prepare their standalone financial statements in accordance with IFRS, and therefore the rules apply to not only the medium-sized and large banks which were already required to draw up their group financial statements under IFRS, but to the whole sector (*Tarpataki et al. 2022*).

Along with the changes in accounting regulations, the amount and volume of such loans increased considerably, and thus the financial statements of the banking sector can be significantly influenced by differences in measurement. In recent years, the companies that perform the audits for banks have held conflicting views about outcome of the classification of subsidised loans under IFRS 9, and consequently the same loan categories were reported differently in banks' financial statements. This became even more pronounced due to the auditor rotation introduced by the Audit Reform, and there were numerous instances when the old and the new auditor classified such loans differently. Due to the requirement to use different measurement principles,[5] this sometimes entailed the revision of the financial statements published earlier.

After formulating the research questions, the Hungarian and international literature on the topic is presented, including the legal provisions pertaining to loans, the IFRS requirements and the related studies. The research methodology is then described, before turning to a detailed discussion of the dilemmas and consequences of the accounting treatment, taking a look at the content of the different requirements, interpreting the concepts used in them, highlighting the "legislator's" intentions, and stating the authors' opinion as a way of summarising the previously established findings.

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[2] AC = Amortised cost
[3] FVTPL = fair value through profit or loss. The fair value through other comprehensive income (FVTOCI) measurement could only be used for the combination of the above-mentioned classification and a business model that is not typical of loans.
[4] https://net.jogtar.hu/jogszabaly?docid=A0000100.TV
[5] Of course, institutions are not required to change the measurement principles picked by them based on the auditor's opinion. If the difference caused by the different measurements remains below the materiality threshold, a revision may not be necessary.

Answers are sought to the following questions: What is the correct IFRS accounting treatment of loans with a multiplication factor of 1.3 in their interest rate, which appeared in the Hungarian banking sector in 2016? Does the sector calculate them correctly? How different are financial and economic content and form, and is there a possibility for substance-based accounting treatment? How does the different accounting treatment of the same loan types affect the comparability of banks' financial statements?

2. Overview of the relevant requirements and the literature

2.1. Requirements pertaining to loans

The study looks at the following state-subsidised[6] retail loans:

• *Prenatal baby support loan* – the interest rate is the five-year government bond rate multiplied by a factor of 1.3 plus 2 percentage points (or 1 percentage point in the case of loans originated after 29 April 2022). The loan is interest-free for customers, unless they fail to meet the conditions of the loan, which makes the transaction interest-bearing retroactively, with an interest premium of 5 per cent (or 4 per cent in the case of loans originated after 29 April 2022). If the number of children undertaken is fulfilled, the interest is paid in full by the state instead of the customer. The loan has only been available to households, since the second half of 2019. These are general-purpose loans, with the collateral provided by a state guarantee, the cost of which is borne by the customer.

• *HPS[7]* – the interest rate is the five-year government bond rate multiplied by a factor of 1.3 plus 3 percentage points. Customers pay a 3-per cent interest rate, while the rest is covered by the state. The loan has been available to households since 2016. It is not to be confused with the non-refundable HPS. The collateral is the mortgage of the property for which the loan is taken out.

• *Home renovation loan* – the interest rate is the five-year government bond rate multiplied by a factor of 1.3 plus 3 percentage points. Customers pay a 3-per cent interest rate, while the rest is covered by the state. The loan has been available to households since 2021. The loan aims to complement the own contribution of the non-refundable home renovation subsidy and create a cover for it. The collateral is the mortgage of the property.

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[6] Unless otherwise indicated, the findings here pertain to the situation prior to the publication of Government Decree No. 150/2022 modifying the reimbursement of certain affected products and the interest premium of the prenatal baby support loans, published in the Hungarian Gazette on 14 April 2022. *(150/2022. (IV.14) Korm. Rendelet az állam által fizetett költségtérítéssel kapcsolatban egyes kormányrendeletek módosításáról* (*Government Decree No. 150/2022 (IV.14.) on amending certain government decrees related to the reimbursement paid by the state*): https://njt.hu/jogszabaly/2022-150-20-22.) Downloaded: 14 April 2022.
[7] Home Purchase Subsidy

One common feature of the loans under review is that their interest rate is set by multiplying the reference rate by 1.3, and that some or all of the cash flow to be paid back is covered by the state instead of the customer.

In connection with the accounting treatment of the state-subsidised loans provided to households, the question is how to classify such loans (those with a multiplication factor of 1.3) under IFRS. This is key because different classifications yield different measurements, which can materially influence the profit or loss of credit institutions.

2.2. IFRS 9 requirements

Pursuant to IFRS 9, the measurement principle of financial instruments is determined by two factors, the business model and the SPPI[8] test. With respect to the latter, it must be established whether the contractual cash flows of the given transaction are solely payments of the principal and the interest on the principal amount outstanding, and do not contain "contractual terms that introduce exposure to risks or volatility in the contractual cash flows that is unrelated to a basic lending arrangement, such as exposure to changes in equity prices or commodity prices".[9]

If the financial instrument does not have contractual cash flows (e.g. equity instruments), the given asset is automatically measured at FVTPL, although the standard also allows for measurement at FVTOCI, subject to an irrevocable election. However, the loans under review here are debt instruments, where the assessment of the SPPI test is essential, because if the contractual cash flows include factors other than the principal and the interest, it is no longer necessary to examine the business model (*Gulyás 2019*).

Under IFRS 9, interest is solely the time value of money, coverage for credit risk, the related direct costs and the profit (*Háda 2018*). The content of the loan contracts under review requires debtors, or the state, to pay only the principal and the interest, although the percentage and amount of the interest is determined in an unusual manner. The interest on such loans is 1.3 times "the arithmetic mean of the yields of the government bonds with a nominal maturity of 5 years, as published monthly by the Hungarian Government Debt Management Agency based on the auctions in the three months preceding the publication date, weighted by the amounts accepted at the given auctions",[10] plus an interest rate of 1, 2 or 3 per cent, depending on the type of loan. The state takes over the variable portion of the interest for all loans, and in the case of the prenatal baby support loans it takes

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[8] SPPI = Solely Payment of Principal and Interest
[9] *IFRS 9 B4.1.7A*
[10] *44/2019. (III.12) Kormányrendelet a babaváró támogatásról,* 10.§ (4). [*Government Decree No 44/2019. (III. 12.) on Prenatal Baby Support*, Section 10(4)]. https://net.jogtar.hu/jogszabaly?docid=a1900044.kor. Downloaded: 14 April 2022.

over the entire interest. In the case of a business model to collect cash flows,[11] if these loans did not include a multiplication factor of 1.3, they would have to be measured at AC under IFRS 9.[12]

When this measurement principle is used, changes in the fair value of the loan portfolio do not affect banks' profit or loss, because that only contains the loans' interest income calculated with the effective interest rate and impairment costs. If the loans are measured at fair value (FVTPL) due to the multiplication, the change in their value is reflected in the profit or loss, which can thus become more volatile, modifying the understandability and usefulness of the financial statements.

In connection with the interest, the IFRS 9 classification test (hereinafter: SPPI test) requires the interest rate not to contain leverage. Therefore, in the case of the loans under review, the most important question is the classification of the 1.3 multiplication factor, because according to the standard, the interest rate can only contain consideration for the time value of money, credit and liquidity risk, lending costs and the profit margin of the lender. Regarding the 1.3 multiplication factor, it is often argued that if it is considered leverage, then all loans that contain a multiplication factor immediately fail the SPPI test, and this means that these instruments should not be measured at amortised cost, but rather at fair value (FVTPL), irrespective of the business model.

Contractual cash flow characteristics were also addressed by the IASB[13] after IFRS 9 entered into force, finding that revisions may be needed to ensure a straightforward application of IFRS 9 classification rules. The product types under review here were examined with respect to the problems in the regulation of classification and state-defined interest rates (*IASB[14] 2022*). The IASB can bring the matter before the IFRS Interpretations Committee (IFRIC) to see whether an interpretation should be published on the issue. But this would only happen if it affected a considerable volume of loans globally, and this is currently not the case.

2.3. International studies on the SPPI test

Although the above instruments containing a multiplication factor are only characteristic of a few countries, implementation of the SPPI test and the assessment of its usefulness has also been discussed in other jurisdictions.

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[11] *IFRS 9, B4.1.1-6*
[12] *IFRS 9, B4.1.7-14, B4.1.18*
[13] IASB (2014): *Project summary – IFRS 9 Financial Instruments*. International Accounting Standards Board. https://www.ifrs.org/-/media/project/fi-impairment/ifrs-standard/published-documents/project-summary-july-2014.pdf. Downloaded: 7 April 2022.
[14] IASB (2022): AP3A: *Contractual cash flow characteristics, Chapter D* (https://www.ifrs.org/content/dam/ifrs/meetings/2022/april/iasb/ap3a-ccfc.pdf). Downloaded: 15 December 2022.

PwC (*2017*) also looked at the issue, although it failed to mention the Hungarian problem in particular in the part on state regulation, but analysed a loan with a multiplication factor of 2.4 on the reference rate, and also referenced certain Brazilian and Chinese loans. The authors find that such loans would probably fail the SPPI test, but it is also possible that the factors do not produce cash flows that have different characteristics than the interest rate, if the cash flows do not lose their interest-type nature on account of an appropriately low multiplication factor. The authors also mention the exception rule pertaining to leveraged interest rates set by the state and declare that an appropriately low leverage may result in passing the SPPI test. However, "appropriately low" is yet another qualitative assessment criterion.

Gope (*2018*) and *Filipova-Slancheva* (*2017*) both establish that financial instruments measured at AC usually contain loan receivables with basic features, although neither of them go into detail about what they mean by basic features. Both of them expected that a change in classification conditions would have a major impact on the banking sector. *Filipova-Slancheva* (*2017*) maintains that one of the main features of the instruments measured at AC is the flexible repayment schedule, containing more than one option, noting that passing the SPPI test can be proven through further analysis. She argues that failing the SPPI test can result from the option to change the currency during the tenor, non-interest-bearing and non-repayable features, as well as features that allow/require a change in interest linked to factors other than credit risk, although these are not specified in detail, and some of her views, for example that interest-free loans necessarily fail the SPPI test and that the conversion of unpaid interest into principal breaches the SPPI, are not shared by this paper's authors. Some of the central features of prenatal baby support loans, such as the option for multiple outcomes and the flexibly modifiable repayment schedule, are considered by her to be features of instruments that typically pass the SPPI test. Filipova-Slancheva does not argue for or against the conditions entailing extra volatility.

Ercegovac (*2018*) examined whether a EUR 10 million loan with an interest rate linked to the 6-month EURIBOR and monthly repricing and repayment passes the SPPI test. Based on both the actual historical interest rates and the forward theoretical benchmark rates, Ercegovac concluded that the loan under review passes the test, because the difference is no more than 5 per cent of the total nominal value of the loan, and so classification and measurement can occur at AC. Ercegovac also points out the effect of the change in classification that goes beyond accounting, namely that in the case of banks using transfer pricing, origination of loans measured at FVTPL may decline due to the structural cost of equity, and the portfolio may be realigned.

Popescu and Ionescu (*2019*) performed a similar analysis of a scenario where the time value of money is not perfectly reflected in the interest rate of a given financial instrument because that could make the cash flows of the instrument fail the SPPI. The instrument analysed by them was a loan disbursed in 2005, with an explicit tenor of 12 years and an interest rate of the 3-month EURIBOR+2.5 per cent, with a monthly repricing, variable interest rate. If the repricing period and the period of the benchmark rate are not identical, entities need to assess qualitative and quantitative factors to test whether the modified cash flows are significantly different from the original ones. The authors underline that the examination should yield the same results for the individual reporting periods and the entire tenor, and the significance level must be determined for each and every instrument. The authors found that the difference between the modified cash flows of the instrument under review and the original cash flows was within 4 per cent, but they did not express an opinion on classification and measurement.

Lejard (*2016*) also considers the introduction of the SPPI test a key element of the implementation of IFRS 9, and he expected an increase in the share of FVTPL instruments and in the volatility of profit or loss, which he believed would have run counter to the objectives of IFRS 9. However, his results contradicted the rise in the share of such assets, because he found that in the case of the banks under review, the share of the FVTPL portfolio, whether measured in this manner by requirement or choice, diminished, while the proportion of investments measured at AC rose. His study does not concern the implementation and content of the SPPI test, but it shows that FVTPL debt instruments do not account for a significant share in bank portfolios. This tallies with the finding of *Ercegovac* (*2018*), who estimates that the share of hybrid instruments, in whose case IAS 39 stipulated that embedded derivatives should be separated and IFRS 9 would yield a failed SPPI test, is 0.1 per cent based on data from the European Banking Authority.

According to *Ha* (*2017*), interest caps and floors suggest hybrid instruments that yield a pass on the SPPI test and thus measurement at AC. In Ha's view, securities protected against inflation do not fail the SPPI under IFRS 9, since inflation is not leveraged and the principal is protected. By contrast, certain government securities, such as American FRNs[15] and Japanese government bonds that are reset every six months to the 10-year rate, may not pass the SPPI test, because the time value of money is not perfectly reflected in them. Of course, the main issue here is still the significance level of the benchmark test results (see also *Ercegovac 2018*; *Popescu – Ionescu 2019*), in other words materiality.

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[15] Floating-rate notes: two-year bonds reset every week to the quarterly rate.

One common finding of all of these studies is that one cannot automatically formulate an opinion on passing the SPPI test based on the presence or absence of certain contract characteristics; further analysis is necessary, which will be performed in *Section 4* of the present paper. To avoid repetition, some studies and rules are discussed in *Section 4*, along with the arguments related to them.
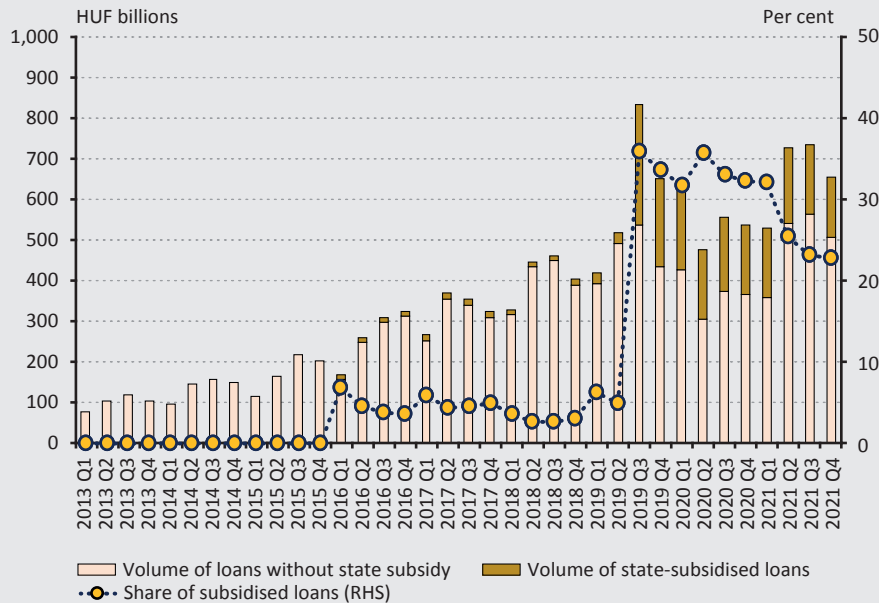
3. Analysis methodology

The analysis uses both qualitative and quantitative methodologies. The IFRS 9 classification requirements are compared to the relevant literature and the justifications in the financial statements under review. The legal provisions pertaining to the instruments as well as their economic content is also taken into account here. The interpretation of IFRS 9 requirements is examined from various aspects and viewpoints, before drawing the conclusions. On the other hand, the analysis also focuses on the structure of the financial statements under review, along with the amounts published in them and the relative share of assets. This method is used to present the differences arising from the varying interpretation of the SPPI test, and to point out the need for a uniform measurement. The appropriateness of the classification decision is assessed by looking at whether the loans under review truly have leverage or some other exposure unrelated to lending. The true economic content of the multiplication factor is then examined, along with how the transactions would be classified under the IFRS framework and what exception rules are available for modifying earlier analysis results. The various angles of the analysis allow the authors to state their opinion at the end.

4. Analysis and results

### 4.1. The significance and types of the loans concerned

Within the new retail customer loans originated by the banking sector, state-subsidised loans had a share of 3–34 per cent in the years when the subsidies were granted (2016–2022) (*Figure 1*). Out of the subsidised retail loans of around HUF 2,100 billion disbursed in the six years between 2016 and 2021, the volume of prenatal baby support loans was HUF 1,600 billion, while HPS loans amounted to roughly HUF 500 billion.

Figure 1
Retail loans originated in the Hungarian banking sector, by quarter

Note: Composition of outstanding lending to the household sector MNB, 2022. https://www.mnb.hu/
letoltes/a-haztartasi-szektor-reszere-nyujtott-hitelallomany-osszetetele.xls. Downloaded: 1 March
2022.

It can be seen that among subsidised loans, the prenatal baby support loan is especially popular and accounts for a growing share within total outstanding debt. The stock of these loans had reached HUF 1,569 billion by the end of 2021, representing 16.6 per cent of households' total outstanding borrowing, and within consumer credit these loans account for as much as 40 per cent of the total (*Figure 2*).

Figure 2
Volume and share of prenatal baby support loans at the end of each month

Volume of prenatal baby support loans
Share of prenatal baby support loans amongst all consumer loans (RHS)
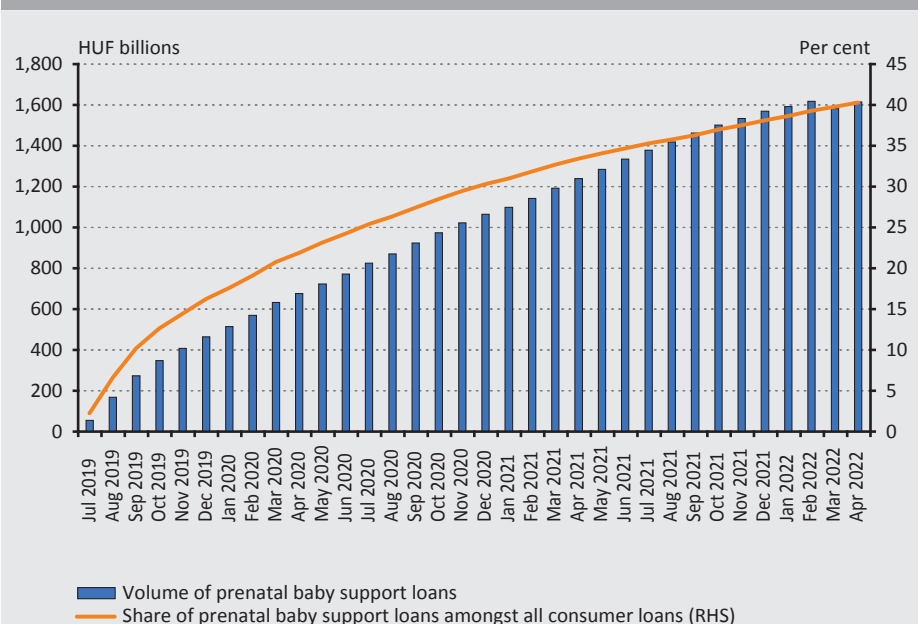
Source: MNB

4.2. Representation of loans with a multiplication factor in financial statements

The topicality of the issue comes from the fact that in its 2020 financial statements, *OTP Bank*, the Hungarian bank with the largest holdings of prenatal baby support loans and HPS loans, reclassified such loans from AC measurement to FVTPL measurement.[16] This reclassification may have been triggered by the compulsory auditor rotation at the bank, because in 2021 its audits were taken over from Deloitte by Ernst & Young, and while the former allowed the loans with a multiplication factor to be measured at AC, the latter does not. In 2021, *MKB,*[17] which had previously measured these loans at AC, also reclassified them, as well as *Takarékbank*[18] and *UniCredit,*[19] with a similar justification and also prior to the change of auditor.

The nine largest market participants in the Hungarian banking sector (as at end-2021) account for more than 95 per cent of the Hungarian banking sector's total assets. The financial statements mentioned here (*Table 1*) show that the banks

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[16] *2020 standalone financial statements.* OTP Bank, 2021
[17] *2021 standalone financial statements.* MKB Nyrt., 2022
[18] *Decisions of the general meeting of Takarékbank Zrt. on 26 April 2022.* Takarékbank, 2022. https://kozzetetelek.mnb.hu/downloadkozzetetel?id=687917&did=K177261/2022. Downloaded: 27 April 2022.
[19] *2021 standalone financial statements.* UniCredit Bank, *2022*

audited by Deloitte were the ones that did not have a major FVTPL loan portfolio (MKB, OTP, Takarékbank, UniCredit). During the auditor rotation, loans with a multiplication factor in the financial statements audited by the former auditor were restated and reclassified from AC to FVTPL. Additionally, *Budapest Bank* started recording the interest of FVTPL loans within interest income in 2021, just like the other banks.[20]

Based on the justification of financial statements, the affected loans were often classified in the fair value category because they failed the SPPI test due to the 1.3 multiplication factor. The data also show that the change in the fair value of the loans with a multiplication factor can significantly influence profit or loss. Despite the shift in measurement principles, the profit after tax and total assets typically did not change in the year of restatement, which suggests that the fair value of the affected loans was probably the same as the AC version.

Table 1

Relevant data of large banks in Hungary

	OTP				K&H			UniCredit			
Year	2021	2020	2019 (restatement)	2019	2021	2020	2019	2021	2020 (restatement)	2020	2019
Auditor	EY	Deloitte*	Deloitte	Deloitte	PwC	PwC	PwC	Deloitte*	Deloitte	Deloitte	Deloitte
Total assets (HUF millions)	13,710,471	11,154,394	10,138,884	10,138,884	N/A	4,416,727	3,554,179	4,580,538	4,083,938	4,084,042	3,416,391
AC loans / total assets (%)	29.4	30.6	30.3	32.4	N/A	64.8	64.7	36	40	42.3	44.2
FVTPL loans / total assets (%)	4.8	4.3	2.4	0.3	N/A	3.2	1.9	1	1	0.1	0.2
Customer loans presented together?	yes	yes	yes	N/A	N/A	yes	yes	yes	yes	N/A	N/A
Profit after tax (HUF millions)	125,339	92,474	193,354	193,354	N/A	32,453	50,414	42,655	32,600	31,953	49,060
Change in FV of FVTPL loans / Profit after tax (%)	10.1	−2.3	N/A	1.0	N/A	16.2	3.0	0	−3	N/A	N/A
Interest of FVTPL loans within interest income?	yes	yes	yes	N/A	N/A	yes	yes	yes	yes	N/A	N/A

	Erste				Raiffeisen			Takarékbank			
Year	**2021**	**2020**	**2019** (restatement)	**2019**	**2021**	**2020**	**2019**	**2021**	**2020** (restatement)	**2020**	**2019**
Auditor	PwC	PwC	PwC	PwC	KPMG*	KPMG	KPMG	Deloitte*	Deloitte	Deloitte	Deloitte
Total assets (HUF millions)	N/A	3,620,880	N/A	2,862,137	N/A	3,202,846	2,598,544	3,233,914	2,804,940	2,804,940	2,167,752
AC loans / total assets (%)	N/A	41.0	N/A	49.1	N/A	44.3	47.3	49	52	42,3	65,3
FVTPL loans / total assets (%)	N/A	5.8	N/A	3.9	N/A	2.1	1.3	7	6	0.1	0.1
Customer loans presented together?	N/A	no	N/A	no	N/A	yes	yes	yes	yes	N/A	N/A
Profit after tax (HUF millions)	N/A	18,906	N/A	55,537	N/A	12,939	20,831	−1,252	−10,780	−10,780	−9,849
Change in FV of FVTPL loans / Profit after tax (%)	N/A	−11.6	N/A	−0.7	N/A	7.0	3.1	13	9	N/A	N/A
Interest of FVTPL loans within interest income?	N/A	yes	N/A	yes	N/A	yes	yes	yes	yes	N/A	N/A

	MKB				CIB			Budapest Bank			
Year	**2021**	**2020** (restatement)	**2020**	**2019**	**2021**	**2020**	**2019**	**2021**	**2020** (reclassified)	**2020**	**2019**
Auditor	Deloitte*	Deloitte	Deloitte	Deloitte	EY	KPMG*	KPMG	KPMG*	KPMG	KPMG	KPMG
Total assets (HUF millions)	3,320,182	2,792,636	2,792,636	1,772,456	2,793,321	2,415,669	2,009,416	2,490,210	2,169,407	2,169,407	1,515,148
AC loans / total assets (%)	34.6	38.2	39.6	52.1	41.4	46.7	50.4	44.4	45.0	45.0	59.0
FVTPL loans / total assets (%)	1.6	1.5	0.0	0.1	2.9	2.4	1.3	2.3	1.9	1.9	1.6
Customer loans presented together?	yes	yes	N/A	N/A	no	no	no	yes	yes	yes	yes
Profit after tax (HUF millions)	55,916	6,232	6,232	42,012	14,171	11,519	13,981	9,639	4,346	4,346	15,998
Change in FV of FVTPL loans / Profit after tax (%)	−3.2	−5.8	N/A	N/A	−33.4	8.2	−0.3	−22.8	−4.9	−4.9	−4.9
Interest of FVTPL loans within interest income?	yes, but together	yes, but together	N/A	N/A	yes	yes	yes	yes	yes	no	no

Reclassification
FVTPL measurement
FVTPL loans recognised separately from AC
Change in FV of FVTPL loans influenced profit or loss by more than 5%.

*Note: Ranking of banks based on their 2020 total assets, *change of auditor in the next year. N/A: no data were available at the time of the analysis. OTP: 2019, 2020 and 2021 standalone financial statements; CIB, MKB and Takarékbank: 2020 and 2021 standalone financial statements; UniCredit, Raiffeisen, K&H and Erste: 2020 standalone financial statements.*

The audit firms operating in the Hungarian market held three differing views on the subject.[21] Some claimed that leverage immediately entails FVTPL measurement and there is no reason for further inspection. Other auditors took into account the rule on the interest rate set by the state (*IFRS 9 B4.1.9E*), but considered that there was a substitute product, on a market basis, that served as an alternative to the loans with a multiplication factor, so there was no state-determined interest rate, and hence the loans fail the SPPI test due to the leverage and thus need to be measured at FVTPL. A third group of firms (based on the financial statements analysed, the only such Big Four company was probably Deloitte) had previously accepted the exception rule on interest rate set by the state and thus allowed measurement at AC.

The table shows that the banks that were previously audited by Deloitte started applying FVTPL measurement for the loans, which suggests that the opinion of the affected banks and their former auditors changed in the matter, and from 2022 all large banks in Hungary recorded these loans under the FVTPL category in their financial statements, which improved the comparability of these documents.

4.3. The IFRS 9 measurement principle and its implications

If the accounting treatment of these loans does not occur uniformly at amortised cost in the banking sector, then:

• the parallel use of amortised cost and fair value measurement in the sector reduces the comparability of banks;

• estimating fair value requires the prediction future cash flows and an appropriate discount rate. In the case of prenatal baby support loans, estimating future cash flows involves huge uncertainty due to the demographic variables, and the determined fair value may not be fully reliable;

• using a measurement model built on market input is difficult because there are no market transactions, or even an active market, with these loans, they are not traded, and some cash flows come from the state (*Grósz et al. 2020*);

• although IFRS 9 generally considers the fair value through profit or loss measurement as the standard approach for financial instruments, when using FVTPL measurement, any change in the fair value actually modifies banks' profit or loss for the given period, unlike with measurement at amortised cost. While the impact of instruments measured at AC on profit or loss can be forecast well, the change in fair value is a much more complex phenomenon involving more variables, making it more difficult to estimate for an outside observer. In the case of such a huge stock of loans, this can considerably influence the annual profit or

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[21] *IASB Request for Information – Post-implementation Review of IFRS 9 Financial Instruments – Classification and Measurement.* https://ifrs-springapps-comment-letter-api-1.azuremicroservices.io/v2/download-file?path=598_29512_GborSchnerHungarianBankingAssociation_0_IFRS9Postimplementationreview_2022_01_27_HBA_signed.pdf. Downloaded: 20 March 2022.

loss of the credit institutions concerned, and forecasting based on the financial statements and explaining past events becomes more complicated for internal and external stakeholders alike;

• it becomes questionable whether the financial statements provide a faithful representation of the facts, as the different measurement principles are solely based on the divergent interpretations of IFRS 9 rules;

• in the case of long-term loans, banks would typically like to generate cash flows and profits from the interest on loans rather than from the change in fair value. If the change in fair value is incorporated into profit or loss, the picture shown about the bank will hardly reflect the entity's intentions and business model;

• the balance sheet and income statement items pertaining to the same type of instruments can be recognised on different lines of the balance sheet and the income statement, which dramatically lowers the usefulness and interpretability of the financial statements.

4.4. Leverage

If the 1.3 multiplication factor is actually not leverage, this issue is resolved, and the instruments need to be measured at amortised cost. The IFRS 9 standard does not provide a first-hand definition of leverage, it simply describes certain features and characteristics associated with it.[22] The entire accounting hierarchy of norms fails to provide a definition of leverage, so the best practices in interpretation should be followed.

Based on the accounting principle stipulating faithful representation (*Lakatos et al. 2018*), whether these loans include leverage is not a straightforward question. If the 1.3 multiplication factor is compared to the characteristics of the instruments mentioned in the standard that are known to include leverage (stand-alone options, forward and swap contracts, interest-bearing instruments indexed to an equity index), it can be seen that the creators of the standard did not use leverage in the meaning that is associated with the 1.3 multiplication factor in economics. The average leverage of such instruments is usually not 1.3 but many times 10, as "credit institutions usually offer instruments with a leverage of 10, 20 or 25 times the contract amount".[23]

The best approximation of the leverage phenomenon is the ratio of external liabilities/own capital, where own capital represents the amount risked by the owners, while external liabilities are typically a bank's stock of deposits. It is easy to see that in an economic sense the use of the 1.3 multiplication factor is not an increase in the external liabilities/own capital ratio, because own capital does not decrease and the stock of deposits remains unchanged. The higher interest income received due to the multiplication factor raises own capital through the profit after tax, so if the multiplication factor is incorporated into the interest rate, leverage is actually reduced.

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[22] *IFRS 9 B4.1.9.; B4.1.13.*
[23] *Tájékoztató a magas tőkeáttételes ügyletekről* (*Information on high-leverage transactions*). MNB, 2011. https://www.mnb.hu/felugyelet/felugyeleti-keretrendszer/felugyeleti-hirek/archiv-hirek/tajekoztato-a-magas-tokeatteteles-ugyletekrol. Downloaded: 1 March 2022.

If the 1.3 multiplication factor is not defined as leverage but as an exposure to risks or volatility unrelated to the basic lending arrangement, the (non-exhaustive) list of examples mentioned by the creators of the standard should be taken as indicative: exposure to changes in equity prices or commodity prices. Due to its characteristics, the multiplication factor in the interest rate bears no similarity to these examples.

4.5. Economic content

The 1.3 multiplication factor can also be interpreted as a pricing parameter, reimbursing the creditor for some cost, risk or profit in the interest rate.

Instruments whose cash flows are solely the payment of the principal and the interest pass the SPPI test. Pursuant to IFRS 9, interest may consist of the consideration for the time value of money, for credit risks and for other risks inherently tied to lending (liquidity, operational, administrative expenses) as well as the usual profit margin on the market. The interest rate can be broken down into the time value of money, the cost of credit risk and other costs associated with lending. If interest beyond the above is collected, it should be examined whether the interest rate of the loans includes other, undue exposure not related to lending. This can be simply refuted if the argument is accepted that the 1.3 multiplication factor is not leverage but something that helps in appropriately pricing loans.

The *MNB*[24] claims that it is wrong to assume that using any multiplication factor higher than 1 to modify a reference rate implies leverage and thus also that the interest rate loses its interest-type nature. According to the justification, the best market reference rate for state-subsidised loans would be the average yield of mortgage bonds. Since "no such index existed until December 2017, the regulatory authority determined it synthetically, based on the Government Debt Management Agency's yield multiplied by a multiplication factor established on the basis of statistical data, because using the Government Debt Management Agency's average yield without a multiplication factor would have resulted in distorted prices".[25] Accordingly, the 1.3 multiplication factor is actually not leverage but the synthetic generator of an appropriate interest rate. Therefore these loans do not contain leverage, risks unrelated to basic lending practices or exposure to volatility. The 1.3 multiplication factor simply compensates the creditor for direct costs and risk-taking.

According to the Hungarian Banking Association,[26] the best reference rate for pricing mortgage loans is not the government securities yield but a yield on mortgage-

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[24] *Az állami kamattámogatással, illetve a fair bankiszabályozással érintett hiteleket az IFRS 9 standard alatt amortizált bekerülési értéken vagy (a kamat meghatározásában szereplő szorzó miatt) valós értéken kell kimutatni?* (*Under IFRS 9, should the loans with a state subsidy or subject to fair banking regulation be recognised at amortised cost or at fair value (due to the multiplication factor in the interest rate)?*). MNB, 2018. https://www.mnb.hu/letoltes/csok.pdf. Downloaded: 15 March 2022.

[25] Ibid.

[26] *IASB Request for Information – Post-implementation Review of IFRS 9 Financial Instruments – Classification and Measurement*. https://ifrs-springapps-comment-letter-api-1.azuremicroservices.io/v2/download-file?path=598_29512_GborSchnerHungarianBankingAssociation_0_IFRS9Postimplementationreview_2022_01_27_HBA_signed.pdf. Downloaded: 20 March 2022.

backed bonds, which has historically had a premium of 30 per cent over the government securities with identical parameters. The government securities yield is considered the cost of funds, or the time value of money, while the additional amount, 0.3 times the government securities yield, is seen as a profit margin, and the rest, a fixed proportion, is stated as the compensation for all other costs in pricing.

Figure 3
Monthly averages of the five-year government securities pricing parameter published by the Government Debt Management Agency and the five-year mortgage-backed bond yield index (BMBX) published by the BSE
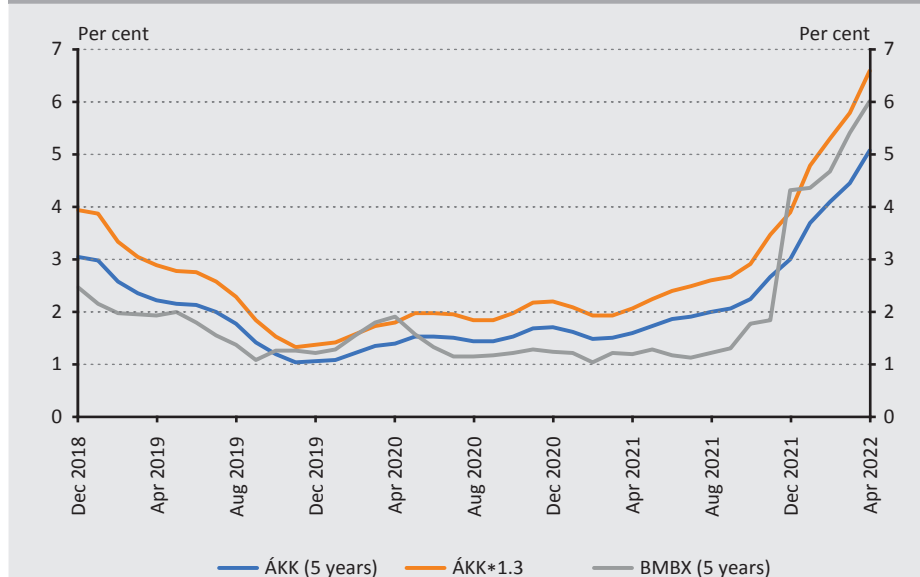
Source: BSE: Mortgage Bond Indices, https://bet.hu/Befektetok/Indexek/Jelzaloglevel-indexek-BMBX. Downloaded: 10 March 2022; Government Debt Management Agency (ÁKK): Data on interest subsidies for housing and the prenatal baby support loan – 3-month average rates. https://akk.hu/statisztika/lakascelu-kamattamogatas-babavaro-kolcson/lakascelu-kamattamogatas-babavaro-kolcson-3havi-aukcios-atlaghozamok. Downloaded: 10 May 2022.

Although historically mortgage-backed bond yields did not offer a 30 per cent premium over government securities yields (see *Figure 3*), this is probably not because there is no economically logical premium, which would mean that Hungarian mortgage banks are better debtors than the Hungarian state, but because of certain other factors, such as the illiquidity of the mortgage-backed bond market.

4.6. Pricing parameter

Deciding which element of income compensates the bank for which cost or risk is subjective. Supplementing the justification of the MNB and the Hungarian Banking Association, in which the profit margin and the reference rate are specified as the cost/risk to be compensated for, another pricing parameter may also be

possible, which would somehow reflect the dependence on the Government Debt Management Agency.

In the case of the loans with a multiplication factor, banks receive the interest rate (ÁKK∗1.3+1,[27] 2 or 3 per cent) and the reimbursement by the state. In exchange, they assume the following costs and risks: cost of funds, cost of equity, cost of risks, operational costs, fees and the commissions payable (e.g. agency fees). The pricing also includes the profit margin. Pairing these up is arbitrary, but nevertheless necessary for illustrating whether the compensation is consistent with the assumed risks, costs and profits overall. One option for pairing the above items is shown in *Figure 4*, where the items on the same line compensate for each other.

Figure 4
Presenting the income realised on loans with a multiplication factor and the factors used as pricing parameters
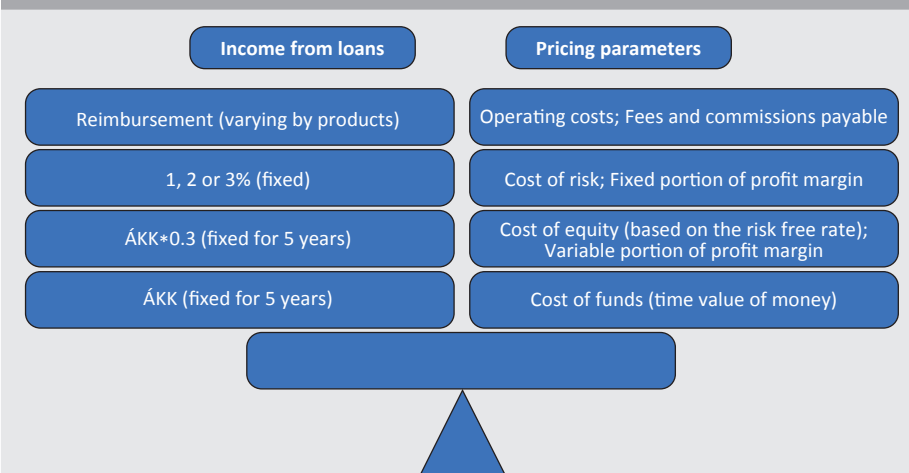
Note: Based on banks' product profitability calculation methods: This approach is similar to an income statement template, supplemented with the cost of equity, which is not reflected in profit or loss but is taken into account during pricing:

 interest + fees – operating costs – cost of risk – (actual) cost of funds – cost of equity = profit margin.

While calculating the profitability of a product, banks take the net profit on the interest income and other income (deducting the fees and commissions), then deduct the margin on operating costs, the risk margin, the cost of funds on the loans (which is simply the time value of money) as well as the cost of equity payable due to capital requirements to arrive at the profit margin. The cost of required capital needs to be taken into account along with the items on the income statement because this is the opportunity cost paid by shareholders investing in the bank due to the capital being tied down on account of the loan. Factoring in the cost of equity (beyond the profit margin) is necessary to ensure that the entity produces economic value added (EVA).

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[27] The fixed portion of the interest rate on the prenatal baby support loans originated after 29 April 2022 is 1 per cent instead of the previous 2 per cent.

The multiplication factor of 1 (ÁKK) is sufficient compensation for the loan's *cost of funds,* as it compensates for the time value of money. The remaining 0.3 of the ÁKK may compensate for risks such as the cost of capital to be held due to the loan (see the minimum capital requirements, Basel regulation[28]), which is another pricing parameter for market products, or for the variable portion of the expected profit margin dependent on the yield environment. The fixed, 1- 2- or 3-per cent part (depending on the product) of the interest rate can be viewed as the cost of risk and a fixed profit margin.

The reimbursement from the state, varying by product, can be seen as income compensating for operating costs and other fees and commissions (e.g. agency fees). Although the *reimbursement* is not part of the nominal interest rate, in an economic sense it is very much so, because the bank would not be entitled to receive it without disbursing the loan, and the amount of the reimbursement is tied to the disbursed amount and the outstanding balances.

The *cost of equity* is typically estimated, usually on the basis of a risk-free rate. The CAPM, often used for estimating the cost of equity, employs the following formula: risk-free rate + beta · market risk premium (*Damodaran 2016*). This shows that it is particularly favourable that the portion of the interest rate received as compensation for the cost of equity depends on the risk-free rate. The cost of equity is included in banks' pricing for the loans for which Basel capital rules require capital to be held, proportionate to that amount. This requires the risk weight (RW) of the given product type to be determined, because if it is 0 per cent, no capital has to be held for the product, so incorporating the cost of equity into pricing leads to false results. The HPS loans are secured by a mortgage, resulting in a risk weight of 35 per cent for retail products, and therefore incorporating the cost of equity into pricing is relevant for such products. By contrast, the prenatal baby support loans have a risk weight of 0 per cent due to the state guarantee, so the cost of equity should not be incorporated into pricing in their case.

The estimated value of the *cost of risk* should typically not be a fixed percentage according to the logic of economics, as a higher yield environment entails a higher probability of default. Nevertheless, using a fixed percentage for the cost of risk in the case of the subsidised loans makes sense because the heightened risk driven by the rising yield environment is realised on the part of the interest rate assumed by the state rather than at the customer, so, ceteris paribus, no higher default rate should be assumed when yields are rising.

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[28] The percentage cost of required capital (or margin) can be calculated with the following formula: risk weight of the loan (RW) ∗ minimum capital requirement of the bank (min. CAR – capital adequacy ratio) ∗ cost of equity (r_E, CoE, in percentage terms). Multiplying this value with the volume of loans gives the nominal cost of equity.

With respect to the profit margin, a fixed pricing parameter (in percentage terms) could only be realistic if it was assumed that the profit margin of alternative products was also fixed, regardless of the change in the yield environment. With perfect deposit-side monetary policy transmission (a rise in the central bank base rate is reflected in the deposit rate), this would be the case, because the profit margin of the alternative products would remain unchanged. However, the current rise in yields was not followed by an increase in deposit rates, which remained low, and this lifts the profit margin actually realised on alternative products. Therefore, it can be realistically assumed that the expected profit increases along with the interest margin. That is why it is worth dividing up the profit margin into two parts, a fixed and a variable portion, the latter of which follows the shifts in the yield environment. In this division, the 0.3 multiplication factor of the ÁKK compensates for this part in pricing (too). The comparison to alternative products is relevant because the source of loans with a multiplication factor is banks' own funds rather than a targeted refinancing operation, allowing banks to decide on how best to allocate their own funds to make the greatest profits.

The interpretation of the multiplication factor as a variable profit margin is also mentioned by PwC.[29] In connection with a multiplication factor of 1.15, the authors specifically state that it would not fail the SPPI test in a volatile yield environment. In the case of a loan with a multiplication factor originated in a less volatile environment, the significance of the benchmark test can prove SPPI conformity (*Table 2*). Other groupings of the pricing elements, not shown here, also lead one to conclude that in its economic content the 0.3 multiplication factor of the ÁKK is a pricing parameter compensating the creditor and not leverage.

4.7. Assessment under the Framework

Along with the justifications for rule-based classification, let us investigate what the creators of IFRS 9 wanted to achieve by introducing the new classification criteria.[30] The IASB distinguishes assets based on the characteristics of cash flows (SPPI test) and the function of the assets (business model). The 1.3 multiplication factor does not result in less predictable cash flows than if it was not there.

The interpretation is assisted by the Conceptual Framework for Financial Reporting, published by the IASB, the body that devised the rules. The Framework should be taken into account if the standards do not provide straightforward guidance in an

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[29] *In Depth Retail banking: practical implications of IFRS 9 classification and measurement*, PWC, 2017, p. 27. https://www.pwc.de/de/newsletter/kapitalmarkt/in-depth-retail-banking-ifrs-9-c-m.pdf. Downloaded: 15 December 2022.

[30] *IFRS Project Summary 2014*: https://www.ifrs.org/content/dam/ifrs/project/fi-impairment/ifrs-standard/published-documents/project-summary-july-2014.pdf, Downloaded: 7 February 2023.

accounting treatment issue. The two types of measurement principles are compared below, on the basis of their compliance with the Framework.[31]

The *objective of general-purpose financial reporting* is to support the decision-making of various stakeholders (*CFR,*[32] *Chapter 1*). The FVTPL measurement of the loans concerned may already fail to fully achieve this basic objective, as the change in fair value of these loans becomes part of the profit or loss, although it has nothing to do with how the company uses its resources and generates cash flows. This is confirmed by the fact that the performance of the divisions and workers charged with the loans is not assessed based on the change in fair value. Furthermore, allowing the change in fair value to be incorporated into profit or loss also makes it difficult for external stakeholders to assess the relevant performance of the entity.

Financial reports also seek to present how an entity used its resources in the past, while also enabling the estimation of future resource use. Under the FVTPL measurement, none of these aims are met, as banks want to generate income from the interest of the loans rather than the change in fair value,[33] and an element in profit or loss that is difficult to estimate reduces the predictability of future performance.

Financial information is considered useful if it meets, as much as possible, certain fundamental requirements (relevance and faithful representation) and some that enhance its usefulness (comparability, verifiability, timeliness, understandability), and if it does not breach the cost constraint determined by its production (CFR, Chapter 2). Financial information is *relevant* if it has confirmatory value for the past and predictive value for the future. Confirmatory value means that the information offers feedback about previous evaluations, while predictive value is when the information can be used as input for estimating future outcomes. In the case examined here, the FVTPL measurement cannot fully meet these requirements. When it comes to *faithful* representation, substance trumps legal form. The previous section showed that although the multiplication factor in these loans looks like leverage, it is nothing like that in an economic sense.

If a phenomenon can be presented in a relevant and faithful manner from various angles, it has to meet some enhancing requirements as much as possible. *Comparability* is among the most undermined characteristics in the FVTPL measurement of the loans under review. In the case of such loans, fair value is usually determined using Level 3, estimated fair value inputs, allowing entities

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[31] The findings here should not be read as a general criticism of measurement principles, as they merely pertain to the loans under review.

[32] *Conceptual Framework:* https://www.ifrs.org/content/dam/ifrs/publications/pdf-standards/english/2021/issued/part-a/conceptual-framework-for-financial-reporting.pdf. Downloaded: 7 February 2023.

[33] Of course, banks can, and do, manage the interest rate risk of their loans, irrespective of the measurement principle used.

to measure instruments differently, even when they have completely identical parameters, thereby greatly reducing comparability across entities. The mixed use of the measurement principles in the banking sector prior to 2021 (where certain banks recognised these loans at AC, while others did so at FVTPL) also ran counter to this characteristic. Within the financial statements, the change in fair value, the interest realised on FVTPL loans and the representation of the part of the change in fair value arising from the shift in credit risk are also inconsistent within the sector, but this is more of a general criticism of the problems with IFRS, attributable to the freedom allowed in preparing the reports. Moreover, using an FVTPL measurement reduces comparability not only across entities, but also the comparability of a given entity over time, as each year profit or loss includes an element that is difficult to predict and interpret.

Verifiability requires that the information be reproducible by knowledgeable and independent outside parties. Out of the two measurements, the AC version fares better in this regard too, as estimating the fair value of these instruments is difficult, requiring almost an expert actuary.

Understandability means that the classification, the characterisation and the presentation of the information occurs in a clear and concise manner. If banks use the FVTPL measurement for loans with a multiplication factor, the understandability of financial statements is greatly diminished because customer loans with more or less identical characteristics are presented in two measurement categories. As most customer loans are measured at AC, understandability within the meaning of the Framework would require that the loans under review here also be measured at AC.

When assessing the usefulness of information, *the cost constraints of producing the information* also need to be taken into account. Measuring at amortised cost is all the more favourable because an FVTPL measurement significantly increases the costs of producing accounting information, which can outweigh the benefits of having that information. Generating fair value also requires additional work from the auditor compared to an AC measurement, as the latter is calculated automatically, while auditing the fair value model is a more complex task involving more work by experts. Moreover, in the absence of an active market, determining fair value in the case of the loans concerned is particularly arduous. Loan portfolios are usually sold as part of a portfolio transfer or when selling non-performing loans, which are not transactions under normal market conditions, so the transaction price does not reflect a normal deal. While an accurately measurable and reliable value could be presented in the books with AC measurement, when FVTPL measurement is used the books contain a more uncertain value based on Level 3 fair value inputs and its change.

While measurement at AC reflect neither the prevailing market conditions at the time of the measurement nor the change in value, the amounts shown are updated as repayments and credit loss are recognised. An advantage of using fair value instead of AC is that the value always reflects the prevailing market information. The Framework (CFR 6) underlines the confirmatory value of the AC measurement, and the predictive and confirmatory value of fair value measurement. The latter may be better able to verify the accuracy of earlier expectations than the AC measurement. However, in the case of the loans with the multiplication factor this confirmation is not very important, as origination always occurs under the prevailing market conditions, as banks do not seek to lend at higher rates by delaying disbursement, but to acquire as much market share as possible in a given period.

Every entity must decide which measurement principle to use, taking into account how they want to realise profits and future cash flows from the different assets. In the case of loans with a multiplication factor, banks would like to realise profits from collecting the principal and the interest, where the latter complies with IFRS 9 requirements as shown in the previous sections. The relevance of the instrument's change in value also has to be considered. While the change in fair value is relevant for derivative instruments, the opposite is true for the loans under review here, as any change in value just muddies the picture. In the case of loans with a multiplication factor, the benefits and relevance of AC measurement far outweigh its drawbacks and the advantages of fair value measurement.

One may also decide to measure some assets using multiple methods. Banks are required to disclose, in the notes, the fair value of the loans measured at AC in the financial statements (IFRS 7),[34] thereby introducing the fair value into the financial statements, while the instruments are presented at AC on the balance sheet and the income statement, with all the benefits this entails.

4.8. Exception rules

If, despite the above, one decides to view the 1.3 multiplication factor as leverage or considers that it results in exposure to risks or volatility not related to the basic loan agreement, there are still three options that can lead to an AC measurement. The first is the exception rule pertaining to interest rates set by the state. The second is the so-called de minimis rule, which allows the characteristics that have a negligible effect to be disregarded, while the most general exception rule is the option for departure from IFRS as stipulated in IAS 1.[35]

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[34] IFRS 7 – *Financial instruments: disclosures.* https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=-CELEX:02008R1126-20220101&from=EN. Last downloaded: 5 August 2022.
[35] IAS 1 – *Presentation of Financial Statements.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=ce-lex%3A32008R1274. Last downloaded: 5 August 2022.

Paragraph B4.1.9E of IFRS 9, pertaining to *interest rates set by the state,* would also provide an exception to the general rule, where the rules do not make the product fail the SPPI test simply because of the size of the interest rate and the way it is produced. This could have helped in the case of loans with a 1.3 multiplication factor, where entities have no say in the pricing of the product. However, in the present analysis this rule cannot fulfil its intended objective, because it is highly subjective due to the use of the word "broadly", and it requires compliance with something that it wishes to provide an exemption from: "[it] does not provide exposure to risks or volatility in the contractual cash flows that are inconsistent with a basic lending arrangement". The regulation is therefore self-contradictory, which is a fundamental issue, because the exception rule and the general rule override each other in the case of loans with a multiplication factor. Moreover, some auditors view the interest rate set by the state as something that only occurs when there is no alternative, market-priced substitute product available on the market.[36] However, loans with a multiplication factor do have a market alternative, so in this interpretation the exception rule would not mean a genuine exception.

Based on the de minimis rule,[37] a contractual condition does not change classification if it only has a marginal impact. In order to prove that the 1.3 multiplication factor is a de minimis condition, it is necessary to establish that its impact is marginal for all years and over the entire maturity of the loan. Two alternative scenarios were compared during the calculation. In the first, the loans are priced without a multiplication factor, and in the second they are priced with one. Although the maximum loan amount depends on the type of loan with a multiplication factor, this does not impact the calculation. The real difference is caused by the ÁKK reference rate at the time when the ÁKK yield is fixed for the first five years of the loan. The calculations for the different yields are shown in *Table 2*. The largest volume of the loans with a multiplication factor was originated between the second half of 2019 and 2021, when ÁKK yields fluctuated in the 1–2 per cent range (*Figure 3*). The table with the calculations shows that with an ÁKK rate of 1–2 per cent upon origination, the cash flows differ by 2.7–5.1 per cent in all periods and in aggregate over the entire maturity period, depending on whether a multiplication factor is used. This is not only much lower than 30 per cent, but also minimal compared to the differences of 10, 20 or 40 times typical of leveraged derivatives. Accordingly, it is safe to say that the impact of leverage on the cash flows is marginal in the case of these loans. As a result of the rise in yields since late 2021, the difference may be as large as around 10 per cent for the currently disbursed loans, but this still falls

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[36] *IASB Request for Information – Post-implementation Review of IFRS 9 Financial Instruments – Classification and Measurement.* https://ifrs-springapps-comment-letter-api-1.azuremicroservices.io/v2/down-load-file?path=598_29512_GborSchnerHungarianBankingAssociation_0_IFRS9Postimplementationre-view_2022_01_27_HBA_signed.pdf. Downloaded: 20 March 2022.
[37] *IFRS 9, B4.1.18*

short of the 1,000; 2,000; 4,000 per cent levels, which are typical of real leverage in a financial sense.

Table 2

Calculation for eliminating the 1.3 multiplication factor, with different average ÁKK yields

Loan amount (HUF)	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
ÁKK (%)	0	1	2	3	4	5	6
a) ÁKK+2% (%)	2.0	3.0	4.0	5.0	6.0	7.0	8.0
b) ÁKK∗1.3+2% (%)	2.0	3.3	4.6	5.9	7.2	8.5	9.8
Monthly interest a) (%)	0.2	0.2	0.3	0.4	0.5	0.6	0.6
Monthly interest b) (%)	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Monthly instalment a) (HUF)	50,503	55,257	60,222	65,384	70,729	76,244	81,915
Monthly instalment b) (HUF)	50,503	56,725	63,296	70,187	77,367	84,804	92,467
Amount to be repaid a) (HUF)	12,120,635	13,261,765	14,453,250	15,692,075	16,975,010	18,298,674	19,659,605
Amount to be repaid b) (HUF)	12,120,635	13,614,056	15,191,067	16,844,827	18,567,991	20,352,956	22,192,081
Total interest a) (HUF)	2,120,635	3,261,765	4,453,250	5,692,075	6,975,010	8,298,674	9,659,605
Total interest b) (HUF)	2,120,635	3,614,056	5,191,067	6,844,827	8,567,991	10,352,956	12,192,081
Difference by instalment, annually and in aggregate (%)	0.0	2.7	5.1	7.3	9.4	11.2	12.9
Annual difference (HUF)	0	17,615	36,891	57,638	79,649	102,714	126,624
20-year difference (HUF)	0	352,290	737,817	1,152,751	1,592,981	2,054,282	2,532,475

Note: Since there is no reliable projection for the five-year forward government securities rates five, ten and fifteen years from now, a simplification was used, namely that these loans are not reset every five years, so the interest rate stays the same fixed amount not only in the first five years, but also for the entire maturity period (up to 10/20/25 years, depending on the type of product). This assumption is supported by the fact that in the context of a higher interest rate the regulatory authority could fix the interest rate of these loans with a procedure similar to the interest rate cap,[1] because higher government securities yields at the time of the reset would raise the government's budgetary spending, as the variable portion is paid by the state in all cases.

Even if every multiplication factor higher than 1 would be considered leverage, it is still important to consider whether this modifying factor has a truly significant impact. IFRS 9 states that the difference is significant if the embedded product causing the leverage would at least double the initial rate of return as compared

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[1] *782/2021. (XII.24.) Kormányrendelet a fogyasztónak nyújtott hitelről szóló 2009. évi CLXII. törvény veszélyhelyzetben történő eltérő alkalmazásáról* (*Government Decree No. 782/2021. (XII.24.) on the Different Application in a State of Emergency of Act CLXII of 2009 on Credit Provided to the Consumer*). https://net.jogtar.hu/jogszabaly?docid=A2100782.KOR&dbnum=1. Downloaded: 14 April 2022.

to the basic contract.[2] It is easy to see that the rate of return is not doubled at all when using the 1.3 multiplication factor. Another requirement for materiality in the standard is that the doubled rate of return be at least twice the market rate applicable to the contracts with identical conditions. This should not even be analysed, since the initial step, the doubling, does not occur.[3]

A last option for measurement at amortised cost could be provided by IAS 1, if every former examination pointed towards FVTPL measurement, and this enables *departure from applying the standards* under certain conditions. However, this is only possible if the application of the standard goes against the objective of the Framework, so this exception rule is hardly used at all in practice, because even if only one entity acts in accordance with the standard in a given industry, the assumption that the employment of the standard undermines the achievement of the objectives of the Framework is immediately refuted. Thus this rule cannot divert users from FVTPL measurement, unless the entire sector switches to measurement at AC.

5. Summary

Overall, if the Framework is analysed and all the known circumstances are taken into account, it must be *concluded* that banks' financial statements would provide more relevant and useful information to their users if loans with a multiplication factor were *measured at amortised cost.* According to the currently held view among auditors, the fair value measurement should be used, even if in principle measurement at AC was better, as they believe that in a strict reading of the regulation these loans fail the SPPI test due to the multiplication factor. This can only be expected to change if the IASB responds to the substance of the Hungarian Banking Association's proposal, or perhaps an IFRIC interpretation is published, or the state changes how the interest rate is set. The latter is unlikely because of the long-standing practices, and for the loans already disbursed it could only be done by retroactive legislation and contract amendments. Since the Hungarian State only adjusted the fixed interest premium of prenatal baby support loans going forward in its Government Decree No. 150/2022 issued on 14 April 2022 and effective from 29 April 2022, reducing it from 2 to 1 per cent, and left the multiplication factor of 130 per cent unchanged, neither retroactive nor future changes can be expected. Therefore, the only thing that can prevent the heavy use of FVTPL measurement in financial statements in the long run along with the corresponding negative user experience is a potential resolution by the IASB.

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[2] IFRS 9 B4.3.8
[3] These rules of IFRS 9 were included verbatim in the previous standard, IAS 39, but in that case the embedded derivative had to be separated from the contract, and it had to be presented at FVTPL, so the basic contract could remain at AC.

This analysis presented the dilemmas related to state-subsidised loans with a 1.3 multiplication factor as well as the relevant rules of the IFRS framework and the typical characteristics of the loans. All aspects of the latter were compared to the various levels of IFRS requirements, and it was demonstrated that overall recognising such loans at amortised cost results in the most reliable and faithful representation of these instruments.

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Challenges in the CSR–Competitiveness Relationship Based on the Literature*

Adrienn Reisinger

The paper examines why there is no consistent answer in either the domestic or the international literature on the relationship between corporate social responsibility and competitiveness and the reasons behind this. The topic has been present in the international literature since the 1970s and has come to the fore in Hungary in the last 15 years. There are many different answers concerning the type of relationship between the two concepts, for a variety of reasons. Drawing on previous research, the paper presents a uniform system, details the causes identified and provides a theoretical framework for empirical research to ensure a complex approach and interpretation.

1. Introduction

After the birth of the concept of corporate social responsibility (CSR), the focus was initially on its practical application. Later, more and more new aspects were added to the analyses. Researchers have looked not only at whether companies are engaging in such activities, but also at what is behind this and what the impacts might be (*Kitzmueller – Shimshack 2012*). This also raised the question of whether CSR activity has an impact on corporate competitiveness. Although the question seems simple, research and literature analysis over the past decades have highlighted the complexity of the issue. To produce truly relevant results, a number of aspects need to be taken into account. A review of the national and international literature on the subject shows that the examination of the CSR–competitiveness relation involves a number of challenges, but these are not systematically reflected in the various publications. The literature review also revealed that most analyses and studies focus on large companies, but there is rarely a direct reference to this: in

many cases it is only the context of the studies that reveals that they are essentially large company oriented.

Neither international nor domestic analyses have produced consistent results on the CSR–competitiveness relationship (positive, negative or neutral), but it can be said that there is a relationship and in the vast majority of cases it can also be detected. The question is now more about the factors that influence this relationship, why some researchers obtain positive and others negative results on the relationship between the two factors, and what should be done to interpret the research on this basis.

In reviewing the international and Hungarian literature on CSR and competitiveness, I focused on the main reasons for the diverging results on the subject. My research question is: Why is there no single answer to the nature of the relationship between CSR and corporate competitiveness? Several studies draw attention to the complexity of the subject, the ambiguity of the results and the reasons behind them (*Málovics 2009a, 2009b; Rácz-Putzer 2015; Vallentin – Spence 2017; Rasche et al. 2017; Deutsch – Pintér 2018; Géring 2018; Lu et al. 2020; Radácsi 2021*). On the basis of theoretical studies and research on the subject, I have identified the four factors that are most often cited directly or indirectly in the literature as causes. Prior to this study, I had not come across any analysis that brought them together in a coherent framework. My paper details the reasons why, until now, there has been no consensus on whether CSR pays off for a company and whether it has an impact on its competitiveness.

In the first part of the paper, I briefly outline the aspects used to approach the issue of CSR and corporate competitiveness and then review the analytical possibilities for the relationship between the two concepts. In the second half of the paper, I describe in detail the main reasons why the results of exploring the CSR–competitiveness relation differ. Finally, I draw conclusions and outline directions for further research. The study also serves as a prelude to a grant-funded research project on CSR and competitiveness among SMEs.

2. The concept of corporate social responsibility and corporate competitiveness

The first ideas about corporate social responsibility date back to the first half of the 20th century (*Radácsi 2021*), but the concept itself was coined by Bowen in 1953. In the first approaches, the responsibility of the businessman appeared (*Bowen 1953; Davis 1960*), but later the corporate level came to the fore as well. *Keith Davis* (*1960:70*) defines CSR as "…businessmen's decisions and actions taken for reasons at least partially beyond the firm's direct economic or technical interest." The birth of the concept in its current sense is associated with *Goodpaster and Matthews*

(*1982*) (Can a corporation have a conscience?). A significant milestone was *Carroll*'s (*1979; 1991*) pyramid model, which distinguished four levels of responsibility (economic, legal, ethical and philanthropic). In this study, I focus on corporate social responsibility, but it is important to note that, building on the conceptual framework of CSR, the social responsibility of other actors can now be interpreted as well, and we can even talk about individual and economic responsibility (*Nárai – Reisinger 2016*). Building on the concept of CSR, but further developed for specific actors, there is also social responsibility of citizens and civil and nonprofit organisations (*Nárai – Reisinger 2016*), higher education institutions (*Dános 2021*), financial institutions (*Lentner et al. 2015, 2017*) and public administration organisations (*Nárai – Reisinger 2019*).

In recent CSR definitions (*McWilliams – Siegel 2001; Whetten et al. 2002; Kotler – Lee 2005, 2007; Angyal 2009; Radácsi 2021*), "it is common to think of CSR as an activity whereby a company pursues its business interests and profits while behaving ethically, caring for its employees and supporting local and even national causes and communities to the extent possible" (*Reisinger 2018:287*). However, there is now also a growing recognition that CSR is not an additional activity, but that responsible thinking must permeate the whole of a company's operations; for example, *Rasche et al.* (*2017*) have defined it on this basis.

Competitiveness can be understood in many ways, including the competitiveness of countries, industries and organisations (companies). This study focuses on the competitiveness of companies. In the words of *Varga* (*2017:726*), "...organisational competitiveness is ultimately the sum of organisational potentials that the enterprise can use and exploit to meet organisational goals, realise profits and satisfy consumer needs." In *Lengyel*'s (*2003*) definition, profitability is at the heart of the concept, according to which a company is competitive if it can satisfy market needs in an appropriate way.

Czakó and Chikán (*2007:3*) interpret competitiveness as follows: "Corporate competitiveness, in our understanding, is the ability of a company to consistently offer consumers products and services that they are more willing to pay for on terms that are profitable for the company than for those of its competitors, while adhering to the standards of social responsibility. The precondition of this competitiveness for a company is to be able to anticipate and adapt to environmental and internal changes by meeting market competition criteria that are consistently more favourable than those of its competitors." This definition includes the term social responsibility, which implies that if a company is competitive, it is also socially responsible, and therefore this definition is the closest to the topic of this study.

3. Research on the relationship between CSR and corporate competitiveness

Research on the relationship between CSR and corporate competitiveness goes back several decades. Although CSR used to be seen as entirely voluntary and unrelated to profit, there is now a growing view that CSR is not entirely selfless and it is not an entirely altruistic activity: companies will engage in activities that can bring them some form of benefit. There may be differences in the extent to which companies do this openly and even consciously, i.e. the extent to which this aspect is present in corporate thinking.

If we accept this line of thinking, we must assume that the motivation behind companies' CSR activity is that the CSR activities carried out should also benefit them, whether financially or non-financially. Previous research shows that there is a link between CSR and competitiveness, but there are a number of factors behind this, which make the study of the subject extremely complex. Furthermore, as companies are very different, their CSR motivations are varied and the environment in which they operate is varied, as a consequence, I believe that generalisable findings for a given group of companies cannot be made, but empirical research can be conducted to learn about corporate practices, contributing to a deeper exploration of the theoretical and practical context of the topic.

The position on the impact of CSR on competitiveness is that this impact can be measured, but the methods vary considerably and depend on certain company-specific factors. In addition to the concept of CSR, two other concepts also emerged in the 1970s (*Carroll – Shabana 2010*), corporate social responsiveness and corporate social performance (CSP), which were framed by *Frederick* (*1978*). Corporate social responsibility was named CSR_1 by Frederick, while the other concept, with similar initials, was referred as CSR_2. CSR_1 is more of a "philosophical approach" to corporate social responsibility, while CSR_2 refers to "processes that enable companies to respond to emerging social pressures, needs and demands" (*Géring 2018:60*), so it refers to more of a managerial mindset. Later, a combination of the two concepts gave rise to the concept of corporate social performance (CSP) (*Carroll 1979; Wartick – Cochran 1985*), which also emphasised the need to focus on the results of social engagement.

With the corporate social performance (CSP) model, the focus has shifted to the impact of CSR and the concept that CSR can be interpreted as a business case and may have an impact on company performance. Since the 1980s, there has been a steady stream of studies that focus specifically on the relationship between corporate social performance (CSP) and corporate financial performance (CFP) (*Carroll – Shabana 2010*), which is a quantified, typically financial, approach to the CSR–competitiveness relationship. In recent decades, a large number of papers

have been written on this topic at the international level, as well as a few at the Hungarian level. There were also international and a small number of Hungarian analyses (*Ullmann 1985; Margolis – Walsh 2001, 2003; De Bakker et al. 2005; van Beurden – Gössling 2008; Málovics 2009b; Peloza 2009; Matolay 2010; Rácz-Putzer 2015; Putzer 2018; Géring 2018; Szennay 2018a; 2018b; Deutsch – Pintér 2018; Carroll 2021*), which aimed to synthesise these studies, thus providing the opportunity to draw generalisable conclusions from the results of previous surveys and works. However, in reviewing this research it can be established that there is no consensus. *Lu et al.* (*2020*) cite the topic as one of the most controversial ones in the CSR literature.

The relationship between CSP and CFP (but this can also be read about the relationship between CSR and CFP) can be positive, negative or even neutral, so there is no consensus in academia on the impact of CSR or social performance on company performance, and hence even on competitiveness. It is certainly important to note that in most cases a positive relationship can be detected (*Rácz-Putzer 2015; Lu et al. 2020; Barauskaite – Streimikiene 2021; Carroll 2021*), which may imply that it pays to be socially responsible, but based on a number of studies *Matolay* (*2010*) and *Rácz-Putzer* (*2015*) point out that this also depends on many factors and circumstances, so such statements should be treated with caution. For example, several analyses (*Barnea – Rubin 2005; Brammer et al. 2009*) have shown a mixed relationship, i.e. the initial positive relationship is replaced by a negative one after a certain period of time, i.e. social activity has a negative impact on performance after a certain level (e.g. because the market no longer rewards responsible behaviour). Many authors have illustrated this phenomenon with a U-shaped curve (*Bowman – Haire 1975; Sturdivant – Ginter 1977*).

One important question is whether it makes sense to interpret the CSR–competitiveness relationship for all types of companies. The main issue is the size of the enterprise, as most of the research to date has been conducted on large companies, and only in the last decade or so have we seen surveys on SMEs (*Jenkins 2009; Málovics 2009b; Tantalo et al. 2012; Turyakira et al. 2014; Tomšič et al. 2015; Zait et al. 2015; Witjes et al. 2017; Zastempowski – Cyfert 2021; Kožená – Mlázovský 2021*).

This issue is further complicated by the fact that the CSP–CFP model typically focuses on the quantifiable impacts of CSR, while some of the impacts of CSR activities cannot be measured in this way; accordingly, the methodology at the heart of the analysis is very important. Moreover, it makes a difference what exactly we are measuring when it comes to the CSR–competitiveness relationship. The emphasis above has been on the CSP model that became popular in the 1970s, which looked at the relationship between social performance and financial performance, but the CSR–competitiveness relationship can go beyond this, since

competitiveness can be measured not only in terms of financial performance and not only in quantifiable terms.

4. The relationship between CSR and corporate competitiveness – reasons why there is no consensus

4.1. Methodology

The studies on the CSR–competitiveness relationship each use a specific methodology to formulate their results. Today, a number of studies point out that it is precisely this diversity that gives rise to a variety of results. Prior to writing this analysis, I could not find any paper that presented this diversity and the analytical challenges of the topic together. However, in order to properly place the results of research on this topic in CSR research and to effectively ground new research, it is necessary to know the reasons why there is currently no generalisable answer to the question of how CSR affects competitiveness. Based on a review of the Hungarian and international literature on the subject, I identified the four most frequently cited causes, which are described in this section. The identification of the international literature was based on the Scopus and the Science Direct databases, while the Hungarian literature was identified from the Hungarian Science Bibliography (MTMT).

4.2. Is there a general term?

Although corporate social responsibility has been in the public consciousness for almost seventy years, there is still no general term that fully describes the phenomenon (*Sarkar – Searcy 2016*). This is precisely what makes it difficult to generalise about any phenomenon related to CSR. The concept of CSR started with the responsibility of business people and has become an increasingly complex issue. Based on *Carroll*'s pyramid model (*1979; 1991*), economic responsibility is the basis of corporate social responsibility, on which other levels such as legal, ethical and philanthropic responsibility can be built. Looking at the CSR–competitiveness relationship from this perspective, it may be useful to split the concept into two parts. The first three levels of responsibility are more related to the general operation of companies and the responsible activities they carry out, while the fourth, philanthropic level, covers the activities that are most directed towards society. It is also recommended to separate them in terminology: In the first case, we can talk about corporate responsibility that is more related to business operations, to the day-to-day running of the business, while social activism can mean that the company notices and reacts to social problems and tries to respond to them to the extent possible (*Porter – Kramer 2011*).

In my view, the activities associated with the two approaches may have different impacts and should be treated differently from a competitiveness perspective as well. For example, a company's performance may appear differently when it conducts responsible business than when it supports causes, sponsors or provides professional assistance in response to social problems. If we follow this train of thought, the definition of CSR that the European Commission came up with in 2011 fits better: CSR is "the responsibility of enterprises for their impacts on society" (*EC 2011:6*). The definition emphasises responsible activity towards society, while keeping the focus on responsible thinking that permeates corporate operations. The effect of the latter is more difficult to detect, and its impact on competitiveness may be different depending on the size of the company and the chosen method of analysis.

The other conceptual challenge is corporate competitiveness. Here again, there is no general, all-encompassing definition, and thus when the CSR–competitiveness relationship is analysed it is important to clarify the framework in which the latter is presented. This is described in more detail in *Subsection 4.3*.

4.3. What do we want to measure?

The conceptual framework of corporate competitiveness is broad and there are many definitions: accordingly, it is important to clearly define what exactly the researcher is trying to measure when analysing the CSR–competitiveness relationship. In general, competitiveness is the ability of a company to perform better than its competitors. This can be measured based on various criteria. The CSP model is widely used in practice to examine the CSR–competitiveness relationship, as discussed in Section 3. CSP is effectively a measure of a company's social activity, which is then compared with its financial performance. Several questions can be raised here: on the one hand, how competitiveness can be approached outside the CSP model, and on the other hand, how the CSP model can be used to show the results and impact of socially responsible activity. It also makes a difference whether we want to show an outcome, an impact or benefits.

In seeking an answer to the question of what we want to measure, we need to define the exact factors we are looking for in the case of competitiveness on the one hand, and socially responsible activity on the other. *Turyakira et al.* (*2014*) approach competitiveness in terms of profitability, market share, sales volume and growth rate, and cite other authors who include other, partly new, factors in the analysis. *Salavou and Avlonitis* (*2008*) mention profitability, sales volume, sales growth and market share as indicators of competitiveness. *Szennay* (*2018a*) raises financial performance and ownership value. *Lu et al.* (*2020*) included the following elements of competitiveness in their analysis: financial capacity, product quality, customer satisfaction, productivity, reputation and innovations.

Similarly, to the understanding of competitiveness, when we talk about socially responsible activity, it is important to know exactly what we are measuring. In general terms, the fact whether the company is carrying out CSR activities can be analysed, it is also possible to analyse specific areas of activity (e.g. *Lu et al. 2020*; *Turyakira et al. 2014*), or a specific activity and its impact. *Lu et al.* (*2020*) approached the CSR–competitiveness relationship through the effects of CSR as a corporate activity. Literature sources have been used to identify what socially responsible behaviour can affect (reputation, brand, financial performance, product, customer loyalty and satisfaction, employees, market share, labour efficiency, costs and risk) and to conduct empirical research on how social responsibility affects each of these elements of competitiveness. *Putzer* (*2011:46*) mentions the benefits of CSR when analysing the relationship. It is based on the premise that CSR is not just a selfless activity, it can also bring benefits, i.e. if a company is active in CSR, it can expect to reap benefits. Based on *Matolay* (*2010*), *Kotler – Lee* (*2007*) and *Ligeti* (*2006*), these are: stronger brand, better corporate image, increasing sales and market share, lower operating costs, increased investor interest, improving financial statements, reducing transaction costs, sustained competitive advantage and a positive impact on groups important to the company, such as employees, public authorities, consumers and business partners.

As can be seen from the above, competitiveness and socially responsible behaviour can appear in many different ways in the analyses, which is why it is important to highlight the factors used in the research, which can help to generalise the results for a particular aspect.

4.4. Where we want to measure – focus on company size

As mentioned above, studies on the CSR–competitiveness relationship typically do not indicate the size of the company to which the relationship is applied, and in many cases the nature of the analysis suggests that large companies are the focus of analysis. This is not a coincidence, since until the late 1990s CSR research, with a few exceptions, focused on large companies, and only in the first half of the 2000s did research start to investigate whether the concept could be applied to smaller companies. The focus of studies was initially on comparing SMEs with large companies and the different CSR characteristics that result from these differences (*Spence 1999; Jenkins 2004*), and from the late 2000s onwards empirical research began to appear (*Csillag 2008;*[1] *Jenkins 2009; Tantalo et al. 2012; Turyakira et al. 2014; Tomšič et al. 2015; Witjes et al. 2017; Zastempowski – Cyfert 2021*).

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[1] In Hungary, the Corvinus University of Budapest was one of the first to investigate the CSR–competitiveness relationship in its research programme "Competing the World".

It is now accepted that the CSR activity of SMEs differs from that of large companies, mainly due to differences arising from company size (*Jenkins 2004; Angyal 2009; Cambra-Fierro et al. 2008; Málovics 2009a, 2009b; EC 2011; Szennay 2018a; Rasche et al. 2017; Knudson 2018*). According to *Málovics* (*2009a*), SMEs may differ from large companies in the following areas:

• funding opportunities,
• the owner–manager system,
• the more informal nature of operation,
• pursuing goals beyond profit maximisation,
• information asymmetry,
• a different type of integration into the region's society and economy,
• different stakeholders,
• different relations,
• local, regional visibility.

The concept of CSR was initially aimed at large companies, but it is now accepted that companies of any size can engage in CSR activities (*e.g. Jenkins 2004, 2006; Vives 2006; EC 2011; Wickert 2016; Bevan – Yung 2016*), although there are significant differences in the way and motivation for doing so. Several authors argue (*e.g. Szlávik 2006; Jenkins 2004, 2006; Spence 1999; Málovics 2009a, 2009b; EC 2011; Rasche et al. 2017*) that perhaps one of the most striking differences is that the CSR activities of SMEs are not or less formalised, but rather instinctive, motivated by a focus on helping and typically without a conscious strategy behind them. For this very reason, *Málovics* (*2009a; 2011*) argues that in the case of SMEs it may not make sense to talk about the impact on competitiveness, since that is mostly a characteristic of conscious, strategically embedded CSR activity, which is less typical for SMEs. However, several studies have shown that some form of impact on competitiveness may arise in the case of SMEs as well (e.g. T*antalo et al. 2012; Turyakira et al. 2014; Lu et al. 2020; Kožená – Mlázovský 2021*). However, the methods are different from those used in large companies.[2]

Although CSR research on SMEs has been steadily present over the last two decades and some of this work also examines the impact on competitiveness, the CSR activities of SMEs are still a relatively unexplored area. Moreover, although we have known since the 2000s about the main differences between the CSR activities of large companies and SMEs, the practical results are even less generalisable, and I have identified the measurement method as one of the main reasons for this.

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[2] This is discussed in more detail in the next subsection.

4.5. How do we measure?

I found that there is no uniform measurement method to show the CSR–competitiveness relationship (*Málovics 2009a, 2009b; Rácz-Putzer 2015; Vallentin – Spence 2017; Rasche et al. 2017; Deutsch – Pintér 2018; Géring 2018; Lu et al. 2020; Radácsi 2021*), but there are already good practices that can be applied to different types of research. Based on the results so far, it can be stated that different measurement practices are outlined for large companies and for SMEs, and this section primarily presents the main methods along these lines.

As seen in the previous subsection, the CSR activities of SMEs are different from those of large companies, which may imply that the motivation of CSR activities is different, for example (*Málovics 2009a, 2009b; Radácsi 2021; Rasche et al. 2017; Porter – Kramer 2006*), and so is the impact that such are expected to have. There is no consensus in either the domestic or international literature on what exactly motivates a company to engage in CSR. Several pieces of literatures distinguish between factors according to whether or not a company decides on the type of CSR activity on the basis of whether or not it generates benefits or profits (*Török 2002; Porter – Kramer 2006; Angyal 2009; Rasche et al. 2017*).

Demonstrating the impact on competitiveness becomes a priority aspect for a company (*Radácsi 2021*) when either the organisation is expected to do so from outside or when it wants to demonstrate this impact itself, because it expects a competitive advantage from CSR activities. This kind of thinking is essentially that of large companies (*Jenkins 2004; Málovics 2009a, 2009b; Radácsi 2021*), and measurement essentially appears in the CSP (CSR) – CFP relationship.

CSP/CSR is typically measured using the following methods (*van Beurden – Gössling 2008; Deutsch – Pintér 2018; Putzer 2018; Barauskaite – Streimikiene 2021*):

• It can be checked whether or not the company provides a CSR or sustainability report.

• It can be examined and assessed what activities the company is engaged in. This basically means content analysis of the reports produced by the company. Here, the assessment is based on the company's self-reported analysis of itself (*Opoku-Dakwa – Rupp 2019*), so the success of the assessment depends to a large extent on the quality of the information provided in the reports, because if they do not contain quantitative data or the depth of information is not sufficient, such analyses cannot be carried out. The analyses focus mainly on the costs associated with socially responsible activities (*Putzer 2018*).

• Surveys have been carried out mainly among large enterprises on whether they produce reports, suggesting that reporting is not widespread among SMEs, and thus the method is basically for large enterprises (*Radácsi 2021*). One should

highlight the Global Reporting Initiative (GRI), an internationally accepted and widely-known accountability tool that provides guidance for sustainable and responsible reporting (*Angyal 2009*). Incorporating ESG-factors[3] into the reporting process provides a more complex approach to corporate reporting, giving a comprehensive picture of the company's operations in terms of sustainability, social responsibility and corporate governance, which can help to reveal deeper links between the company and its environment. The most complex assessment is performed using indices. Examples include the Dow Jones Sustainability World Index (DJSI), the National Corporate Responsibility Index (NCRI), the Domini Social Index 400, etc.[4] These indicators are basically interpreted in the context of large companies, and in some cases only listed companies can be assessed with them. However, the calculation of the indices is not uniform and none of the indicators is universally accepted. *Barauskaite and Streimikiene* (*2021*) consider the Dow Jones index to be the best known and most commonly used indicator.

Companies' financial performance is basically measured by calculating market and/or accounting indicators (*Deutsch – Pintér 2018; Barauskaite – Streimikiene 2021*). Although *Barauskaite and Streimikiene* (*2021*) note that financial performance is easier to measure than CSP, since there is no uniform methodology and market indicators are basically interpreted for listed companies, the detection of financial performance is also context-dependent. *Málovics* (*2011:31*) notes, based on a study by *Evangelinos and Halkos* (*2002*), that "most companies' accounting system fails to estimate the financial benefits of environmentally/socially responsible action on the one hand and the costs of implementing and operating certain assets/measures on the other." This can make it challenging for large companies to demonstrate financial performance related to CSR.

The measurement of the CSP – CFP relationship is not uniform either. The vast majority of analyses use a unidirectional linear regression model (*Deutsch – Pintér 2018*), but there are now examples of this direction being reversed (*e.g. Schaltegger – Synnestvedt 2002*), assuming that corporate performance has an impact on CSR activity, or interpreting the relationship in both directions (*e.g. van Beurden – Gössling 2008; Lu et al. 2014*).

The measurement methods described above can be used mainly in large enterprises. Few studies make this claim explicitly (*e.g. Radácsi 2021; Málovics 2009b*), but one can infer this from the fact that CSR competitiveness research among SMEs in the last 10-15 years has been showing a kind of wayseeking. It can be seen that the CSR activities of SMEs are following different paths, which raises the use of new and different methods that are not only useful for SMEs, but can also be applied by

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[3] ESG: environmental, social and governance components
[4] There are many other indices in practice for the assessment of large companies and listed companies; *Bahurmoz* (*2020*) has compiled 22 such indices in his study.

large companies. The following is a non-exhaustive list of methods that have been used in recent years for SME research.

- *Csillag* (*2008*), Corvinus University of Budapest, in the framework of its research programme "Competing the World", conducted interviews on the topic, mostly among SMEs (10 companies were interviewed, of which 3 were large, 6 medium and 1 small in terms of the number of employees). The research explored the topic through open questions.

- *Tantalo et al.* (2012) presented the results of their interview survey of 50 Italian SMEs. During the interviews, the interviewees were asked to describe the company's CSR activities and then to rate on a Likert scale from 1 to 4 how important these activities were in the life of the company and how they impacted on competitiveness.

- A 2013 survey (*Tomšič et al. 2015*) examined the impact of corporate sustainability on economic performance in 645 Slovenian SMEs. Although CSR was not in the focus here, sustainability issues can be linked to socially responsible activity, so research on this topic is also relevant.

- *Turyakira et al.* (*2014*) presented a survey in Uganda, in which 383 SMEs (in the country this means enterprises with between 6 and 99 employees) were interviewed through a questionnaire survey. The four dimensions of CSR activity (employee, social, market and environmental) were chosen as independent variables, while the four dimensions of competitiveness (profitability, market share, sales volume and growth rate) were chosen as dependent variables. Companies were asked how much each CSR area influenced competitiveness on a 7-point Likert scale.

- *Lu et al.* (*2020*) surveyed 33 Lithuanian companies in 2019, also using a Likert scale (1 to 4). They also decomposed the CSR activity and competitiveness into different domains, but defined partly different dimensions than *Turyakira et al*. In the case of CSR: environmental, social and economic; in the case of competitiveness: financial capacity, product quality, customer satisfaction, innovation and reputation.

- In 2020, *Kožená and Mlázovský* (*2021*) conducted structured, in-depth interviews with 15 medium and large Czech companies.

The presented methods show that the CSR–competitiveness relationship can also be analysed by asking the company's managers or representatives indirectly, through a questionnaire or an interview, about their perception of the relationship between CSR activities and competitiveness, rather than by analysing the quantifiable effects of CSR. The methodologies presented at the beginning of this subsection are mainly

based on CSR reports. In order to calculate indices, for example, it is necessary to have data on CSR activity, which is typically found in reports. The SME surveys presented prove that impacts can be detected without reports and quantification, although only indirectly, because the answers will primarily reflect the opinion of the interviewee, the person who filled in the questionnaire.

These methods are not only effective when it comes to evaluating a company in the absence of reports. Interviewing company managers can also complement the analysis of CSR reports, which can lead to even more complex conclusions. Indirect methods can be used to analyse a company even if it does not collect any data at all on its CSR activities or if the impacts and the relationship can be detected only in non-quantifiable manner, because, regardless of this, the company manager must have an opinion on the benefits of CSR activity and on what it affects and how.

5. Discussion, summary and future research directions

All organisations, including companies, have an impact on the environment in which they operate, and the environment also affects them. The same is true for CSR activities. By implementing socially responsible activities, companies have some form of impact on their own operations and on their environment, and the organisational system and external environment also influences the area in which they are active.

One specific area of impact on the environment and on the company's own operations is the question of the impact of socially responsible activity and whether it generates a competitive advantage. On the one hand, it is important to see that the two questions are not exactly the same, as the fact that CSR has an impact on certain processes does not necessarily mean that it makes the organisation competitive. On the other hand, in order to ask a company whether CSR has an impact on competitiveness, it is also necessary to know how the company itself understands the concept of competitiveness, because only in this knowledge can it deal in effect with the impact on competitiveness, if it is even a question for the management of the organisation. It is also important to link this to the issue of motivation, because it is not all the same why a company measures the impact of CSR. If the motivation for CSR activity is to benefit the company and thus make it more competitive in the first place, then the methods chosen will also be those that can be used to demonstrate such a relationship. However, the impacts can be interpreted even if the aim is not to have an impact on competitiveness, but rather, for example, good feelings by helping others, since CSR activities can have an impact and benefit in this case as well. Based on this thinking, I have identified the following ways in which a company can respond to CSR impacts:

1) In the first case, the companies do not pay attention to the effects, which they are not even aware of, so obviously in this case the effects are not even detected in any form, and it is not possible to formulate the impact on competitiveness.

2) In the other case, the process is more conscious or fully conscious, with two more possible paths:

   • Although the company consciously monitors the impact, it does not report it and does not measure it for various reasons, e.g. there is no will or capacity, it does not collect such data or the nature of the CSR activity does not allow for the impact to be measured.

   • The company is conscious and wants to demonstrate the impact in some way, so it measures the impact of CSR. Either it does this voluntarily, out of its own internal determination, or there is an external expectation to do so.

From the point of view of the analysis of this topic, it is obvious that it is the companies in the latter group where the impact on competitiveness can be interpreted in effect. However, a small body of national and a large body of international research has not yet come to a consistent conclusion about the direction of this effect, although as mentioned earlier, most research has shown a positive relationship. Based on the existing research, I am of the opinion that generalisable results cannot and should not be obtained. I think this is because all research is conducted under specific conditions; the environment in which the company operates is complex and the parameters of the company are also crucial. I have presented four of these factors in my study, which are most frequently mentioned directly or indirectly in the literature I have come across, but are not presented in a comprehensive way. It can help to organise research results and design new research if we know the reasons behind the different results so far.

1) There is no single definition of CSR or corporate competitiveness, and it is important to be clear about the context in which the research is interpreting them.

2) For both factors, there are various criteria to determine what exactly we want to measure, and for both CSR and competitiveness, these need to be clarified.

3) As the way large companies and SMEs operate can differ significantly, the size of the company has an impact on the analysis of the topic.

4) There are differences in analytical methodologies, both because there are many different approaches to CSR and competitiveness, and because the characteristics of the company are also determinant, the most important of which is its size.

I believe that the reasons identified in this study illustrate the complexity of the CSR–competitiveness relationship. I have found that the CSR–competitiveness relationship is essentially examined from a financial perspective, typically using the CSP–CFP model in most of the literature. The studies often only implicitly suggest that the analyses are essentially carried out among large companies, because this is the size of company where some form of social and financial performance is reported. The analysis of the CSR–competitiveness relationship is typically based on company reports, which is still mainly a feature of large companies, but it is now clear that the impact of CSR can also be analysed among SMEs, using different methods, of course, and not only in financial and less quantifiable terms. Obviously, it will be large companies – because of their size – that have a significant economic, social and environmental influence, so the impact of any action they take could be a relevant factor. The role of the SME sector is not negligible, however, and although their economic power is not so great, the impact of their activities, and therefore of their CSR activities, is an important social and economic factor.

Future research opportunities include studies that explore in more depth the differences between CSR practices and motivations of SMEs and large companies in practice, that analyse the effects of CSR activities and their links to motivations, and that, reflecting on the role of company size, examine the advantages and disadvantages of different methods of exploring the CSR–competitiveness relationship. These research directions can be linked to my ongoing interview research among SMEs in Hungary, which among other things explores the CSR characteristics of SMEs, focusing on the impact of activities and their relations to competitiveness. The study was designed to provide a theoretical basis for this research.

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The Reasons Behind Banking Crises and their Real Economy Impact – Achievements of the 2022 Nobel Laureates in Economics*

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In 2022, the Nobel Prize in economics was awarded jointly to Ben S. Bernanke, Douglas W. Diamond and Philip H. Dybvig, for their research on the financial system that shed light on the reasons for, and the consequences of, bank panics. Diamond and Dybvig showed that the banking system provides socially useful services through maturity transformation and delegated monitoring, and they also pointed out that maturity transformation made the banking system fundamentally vulnerable, which, if left unregulated, may experience bank panics. Bernanke demonstrated the macroeconomic significance of the banking system and analysed the negative macroeconomic impact of bank panics. Their research helped lay the foundations of a regulatory environment that fosters the efficient functioning of the financial system without bank panics.

1. Introduction

The 2022 Prize in Economic Sciences in Memory of Alfred Nobel was awarded jointly to Ben S. Bernanke, Douglas W. Diamond and Philip H. Dybvig. It was awarded in recognition of their research on the financial system and the reasons behind financial crises and their macroeconomic consequences.

Bernanke earned his PhD at the *Massachusetts Institute of Technology* in 1979. He later became a professor at *Princeton University* before working as the governor of the *Federal Reserve* between 2006 and 2014. He is currently a distinguished senior fellow at the *Brookings Institution*. Diamond received his PhD at *Yale University* in 1980. He is now a professor at the *Booth School of Business* at the *University of*

Essay

Chicago. Dybvig also obtained his PhD at *Yale,* in 1979 and is now a professor at the *Olin School of Business* at *Washington University in Saint Louis*.

Typical scientometric data of the Nobel laureates can be found in *Table 1.* As nowadays some people produce studies in rapid succession, by the hundreds, one may find the number of publications low, but the *h*-index, a measure of citations and scientific impact,[1] convincingly demonstrates that they are indeed influential researchers. According to the *ideas.repec.org* database, Bernanke is ranked 30th among economic researchers based on citations, and 92nd based on the *h*-index. Diamond is in the top 3 thousandths based on citations and the top 1.5 per cent based on the *h*-index. Dybvig is in the top 1 per cent based on citations and the top 3 per cent based on the *h*-index.

Table 1
Scientometric data of the 2022 Nobel laureates in economics

	Ben S. Bernanke	**Douglas W. Diamond**	**Philip H. Dybvig**
Publications	87	33	44
References	24,762	9,907	4,636
h-index	49	26	20

Note: The number of publications reflects the number of journal publications and independent book chapters combined.
Source: ideas.repec.org

The popular science and scientific background documents published for the 2022 prize (*Royal Swedish Academy of Sciences 2022a; 2022b*) point out three ground-breaking pieces by the laureates: *Bernanke* (*1983*), *Diamond and Dybvig* (*1983*) and *Diamond* (*1984*). This paper describes these three studies and gives a brief overview of the further research inspired by them, along with the related economic policy implications.

2. Liquidity, maturity transformation and bank panics

2.1. The Diamond–Dybvig model

Diamond and Dybvig (*1983*) offer a theoretical analysis of the reasons behind, and the welfare impact of, banking crises. Their paper starts off by establishing the notion of liquidity. Liquidity is usually regarded as a financial concept, but since every financial instrument is ultimately based on claims on real income, it is important to clarify how liquidity relates to the real economy.

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[1] For more on the *h*-index, or the Hirsch index, see *Hirsch* (*2005*).

It is common knowledge that people with savings lock in a significant portion of their investments for the short term, even though long-term assets yield greater returns. This is because it is impossible to accurately predict the schedule of spending by households and firms, as there can always be unforeseen and urgent expenses (illness, accident, natural disaster, or on the contrary, a once-in-a-lifetime business opportunity, when time is of the essence), and that is why short-term, liquid assets are held that can be used to access the necessary amount of real income at any time.

On the other hand, there is a technological limit, insofar as efficient production requires investment projects that take a lot of time, for example the construction of a railway line or a semiconductor fabrication plant. Once such a project gets under way, it is only able to produce goods and real income after a long time. If investors need income urgently and at all costs before the completion of the project, most projects can be liquidated, but only at an enormous loss. This is, once again, due to technology: some of the parts and machinery in a half-complete plant can be used elsewhere, but much goes to waste.

The above feature of the real economy leads to a trade-off: efficient production and the associated high returns require investors to forego some of the income for a long time. Households, however, may very well need the income they have foregone. As the liquidation of long-term projects involves huge losses, it is better to secure the income needed to meet contingencies using assets that are ultimately backed by investments that can be realised quickly. However, such projects typically produce much lower income and thus lower returns. If too much is invested in short-term projects, little income is realised. If too much is invested in long-term projects, with some luck they can do well in the long run, but without luck investors could be in serious trouble, as they are unable to access the income necessary to address the problem.

If every individual seeks to solve the above issue in isolation from everyone else, it can have very negative consequences for society as a whole. Compared to autarky, social welfare is improved if there is a financial market where investments can be bought and sold. If, for example, some people invest all their savings in a single long-term project and they are not lucky, they do not need to liquidate the project, as they can sell it to someone who was lucky and does not need the income in the short run. Conversely, if some people are overly pessimistic and only invest their income in short-term projects, but it turns out that they can wait, they can sell their short-term investments and buy long-term ones. Diamond and Dybvig show that from the perspective of society the existence of financial institutions that collect and invest individuals' savings provides even better solutions than financial markets.

These institutions are referred to as banks from here on. Banks invest some of the income collected from individuals in long-term projects and some of it in short-term ones. But they allow individuals to access their "deposits" at the bank even before the long-term investments produce income. If banks know the expected share of the deposits that are withdrawn in the short run, it can be shown that a socially optimal equilibrium can be reached.

In this socially optimal equilibrium, banks make short-term investments with the exact share of deposits that they expect to be withdrawn, and only depositors that urgently need their deposits withdraw them, while the others wait until the long-term investments start producing income, and this extra income is distributed among them by the banks.

In the above equilibrium, banks perform maturity transformation: their liabilities are liquid (they can be withdrawn at any time), while many of their assets are invested for the long run. Banks clearly improve social welfare through this maturity transformation. In an autarky, individuals can only be guaranteed access to their income in the short run if everyone has short-term investments. However, this considerably reduces aggregate real income in the economy, as long-term investments provide a larger volume of production. Only the banking system can deliver a socially optimal investment portfolio while guaranteeing that investors can access their income if necessary.

This is basically the first important result of Diamond and Dybvig: they show the necessity of the banking system's maturity transformation, and that it is a socially useful service that other institutions are unable to provide.

Although the results described above are not without merit, the authors' paper is famous for their analysis of bank panics. They point out that the above socially optimal equilibrium is unfortunately not the only equilibrium. It is well established that, from a game theory perspective, an equilibrium must satisfy two conditions: (i) individuals behave optimally, taking their expectations as a given; and (ii) the expectations are identical to the actual outcome of the situation. In a socially optimal equilibrium, every individual expects that others only withdraw their deposits if necessary. Based on these predictions, the optimal behaviour for everyone is to leave their deposits in the bank until the maturity of long-term projects, if they do not face any trouble. Diamond and Dybvig show that the situation changes dramatically if individuals expect that everyone else will withdraw their deposits early.

If depositors expect that everyone else will withdraw their deposits in the short run, it would not be rational for them to leave their savings in the bank for long. This is because if everyone else withdraws their deposits, the bank would need to

give back much more deposits than the number of short-term projects it holds in its portfolio. In other words, the bank simply does not have enough income from short-term projects to satisfy depositors' demands. To do so, it needs to liquidate its long-term investments, but, as mentioned above, this results in heavy losses and does not generate enough income to satisfy all depositors, some of whom get their deposit, while others don't. Under such circumstances, if depositors keep their money in the bank for long, they will definitely not get it back.

In other words, the second important finding by Diamond and Dybvig is that there is a potential equilibrium where everyone expects all the other agents to withdraw their deposits early, in which case it becomes rational for individuals to withdraw their own deposit, making such expectations self-fulfilling. This equilibrium is referred to as a bank panic.[2]

It should be noted that the Diamond–Dybvig model has no fundamental uncertainty, meaning that the projects financed by the banks are risk-free. In other words, the panic is not caused by bad investments by the banks, but instead by the coordination of depositors for the wrong equilibrium.[3]

A bank panic is obviously suboptimal, as the liquidation of long-term investments reduces aggregate consumption well below the level of the socially optimal equilibrium. It is even lower than if the banking system invests all its liabilities in short-term projects. In other words, a bank panic causes severe macroeconomic damage, and it is not only the "internal affair" of bankers. It must be underlined that the possibility of a bank panic is due to the fact that banks perform maturity transformation: if banks' assets were liquid as well, if they only invested in short-term projects, it would not make sense to make a run on banks. But without maturity transformation the banking system would have no reason to exist, as it could only offer as much as autarky. The vulnerability of the banking system is due to the very fact that justifies its existence.

Of course, when an economic analysis points out that a market outcome is suboptimal, the question always arises as to whether there is some kind of policy intervention that would approximate a socially optimal outcome. Diamond and Dybvig also take a look at this, and their third most important finding is that the introduction of deposit insurance helps avoid the suboptimal equilibrium, i.e. the

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[2] Diamond and Dybvig use the term bank run. A bank panic occurs when the run spreads to other banks as well and the phenomenon becomes a systemic macroeconomic problem. Since the Diamond–Dybvig model uses one representative bank, there is no difference between a bank run and a bank panic. For the sake of simplicity, the term "bank panic" is used throughout the paper here.

[3] From a game theory perspective, the depositors in the Diamond–Dybvig model are playing a simultaneous game, taking decisions at the same time, without observing the actions taken by others. This was not true in the case of classic bank panics, as depositors literally made a run on banks and they could quite clearly observe each other's actions. However, modern bank panics often play out over the computer, and the decisions are taken simultaneously. Later research extended the Diamond–Dybvig model to sequential decisions.

bank panic. With deposit insurance, depositors always get their deposit back, so the expectation that everyone else will withdraw their deposit does not become self-fulfilling, because in such a scenario individuals do not have an incentive to withdraw their own deposit.[4] This eliminates bank panics as an equilibrium.

Those who have managed to follow this quite abstract discussion might ask why these results are important at all? Bank panics are well known from economic history, for example in the 19th century bank panics occurred in the USA almost every decade, and it is also well known that they were stopped by the introduction of deposit insurance in the 1933 Glass–Steagall Act. What does the analysis by Diamond and Dybvig add to this then?

It can be argued that these results are important because they clearly show that banks' basic features include their vulnerability, as bank panics occur due to one of their main functions, maturity transformation. Diamond and Dybvig demonstrated that bank panics are not necessarily caused by inexplicable and irrational behaviour, they are not necessarily related to the quality of banks' management, as they can happen with completely calm and rational depositors and entirely prudent financial management.

However, this has crucial implications from a regulatory perspective: if the banking system is not regulated from a liquidity perspective, bank panics will always be a possibility. It is well known that, for example, an industry needs to be regulated if it is a natural monopoly. By contrast, if a monopoly can be broken up, and competition can be enforced in the given industry, no regulation is necessary. Diamond and Dybvig proved that this does not hold true for the banking system. No matter how efficient banks are, and whether there is competition in the banking sector or not, bank panics can occur. It has also been shown that the welfare costs of bank panics are high (this is covered in more detail during the discussion of Bernanke's work), so from a social perspective it is definitely important to eliminate the possibility of bank runs, and this is only attainable if the banking system is regulated, for example through deposit insurance,[5] as this is a special industry where the laissez-faire approach does not work.

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[4] Of course, in practice, deposit insurance does have an upper limit, as depositors only get back their deposits up to a certain amount. However, in most cases this is above the size of the deposits, making it suitable for preventing bank runs.

[5] Another possible regulatory step for preventing bank panics is the temporarily suspension of convertibility. If the bank can credibly make depositors believe that it will suspend payments in the event of mass withdrawals, then enough deposits will remain in the bank that the profitable long-term investments do not need to be liquidated and those who do not take out their deposit (because they cannot do so due to the suspension) will be guaranteed a high payment, a higher one than if they withdraw their deposit quickly. If the depositors understand this, those who are not subject to a liquidity shock will keep their money in the bank, thereby preventing a bank panic. This as a self-regulatory instrument was often used by banks in the 19th century, see the historical overview by *Gorton* (*2012*). The wave of bank panics that began in 1929 came to a halt when President Roosevelt ordered a one-week bank holiday on 5 March 1933.

Another important finding of the paper by Diamond and Dybvig is derived from the fact that their discussion was highly abstract. The results apply to all institutions that collect and invest funds and perform maturity transformation, regardless of whether in reality such institutions are officially referred to as banks or not. This is all the more important as there is a so-called "shadow banking system" in the modern financial system, and many institutions satisfy the above criteria, even though they are not officially banks. Diamond and Dybvig showed that if an institution engaged in financial intermediation and performed maturity transformation, it is vulnerable, and it needs to be regulated, irrespective of whether it is considered a bank or not in a legal sense.

2.2. Related research

The key takeaway from the above is that maturity transformation in itself can lead to bank runs, regardless of the prudent financial management of a given bank. Of course, this does not contradict the fact that if banks incur losses, whether because of flawed financial management or sheer bad luck, they are more likely to experience a bank panic. This claim is not simply an intuitive conjecture, but a fact confirmed by empirical research. For example, *Gorton* (*1988*) demonstrated that in the USA almost every recession was followed by a bank run in the second half of the 19th century and the early 20th century, because the recession increased the share of non-performing firms and thus also bank losses. This conclusion was confirmed by *Calomiris and Gorton* (*1991*) in their comprehensive empirical research. *Davison and Ramirez* (*2014*) looked at US banks in the 1920s and found that weaker economic fundamentals increased the likelihood of bank runs. They also concluded that in 40 per cent of the cases the panic was not fundamental, but rather a result of the poor coordination of expectations. *De Graeve and Karas* (*2014*) used Russian data from between 2002 and 2007 to analyse the extent to which fundamentals and expectations contributed to mass deposit withdrawals. They list arguments for both explanations, but their results attest that self-fulfilling panic has a greater effect than the decisions explained by the fundamentals.

Due to the above empirical results, the theoretical research on bank panics shifted from the original approach by Diamond and Dybvig, focusing mainly on the relationship between bank panics and the fundamentals of banks. It can be argued that this avenue of research complemented rather than discredited Diamond and Dybvig's original results, namely that in the context of maturity transformation a bank run may occur if depositors' expectations change for the worse. However, they originally did not inspect the motives behind the expectations. Later research, for example *Allen and Gale* (*1998*), *Chari and Jagannathan* (*1988*), or *Goldstein*

and Pauzner (*2005*), showed how the change in expectations was related to banks' assumed or actual financial position.[6]

Readers may nevertheless wonder whether the topicality of examining bank panics might perhaps have diminished, because for example the 2007–2008 financial crisis played out in an entirely different institutional setting than classic banking crises, as it happened in the shadow banking system based on securitisation.[7] But as shown by *Gorton* (*2010a; 2010b; 2012*), although many technological and institutional factors changed between the early 20th century and 2007, the factors relevant from the perspective of financial crises have remained unchanged.[8]

Although the panic of 2007–2008 was mainly outside the retail deposit market and occurred on the money markets, the repo market and the markets for other short-term instruments, the key to understanding the events back then is the concept of maturity transformation. Similar to a classic bank panic, the panic was started by negative economic news, in particular the bursting of the mortgage market bubble. But the panic itself was due to the fact that the institutions in the shadow banking system financed their long-term instruments, such as mortgages, through short-term loans. In other words, the shadow banking system performed a significant maturity transformation, but in contrast to the traditional banking system protected by deposit insurance, it was basically unregulated.

As noted above, one of the virtues of the analysis by Diamond and Dybvig is that general conclusions can be drawn from it due to its abstract nature. The main message that maturity transformation is socially useful but, without an appropriate regulatory environment, it inherently entails the potential for a financial panic, applies just as much to 2007–2008 as to the 19th century. The problem was that the regulatory lessons from the Diamond–Dybvig model were not applied to the shadow banking system.

Of course, the research inspired by Diamond and Dybvig also has a strand that analyses bank panics in the actual modern institutional environment, such as *Rochet and Vives* (*2004*) or *Brunnermeier* (*2009*). The latter's model examines the financial panic in the shadow banking system in 2007–2008: when financial markets refused to renew the short-term loans of some (shadow) banks that nevertheless had to obtain money, they had to sell their assets at fire sale prices. Other banks also ran into trouble as a result of falling asset prices, resulting in more fire sales. This created a self-reinforcing loop, which ultimately led to a systemic crisis.

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[6] For a detailed overview on this topic, see *Freixas and Rochet* (*1997*), *Rochet* (*2008*), as well as *Allen and Gale* (*2010*).
[7] Although Northern Rock exhibited elements of a classic banking crisis, too. See *Shin* (*2009*).
[8] For a review of *Gorton* (*2012*), see *Világi* (*2016*).

Another interesting field of research is analysing depositor behaviour using laboratory experiments. For more on this, see *Kiss et al.* (*2015*) and *Kiss* (*2018*).

3. Delegated monitoring

The aim of the Diamond–Dybvig model discussed above is to examine the role of liquidity from the perspective of the banking system, and so the authors completely disregarded the issue of solvency, and the returns of the potential investments in their model are risk-free. Nevertheless, the banking system has a well-known role in managing risks. *Diamond* (*1984*) inspects this aspect of the operation of banking systems.

The starting point of the analysis is the issue of how the form of financial contracts depends on the information of the parties. If investors seek to finance a project with an uncertain outcome, a share-type contract could be optimal when the project manager and the investor have symmetric information. In such cases, investors take a share of the project's profits, depending on the outcome. In the case of large information asymmetry, however, for example when the investor cannot observe the income flows of the project and only obtains information through the reports of the manager, a share-type contract is unfavourable for the investor, as the manager has an incentive to report low profits. Therefore, a debt contract should be signed.

The essence of debt contracts is that the manager always pays a predetermined and fixed amount to the investor. Should it fail to do so, it goes bankrupt. The investor is then entitled to liquidate the project and compensate itself from the income received. Debt contracts are incentive compatible, i.e. the manager has an incentive to report the truth, but their disadvantage is that liquidation during bankruptcy proceedings is costly, and both parties would be better off if it could be avoided.

In theory, a debt contract is not necessary if the investor can monitor the manager by allocating some resources for this. In practice, however, close monitoring is often quite costly. This is especially problematic if the investors are much smaller than the project. One only needs to think of households as investors and a large corporation as the project. The cost of monitoring would be so high that households could not afford it.

Diamond realised that this problem can be resolved if the monitoring is performed by a financial intermediary. The financial intermediary, say a bank, collects small investors' savings to finance and at the same time monitor the project. This allows the cost of monitoring to be distributed, and households can afford that. This is what the author refers to as delegated monitoring.

But of course one might ask who monitors the banks? If the banks are large enough to monitor the corporations, monitoring the banks themselves is once again out of reach for households. However, Diamond shows that it makes sense for small investors to enter into a debt contract with the bank, in this case, there is no need to monitor the bank, and small investors are better off sign a contract with the bank than investing directly in the project.

As banks and investors sign a debt contract, bankruptcies might occur, which is a very costly process, so all affected parties are interested in minimising the probability of default. Diamond points out that this can be achieved by banks diversifying their portfolio and not investing in a single large project but financing many smaller ones instead.

Using this model, Diamond demonstrates that banks are socially useful not only because they provide the necessary liquidity to economic agents through maturity transformation but also because they reduce the social cost of financial contracts through delegated monitoring. The author also provides an explanation for the empirical findings that banks diversify their investments and most of their liabilities are debts. In connection with all of this, it is worth reading *Diamond's* (*1996*) paper, which explains the above results in an intuitive, non-technical way.

4. The macroeconomic significance of financial intermediation

Out of the three Nobel laureates, Ben Bernanke is the best known, as he was the governor of the Fed during the financial crisis of 2007–2008 and made efforts to reduce the damage caused by the crisis as much as possible. Even before that, he had had an important scientific research career, and of course that is what earned him the Nobel Prize.

Interestingly, the ground-breaking article by *Bernanke* (*1983*) was published at the same time as Diamond and Dybvig's work with a similar impact. Today's readers may be surprised to know that Bernanke was the first to prove with scientific rigour that the banking system and bank panics contributed significantly to the Great Depression of 1929.

Before him there had been two main views on this issue. According to the first, the problems of the banking system were a consequence of the real economy crisis rather than its cause. The most influential advocate of the other view was another Nobel laureate, Milton Friedman, who claimed that the dramatic decline in banking did contribute to the crisis, but only by contracting money supply.

Bernanke claims that Friedman's explanation is valid, but not sufficient. Providing a transaction instrument, money, to economic agents in the form of liquid

deposits is only one of the activities performed by the banking system. Financial and investment markets experience considerable information asymmetry, which would make such markets highly inefficient in the absence of financial intermediary institutions that use their special knowledge and technology to provide services that mitigate the losses from this information asymmetry, for example through the delegated monitoring analysed by Diamond. If activity in the banking system diminishes substantially for some reason, economic actors do not have adequate access to these services, which entails major real economy losses.

To be clear, Bernanke does not claim that real economy developments fail to affect the banking system. As discussed above, bank runs are typically triggered by a recession in the real economy. However, bank panics significantly magnify the initial problem in the real economy, and banking declines so much due to the panic that it causes much greater damage in the real economy than the initial recession that started the whole process.

Bank panics significantly reduced the loans extended by the banking system. On the one hand, some banks went bankrupt due to mass withdrawals of deposits and even those that remained standing had their funds reduced. On the other hand, banks' liquidity risk skyrocketed, and they reduced their maturity transformation by increasing the share of their liquid assets and offloading loans from their portfolio. Due to the deepening recession and deflation, the collateral behind the loans also lost value, while the real burden on debtors increased and they found it increasingly difficult to make payments. This raised lending risk considerably. On account of the greater credit risk, loans were not extended to the riskiest customers, while others only obtained more expensive loans than before. This further deepened the recession, which further increased the risk of bank panics and credit risk, which in turn led to further falls in bank lending, thereby creating a negative self-reinforcing process.

But the real significance of Bernanke's 1983 article is that it was able to provide empirical evidence for the above. Bernanke first examined whether monetary effects explained the evolution of real output between 1919 and 1941, as hypothesised by Friedman. For this, he regressed output to the measure of monetary and inflationary surprise (assuming, based on Robert Lucas, that the change in the quantity of money and the portion of inflation/deflation that can be forecast have no real economy impact), and he obtained statistically and economically significant results. According to the simulations performed based on the estimates, however, monetary effects capture no more than half of the total decline of output during the period of the Great Depression between 1930 and 1933. He then complemented the estimated regressions with variables that measured the non-monetary impact of the banking system. These included (real) deposits of failing banks and the liabilities of failing businesses. The signs of the estimated coefficients of the new

variables in the complemented regressions were economically meaningful and significant. Furthermore, the new variables reduced the mean squared simulation error by about 50 per cent. This offered empirical evidence that the banking system contributed to the extremely deep recession, not only through the monetary aggregate but also through the contraction in lending.

Most of Bernanke's scientific work concerned the real economy impact of the financial system, but it was not limited to the 1929–1933 crisis. He was just as much interested in the macroeconomic role of lending and the banking system under normal circumstances as well as their role in the transmission of monetary policy. This area of research can be labelled as the examination of the credit channel of monetary policy, a comprehensive overview of which is given in *Bernanke and Gertler* (*1995*).

It is generally acknowledged that in the presence of sticky prices, monetary policy can influence real interest rates, thereby affecting households' saving and investment decisions as well as companies' investment decisions. However, empirical evidence suggests that the real economy response to monetary policy shocks is difficult to attribute solely to the interest rate channel. For example, experience has shown that much of the negative impact of monetary policy tightening on investments can only be felt when the real interest rate starts to fall again after the tightening. This leads one to conclude that monetary policy also affects the real economy in ways other than the interest rate channel.

The credit channel, referring to the impact of monetary policy through lending, can be divided into two parts: the balance sheet channel and the bank lending channel. Information asymmetry is once again key in the operation of both.

The balance sheet channel is the result of the fact that due to the information asymmetry between lenders and debtors, the larger the proportion of the loan relative to equity (leverage), the greater the risk premium paid on corporate loans. In the event of monetary tightening and an interest rate increase, since companies' revenue falls and interest expenses increase, their net worth declines (or grows less than before), which entails a rise in the risk premium, an even greater interest burden and a further contraction in net worth. These factors reduce investments more than the interest rate channel, and their impact is much longer. The bank lending channel functions similarly. Banks and borrowers are also in information asymmetry, so banks cannot increase their leverage to an unlimited extent, either due to regulatory requirements or their own risk management considerations. In times of monetary tightening, banks' equity and leverage both fall, which exacerbates the negative effects of tightening. *Bernanke and Blinder* (*1988*) and *Bernanke et al.* (*1999*) analyse the operation of the credit channel using formal models.

At the end of the 1990s, Bernanke's research turned towards the problems of inflation targeting, and partly because of this he served as the governor of the Federal Reserve between 2006 and 2014. This part of his work is not discussed in the present paper but is mentioned briefly in the Closing remarks.

5. Reception of the awards

Since scientific performance cannot be measured as exactly as the 100-metre dash, the award of the Nobel Prize always stirs up debate. The 2022 Prize in economics did so too, perhaps more than usual. This may be because, while the 2021 Prize, for example, rewarded methodological developments that were mainly of interest to the profession, the research area that received the Prize now, the operation of the banking system, directly influences the life of a wider audience.

The most superficial critiques of the award process claim that basically trivial, generally known results were recognised. It can be argued that there is a basic misunderstanding here. Natural sciences often discover new things whose existence was not even suspected before. One such example is the discovery of penicillin. But economics does not produce results of this nature. Everyone even moderately well-versed in economic history knows that bank runs occurred as early as the 19th century. Diamond and Dybvig obviously did not discover the existence of bank panics, but instead *provided a very important interpretation,* with major economic policy implications. By this logic, the value of Thomas Sargent's research on hyperinflations (2011 Nobel Prize) could also be called into question, because everyone knows that there were periods of hyperinflation in history.

A more substantiated criticism was levelled by *Tooze* (*2022*), who claimed that if the analysis of financial crises merits a prize, Hyman Minsky or Charles P. Kindleberger would have deserved it much more, but as they were not mainstream researchers they were ignored in their lives. Without taking a position on whether Minsky and Kindleberger would have deserved a prize, based on *Krugman* (*2022*) it has to be underlined that the work of those two researchers and the current Nobel laureates is difficult to compare as they focused on *different* aspects of financial crises. According to the hypothesis of Minsky and Kindleberger, financial crises are the end points of financial cycles driven by the irrational mood swings of economic actors. On the other hand, *Diamond and Dybvig showed which specific features of the financial system make bank panics possible and how, while Bernanke examined the macroeconomic effects of bank panics.*

The most radical criticism was voiced by *Bofinger and Haas* (*2022*). They believe that the Diamond–Dybvig model is fundamentally misguided. They base this on an approach that is a minority view within economics: they call into question whether banks perform financial intermediation, and they argue that all models of the

financial system that only contain real variables are flawed. A detailed analysis of this view is outside the scope of this paper,[9] but this criticism misses the point because *Diamond and Rajan* (*2006*) later expanded the original Diamond–Dybvig model to include money and monetary policy. Their results somewhat nuanced the message of the original model but did not contradict it.

6. Closing remarks

The ground-breaking studies by Bernanke, Diamond and Dybvig were published in 1983, and while they later became part of the advanced finance and macroeconomics curriculum, their significance has long been unrecognised by the majority of the profession. The importance of their message was made conclusively clear by the 2007–2008 crisis.

Now there is a consensus among economists that, along with the traditional banking system, the shadow banking system must also be regulated from a liquidity perspective. Even the crisis of 2007–2008 could probably have been avoided if such regulations had been in place back then. This was the most important lesson from the work of Diamond and Dybvig from an economic policy perspective.

It is a huge and lucky coincidence that Ben Bernanke happened to be the governor of the Federal Reserve at the time when the 2007 Great Recession hit, as he was the man who had spent most of his career highlighting the severe macroeconomic consequences of systemic financial crises. Armed with this knowledge, he was one of the best placed to use unprecedented monetary policy instruments to mitigate the macroeconomic consequences of the financial crisis,[10] which he finally did successfully, because however deep the recession after 2008 was, it did not even come close to the Great Depression of the 1930s.

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[9] For an analysis and criticism of the view calling into question the financial intermediation of banks, see *Világi and Vonnák* (*2022*).
[10] For more on this period, see *Bernanke* (*2013*), or its review by *Plajner* (*2016*).

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Digitalisation and Convergence – The Example of Estonia*

Szabolcs Szentmihályi

Estonia achieved development while maintaining balance through comprehensive, innovative competitiveness reforms, with significant economic convergence between 2010 and 2019. The development level of the Estonian economy rose from 64.2 per cent of the EU average to 82.3 per cent during this period, the second highest change in the East-Central European region in the last decade. On the whole, the room for manoeuvre for Estonian macroeconomic policies was very limited over the past two decades as a result of the fixed exchange rate system and later introduction of the euro. As a result, the growth path that ultimately led to rapid convergence had to be pursued in the area of competitiveness and structural policies. Estonia found the opportunity to break through in digitalisation and transformed itself into the region's digital leader through symbolic gestures and practical steps, not only leading to improvement in productivity but also contributing to the creation of world-renowned companies.

1. Unsustainable catching up and crisis management before 2010

Before looking back on the successful decade, let us first review the situation from which the results were achieved. After gaining independence from the Soviet Union, Estonia simplified its tax system to create a business-friendly environment by establishing a flat-rate income tax system, and the rate of the income tax was gradually reduced during the 1990s (*Karsten 2004*). In financing, they focused on attracting foreign investors by creating a uniquely attractive business environment. The influx of fresh working capital created new jobs, many old factories were rebuilt, and new knowledge and technology entered the economy, making the country even more modern and competitive. Similarly to the other East-Central European countries, the Baltic countries also face the challenge of current demographic trends, i.e. an ageing and shrinking population, exacerbated by the emigration of a part of the working-age population to the EU. Within 15 years of Estonia's independence, nearly 15 per cent of the population had left the country.

Attracting foreign capital was an important tool in Estonia's convergence process. After the change of regime in Estonia, there was significant privatization, with most companies privatized by 1995. The arrival of foreign capital and investors was crucial to the rapid transition after becoming independent. FDI-related legal provisions were favourable for foreign investors, as Estonia guaranteed the possibility to transfer profits abroad (*Angelov 2007*). In particular, close economic ties were established with the Nordic countries, allowing the flow of advanced technology and competitive economic views.

Estonia exercised a fixed exchange rate monetary policy after becoming independent and pegged its currency to the euro from 2002. Some two decades before adoption of the euro, they gave up their independent monetary policy (initially pegging their currency to the German mark and later to the euro) and the possibility of external adjustment through the exchange rate. Maintaining this required disciplined fiscal policy, which is why in the 2000s the Estonian budget was in surplus for most of the decade. In addition, Estonia inherited a very low level of government debt when it became independent, which has helped its budgetary situation considerably to date. However, this monetary policy system and the significantly liberalized money and capital markets, together with EU accession in 2004, brought significant capital inflows and a surge in lending, which led to pronounced overheating of the economy in the 2000s. Overheated lending caused excessive growth in real estate investment, wages and consumption.

The strong economic recovery and overheating that preceded the global financial crisis of 2008–2009 led to internal and external imbalances, which left Estonia with a large current account deficit (in some years exceeding 10 per cent of GDP) in the years before the crisis. By comparison, the current account deficit of the EU-27 countries averaged around 3 per cent over this period (*Figure 1*). In response to the crisis, Estonia made a significant fiscal adjustment between 2009 and 2011: all major expenditure items were cut (except social transfers to the population), the VAT rate on food was increased and the excise tax on alcohol and tobacco products as well as on fuels was increased (*Friedrich – Reiljan 2015*). As the government deficit did not exceed the 3-per cent Maastricht criterion during the crisis years, Estonia's government debt-to-GDP ratio did not increase markedly during the crisis years.

Figure 1
Current account balance in the East-Central Europe region between 2000 and 2009

As a percentage of GDP

Note: Baltic-2: means the unweighted average of Latvia and Lithuania. V3: Czechia, Poland and Slovakia.
Source: MNB calculation based on Eurostat
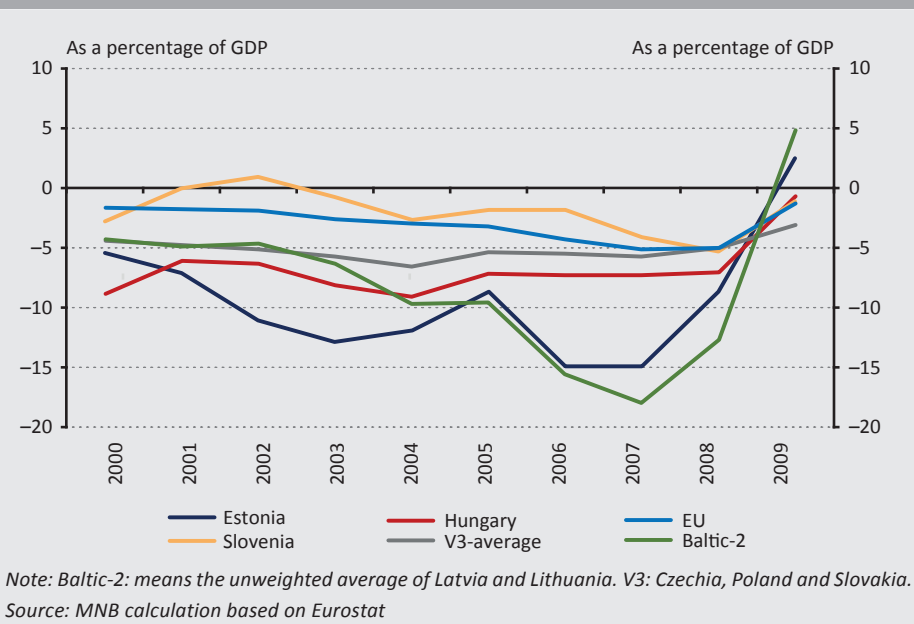
During the crisis, along with the other Baltic countries, Estonia opted for internal devaluation to address the imbalances, which meant that the pre-crisis real wage levels were only reached again in 2014. Devaluing the currency would have seriously jeopardized the objective of early euro adoption and the credibility of the currency board arrangement. Internal devaluation occurred via a reduction in nominal wages, made possible by the flexible labour market. The reduction of wages and fiscal austerity led to a dramatic, rapid improvement in the external balance, but the social costs of these measures were significant.

Partly as a result of internal devaluation, Estonian growth was slowed by the rising share of outflowing labour. According to UN data, in 2020 there were more than 200,000 Estonians living abroad, which is almost 16 per cent of the population of 1.3 million. The number of Estonians living abroad reached its current level gradually, but the period between 2010 and 2015 saw the largest increase.

Prior to the global financial crisis of 2008–2009, Estonia was characterized by an overheated economy, leading to one of the deepest economic downturns in Europe (GDP fell by 18.7 per cent compared to the same period of the previous year in the third quarter of 2009). However, the measures taken before 2010 contributed to a relatively quick recovery from the crisis, even without reaping the benefits of an independent monetary policy.

2. Growth while maintaining balance between 2010 and 2019

Between 2009 and 2019, Estonia achieved significant convergence with the EU average, moving from 64.2 per cent of the EU average to 82.3 per cent from 2009 to 2019 (*Table 1*). However, Estonia is notable for having achieved this in conjunction with the lowest government debt-to-GDP ratio in the EU, a position it has maintained over the past decade. In the East-Central Europe region, Estonia's development changed the second most between 2009 and 2019.

Table 1			
Development of the East-Central Europe countries between 2009 and 2019			
	2009	**2019**	**Change between 2019 and 2009**
Lithuania	56.9	84.2	+27.3
Estonia	64.2	82.3	+18.1
Romania	52.2	69.6	+17.4
Latvia	53.4	69.4	+16
Poland	59.9	72.9	+13
Hungary	65.1	73	+7.9
Czechia	86.8	93.2	+6.4
Slovenia	86.4	88.7	+2.3
Slovakia	72	70.5	−1.5

Note: EU27=100
Source: Eurostat

Estonia's success after joining the euro area in 2011 is not a common phenomenon among euro area members. Italy and Spain, which are more developed than Estonia, have not made much progress since the introduction of the euro. Similarly, Slovakia's development even declined after the introduction of the euro between 2009 and 2019 (*Table 1*). This suggests that successful convergence is not linked to the euro in its own right, but rather to the maturity of a country to adopt the euro and to the extent to which it implements the necessary competitiveness reforms before adopting the single currency. Between 2010 and 2019, Estonia managed to put itself on a growth path where it grew at around 2 percentage points above the EU average.

On the production side, the service sector and industry were the largest contributors to cumulative GDP growth in Estonia in the past decade, accounting for more than 90 per cent of the growth between 2010 and 2019 (*Figure 2*). Estonia is a relatively resource-poor country, with the services sector accounting for nearly 70 per cent of its economy on average between 2010 and 2019. In 2019, the weight of the

services sector was nearly one and a half times higher than the Baltic average for the ICT sector and 1.7 times higher for the financial and insurance sector. Industry accounted for 21 per cent, and construction and agriculture for 6.7 and 3.2 per cent, respectively.

Figure 2
**Output-side decomposition of cumulated GDP growth (2010–2019)**

Source: MNB calculation based on Eurostat
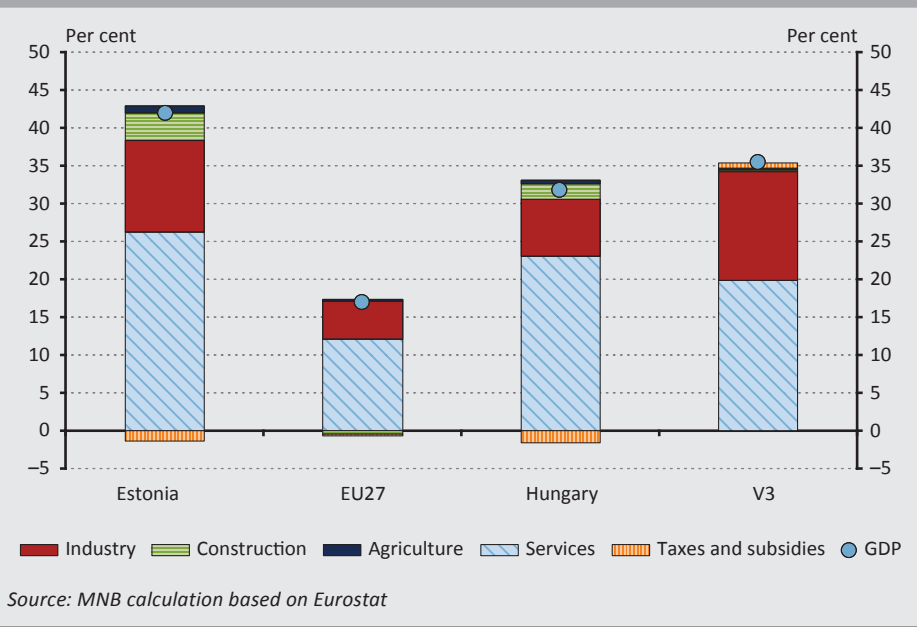
Following the financial crisis, between 2010 and 2019, Estonia's average investment rate exceeded 25 per cent. The investment rate is an essential condition and an important indicator for the success of any economy, as an adequate level of investment is essential for sustained and sustainable economic growth. Estonia's investment rate was still only marginally above the EU average in 2010, but later significantly outpaced both the EU average and the Baltic countries, thanks to a favourable macroeconomic and entrepreneurial environment. Its only challenger in the East-Central Europe region is Hungary: Estonia's investment rate for 2019 was 25.4 per cent, while Hungary's for the same period was 27.0 per cent. However, it is not just the level of the investment rate that is important. In the 21st century, its structure is the key to successful economic convergence.

Investing in smart capital offers qualitatively greater potential for economic growth than investing in construction alone. The share of investment in ICT equipment in total investment in Estonia was 6.2 per cent over the decade, compared

to an EU–27 average of 3.6 per cent (which put Estonia in 5th place in the EU ranking.)

For the period 2010–2019, Estonia's government debt stands out in the East-Central Europe region with a single-digit value thanks to its exemplary budget policy. Estonia managed to correct the imbalances of the overheated growth of the 2000s during the crisis management and to grow with a balanced budget throughout the crisis. Even at the onset of the crisis, Estonia stuck to a tight fiscal policy and, unlike the other two Baltic countries, its government debt did not soar above 10 per cent of GDP, even after the crisis, while in Latvia and Lithuania it was around 35–45 per cent of GDP (*Figure 3*).

Figure 3
Government debt in the East-Central Europe region

Source: Eurostat
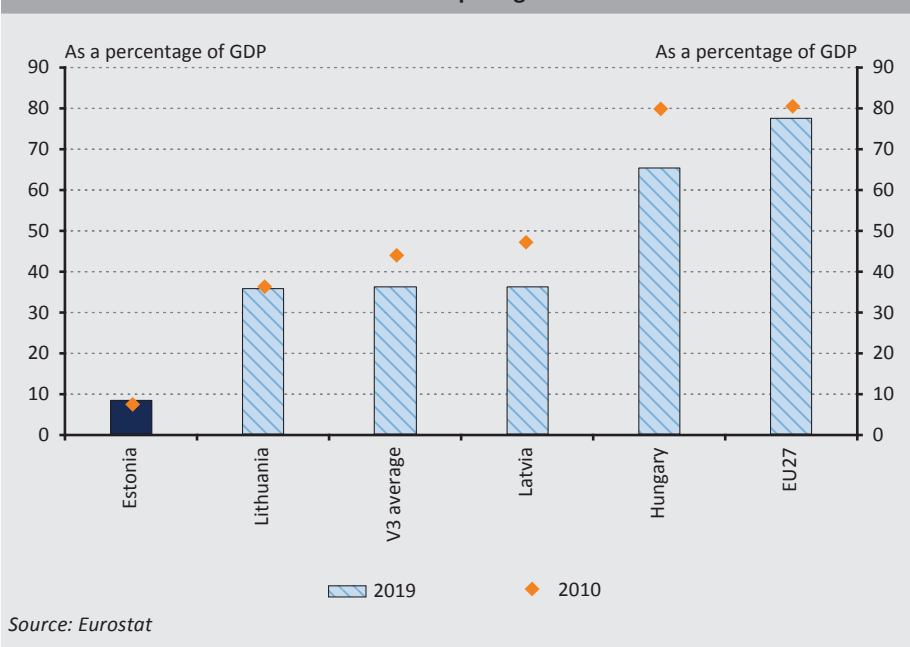
From 2010 to 2019, Estonia's average current account balance surplus of 1.1 per cent of GDP was slightly above the EU average of 0.9 per cent and more favourable than the other two Baltic countries and the V3 countries. In the years following the crisis, the country restored its current account balance and the asset position could be sustained. Estonia has a high credit rating: it is currently rated A1 by Moody's, AA– by Standard & Poor and AA– by Fitch, thanks to its favourable current account balance and disciplined budget policy.[1]

[1] https://tradingeconomics.com/estonia/rating. Downloaded: 11 January 2023.

Estonia's inflation was volatile between 2010 and 2019 in the absence of an independent monetary policy. At the beginning of the decade, as the economy recovered from the global economic crisis of 2008–2009, rising domestic demand led to a sharp increase in inflation (reaching 5.2 per cent in 2011). The acceleration in inflation was halted by decreasing imported inflation as a result of the euro area sovereign debt crisis, and then Estonia's inflation fell to around 0 per cent from 2014 as world market oil prices fell. The surge in world energy prices in the second half of the decade led to a renewed rise in inflation, and from October 2019 onwards the fall in energy prices had a moderately negative impact on inflation.

As a whole, the country has made significant progress over the last decade in all macroeconomic fundamentals: it has moved significantly closer to the EU average in terms of development, has an outstanding ability to attract capital and a high investment rate, has seen marked improvements in the unemployment rate, which soared during the crisis, and has achieved these results while maintaining external and internal balance.

3. Competitiveness through digitalisation

Estonia has earned a global reputation for being at the forefront of digitalisation, from e-government to the use of modern blockchain-based technologies and the high degree of digitalisation of businesses and the population. In EU countries, the Digital Economy and Society Index (DESI) is used to monitor the spread of digitalisation. Estonia had the 6th highest score in the European Union in the period 2016–2019 (*Figure 4*), ranking 1st in a sub-index measuring the digitalization of the state and 7th in the index measuring the digitalisation of the population.

Figure 4
EU Digital Economy and Society Index (2016–2019 average)
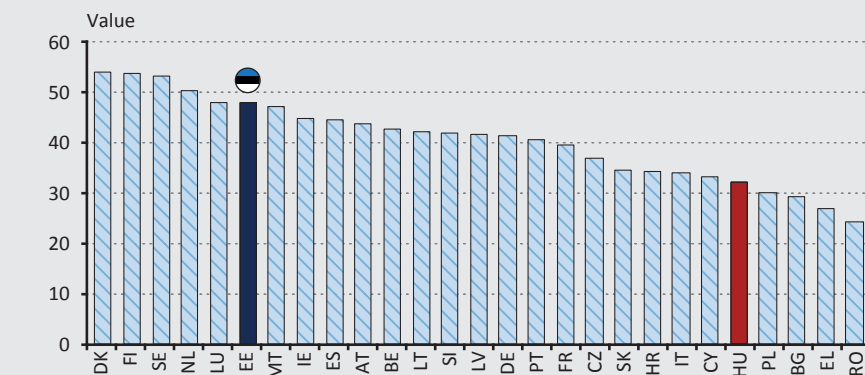

Note: Data is available from 2016 only.
Source: European Commission

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In 2000, the Estonian Parliament enshrined in the Constitution that free access to the internet is a fundamental human right. In this spirit, the list of places offering wireless internet access in major cities and in the countryside, in cafés and petrol stations, has been growing steadily. Compared to other EU countries, the IT sector is among the fastest growing sectors (*Figure 5*). One component of the DESI shows the percentage of the population aged 16–74 who have never used the internet. This indicator was one of the lowest in Estonia in 2019, with only 7.25 per cent of the population never having used the internet, lower than the EU average of 10.4 per cent, and Hungary's figure is 14.2 per cent.

Figure 5
Weight of the IT sector in EU Member States
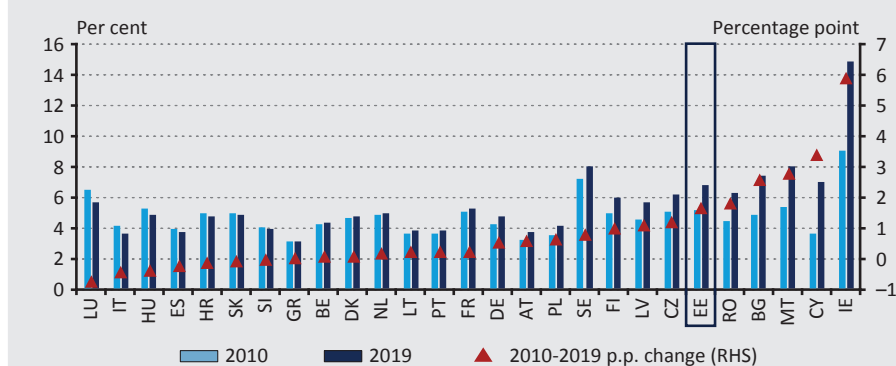
Note: NACE classification (Statistical classification of economic activities), branches of the national economy.
Source: MNB calculation based on Eurostat data

3.1. Education as the foundation for digitalisation

The Estonian education system is one of the most successful in the world according to international surveys. In 2018, Estonia was the best-performing European country in all three categories (maths, literacy and science) in the OECD's PISA competency test. Between 2009 and 2018, Estonia improved its average PISA score the second most after Poland, overtaking Finland, which was ranked first by a large margin in 2009.[2] The UN Human Capital Index (HCI[3]) is also used as a measure of education systems: Estonia's HCI score is outstanding (similarly to the other Baltic countries), with a score above 92 per cent, exceeding the 87 per cent average of the EU.

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[2] *PISA results*. OECD, 2018. https://www.oecd.org/pisa/. Downloaded: 11 January 2023.
[3] The HCI takes into account four factors: the literacy of adults, the proportion of those remaining in the education system, the number of years of expected schooling and the average level of schooling.
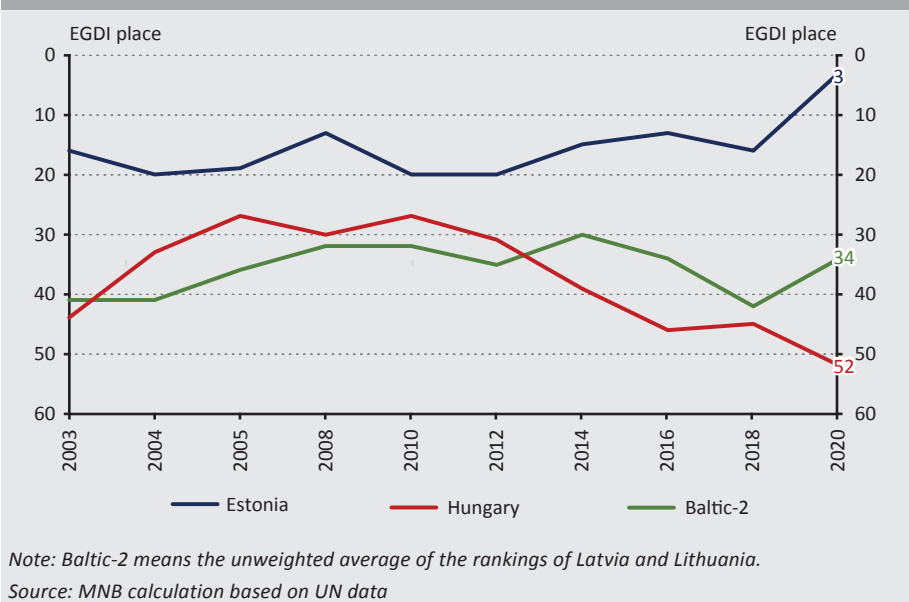
The success of public education is also reflected in Estonia's high share of the population with tertiary education. The share of people with a qualification obtained in higher education is also among the highest in Europe, at 36.5 per cent for the 15–64 age group (compared to an EU average of 27.9 per cent). The high share of people with higher education also explains the high share of people with digital skills in Estonia. The proportion of the population with skills above basic digital skills in Estonia was 37 per cent in 2019, compared to the EU average of 31.1 per cent. According to the latest Times Higher Education Ranking, two Estonian universities were ranked among the world's top 1,000 higher education institutions, with the University of Tartu in the prestigious 201–250 category and TalTech in the 601–800 category. The small size of the domestic market has increased the value of foreign trade, resulting in a large proportion of the population speaking several foreign languages, and Estonia has one of the lowest proportion of those not speaking a second language. Combined with Estonia's relatively high education expenditure and the advanced digital skills of the population, supported by the legal provision of internet access, a picture of a digitally-open population is unfolding, which is an important building block for technological reform.

3.2. Digital state

Estonia has gained an international reputation as a "digital state" with a high degree of digitalisation in public services. The term "digital state" does not mean the digitalisation of all public tasks, as some civil servant jobs cannot be replaced by computers, but it refers to the digitalisation of government operations. The e-Government Development Index (EGDI) ranks Estonia 3rd among UN Member States in 2020 (*Figure 6*), with only Denmark (1st) and South Korea (2nd) ahead of it.[4] In Estonia, the development of e-government already started in the 1990s, with some local banks launching internet banking services as early as 1996 (*Kitsing 2017*). The fast, affordable and quality service is catching on quickly with the public. Seeing the initial success, the government has also launched access to some public services through banking platforms. The tax authority was the first to make online tax returns available from 2000, using internet banking identification interfaces.

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[4] United Nations, *E-Government Survey 2020,* https://publicadministration.un.org/egovkb/Portals/egovkb/ Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20(Full%20Report).pdf. Downloaded: 12 January 2023.

Figure 6
E-Government Development Index (EGDI) rankings

Note: Baltic-2 means the unweighted average of the rankings of Latvia and Lithuania.
Source: MNB calculation based on UN data

With the continued support of the public, Estonia has gradually implemented e-government, which now allows 99 per cent of public services to be accessed online. To meet this need, it was necessary to create a central backbone network that could manage different IT systems over the internet, transfer large amounts of data and search across disparate IT systems simultaneously (*Figure 7*). The safety of e-government is secured by blockchain-based technology: the KSI (Keyless Signature Infrastructure) system is an Estonian-designed blockchain-based technology used around the world to protect networks, systems and data (*Semenzin et al. 2022*). The advantage of blockchain is that it contains predefined rules, so no one can change them: data cannot be manipulated or stolen. For transparency, people are informed about everything, who is using their data, when and for what purpose.

Figure 7
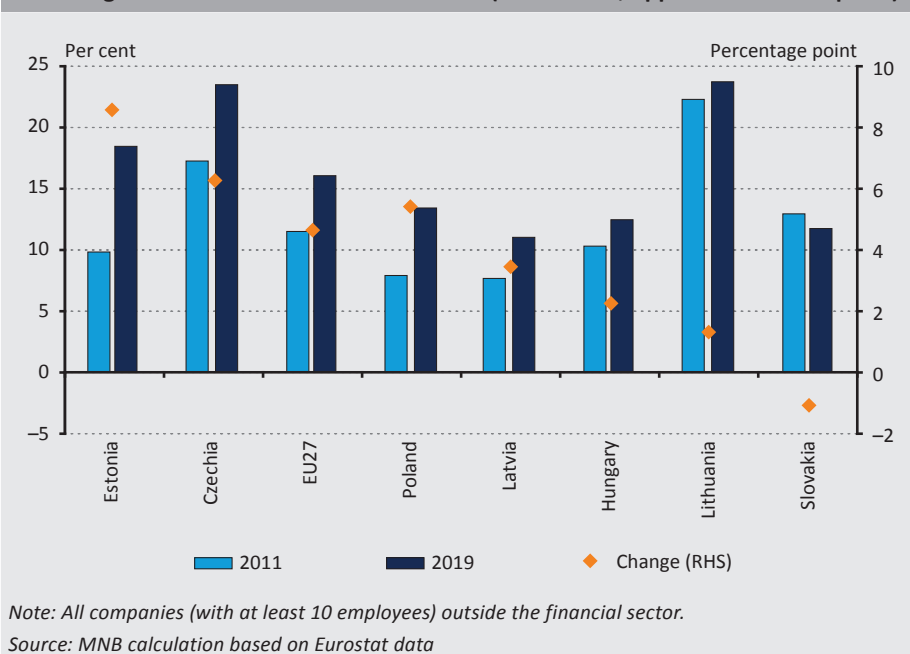**How the Estonian digital state works**
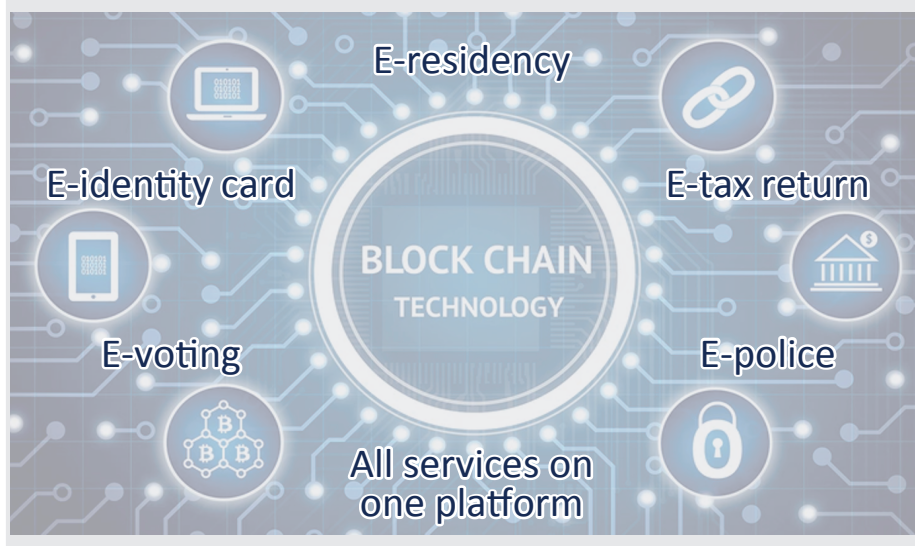
3.3. Corporate digitalisation

Business digitalisation in Estonia made huge strides between 2010 and 2019. The share of companies selling online almost doubled over this period (*Figure 8*). Estonia developed faster than its Baltic neighbours and the V4 countries, with 2019 data showing that the share of companies with web sales opportunities is higher than the EU average. This is also due to the fact that, as a small country, the domestic market is not sufficient for the sustained growth of companies, and foreign markets are easier to reach through digital channels. In Estonia, the efficiency of digital professionals, quantified by the ratio of companies using ERP[5] and CRM[6] software to the corporate penetration of ICT professionals, has improved tremendously since 2010. While in 2012, this efficiency indicator in Estonia stood at around 60 per cent of the EU average, by 2019 it was already almost 9 per cent above the EU average.

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[5] The term ERP (Enterprise Resource Planning) actually stands for integrated business process management software, which optimally allows access to the recorded organizational data in real time. ERP systems support the collection, storage, management, processing and interpretation of data generated in certain areas, at company or even group level.
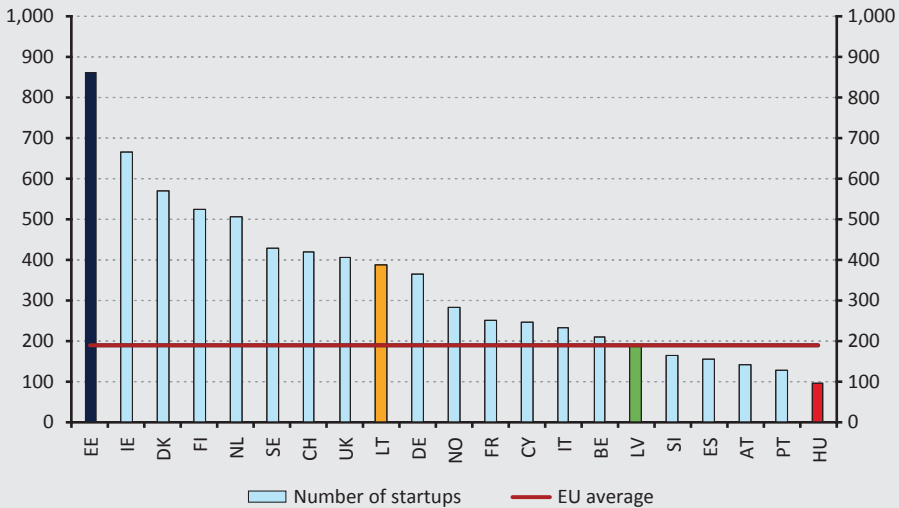
[6] The concept of CRM (Customer Relationship Management) refers to the description of a company's processes in relation to its partners. The purpose of CRM software is to support these processes and store information about current and potential customers.

Figure 8
Percentage of businesses with internet sales (via website, app or web marketplace)

Note: All companies (with at least 10 employees) outside the financial sector.
Source: MNB calculation based on Eurostat data

The number of startups registered in Estonia is outstanding. Estonia has the highest number of startups per million inhabitants in Europe, according to the 2020 *State of European Tech Report* (*Figure 9*). Looking at the time series, especially between 2010 and 2019, the number of new firms registered in Estonia in proportion to the population has risen sharply, which neither the region nor the EU average has been able to follow.

Figure 9
**Number of startups per one million persons**

Estonia's growing startup advantage compared to the Baltic countries can be explained by its digitalisation: in a unique way in the world, fast and paperless digital government services were introduced in December 2014, making them accessible to citizens worldwide. This initiative is called "e-residency".[7] This has removed borders in the digital world, allowing anyone to run a company in Estonia from anywhere in the world without having to reside there or acquire citizenship. For entrepreneurs, the benefits of e-residency include, but are not limited to: setting up a company online within a day, access to business bank accounts, international payment services, digital signature of documents and contracts, online tax return preparation and a favourable corporate tax environment.

Innovation is a key driver of productivity. According to the European Innovation Scoreboard 2020,[8] Estonia is one of the strong innovators. Estonia is also the best performer in the East-Central European region in terms of two indicators of the strength of innovation: the innovation index and the share of innovative SMEs (*Figure 10*). The quality of the institutional system has a strong influence on the entrepreneurial spirit, which can be the basis for the creation of innovative businesses.

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[7] *Recommendations for making Estonia's ground-breaking e-Residency initiative more beneficial to everyone who is part of our digital nation.* E-residency 2.0 White Paper. https://s3.eu-central-1.amazonaws.com/ereswhitepaper/e-Residency+2.0+white+paper+English.pdf. Downloaded: 11 January 2023.

[8] *European Commission (2020)*

Figure 10
Innovation indicators for the countries in the East-Central European region

Per cent

Per cent

Innovation index
The proportion of innovative SME-s in the EU average
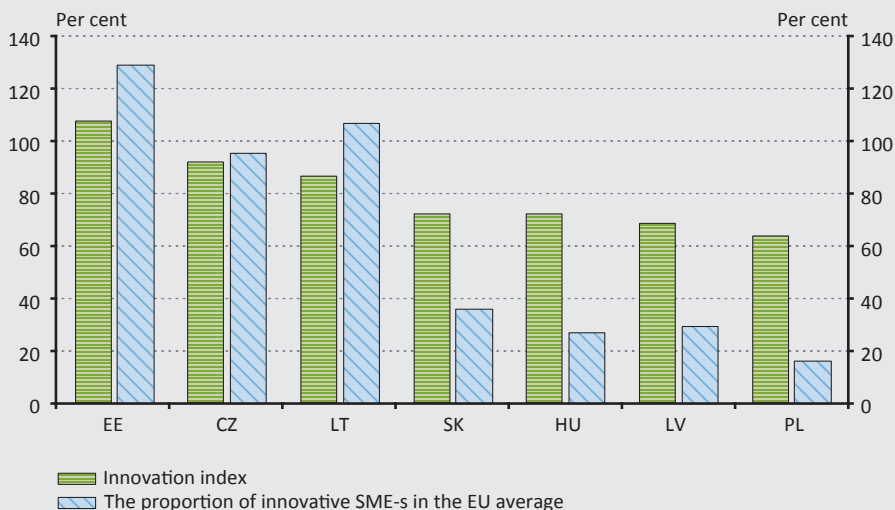
Source: European Commission (2020)

Estonia has given world-famous companies such as Skype, Transferwise and Bolt to the digital world. Skype's founders are of Danish and Swedish origin, but the software itself was written by three Estonian programmers[9] and the majority of its employees are based in Tallinn and Tartu. At the beginning of the 2000s, international calls were still very expensive and roaming charges were high, so Estonian programmers developed Skype, based on peer-to-peer technology, to solve this problem. Transferwise was set up in 2011 to help people working abroad convert their earnings into another currency at lower fees, as up to 5 per cent of their earnings could be lost on the exchange. They saw the solution in the fact that there is no need for a bank currency conversion, an in-country transfer is enough, for example by connecting users who are looking for euros with those who have them. Bolt (formerly Taxify) is the brainchild of a 19-year-old Estonian high school student, an online service where you can book a taxi online quickly and easily. Since its creation in 2013, it has grown to rival Uber, expanding not only in Europe but also in Asia and Africa.

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[9] Ahti Heinla, Priit Kasesalu, Jaan Tallinn

4. Conclusion

Between 2010 and 2019, Estonia made significant progress in all macroeconomic fundamentals and is at the forefront of digitalisation for government, businesses and citizens. The rapid growth that preceded the global financial crisis of 2008–2009 was achieved in an unhealthy structure, resulting in Estonia suffering the second largest decline in the European Union in 2009. In the decade that followed, however, it moved significantly closer to the EU average in terms of development, exhibited an outstanding ability to attract capital and a high investment rate, and saw a marked improvement in the unemployment rate that had surged during the financial crisis. It achieved these results while maintaining its external and internal balance. Significant progress was also made in the area of digitalisation, with a rapid transition to technological reform, driven by the openness of the population to digital technologies and supported by high quality education. Government incentives for entrepreneurship and the cross-border sharing of digital technologies in e-government have been coupled with extraordinary entrepreneurial spirit over the past 10 years. Estonia stands a good chance of becoming the Silicon Valley of the European Union in the next decade.

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The Greatest Success of European Integration: The Achievement of Economic Integration in the European Union*

Balázs Ferkelt

The greatest success of European integration has undoubtedly been the peace that has prevailed on the territory of the Member States for more than six decades, the steady expansion of economic and trade cooperation, and the creation and functioning of the internal market. The European integration is unique in the world in that there is no other integration formation where such a large number of countries have such extensive internal trade. In 2021, there were only three EU countries with higher export performance to non-EU countries than to other EU countries (Ireland, Cyprus and Malta) and only one country, Ireland, whose imports from outside the EU exceeded its imports from EU countries.[1] This is why it is important to pay particular attention to the dynamics of economic cooperation if we want to understand the development and strength of the European integration. This is something that could have a major impact on the future of the European Union.

Péter Halmai's book examines the system of European economic integration in a complex way, based on state-of-the-art international approaches. The work discusses the European integration, some of the competences of the European Union (the common and Community policies taking the term used before the Treaty of Lisbon), in an applied economics approach. Throughout the book, the author uses both the micro- and the macroeconomic approach depending on the topic. The trade and competition policy are essentially based on a microeconomic analysis, while the chapters on structural and regional policy, Economic and Monetary Union (EMU), economic policy coordination, fiscal policy, European growth potential and structural reform pressure are discussed in a macroeconomic approach. In keeping with the complexity of the subject, Halmai analyses the Common Agricultural Policy from both a microeconomic and a macroeconomic perspective.

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[1] *Eurostat* (*2022*)

"The European integration is first and foremost an economic integration," the author points out in the theoretical introduction to his book. We can agree with this statement even in the knowledge that the development of the economic integration has been shaped by political intentions, considerations and compromises in the practice of the European integration. The book's assertion that the integration process is not about the loss of national sovereignty, but rather about the exercise of certain elements of sovereignty (transferred to the Community or the Union) jointly with the Member States, could be given more space in public thought. Economies of scale, the trade creation and trade diversion effect of the customs union, the EU-level regulation of public procurement and concession contracts have all contributed to the success of the internal market (single market), which will be 30 years old in 2023, as shown by the analysis of the BE-COMP curves in Chapter 1. The EMU can be seen as the crowning achievement of the internal market, even if it had only a modest real trade impact in itself.

The establishment and operation of a common trade and competition policy was a prerequisite for the completion of the internal market, as well as for the completion of the common market, which was already a goal of the Treaty of Rome on the EEC. Without an evaluation of this, the logic of European economic integration cannot be understood. Given that the trade policy is an exclusive competence of the Union under the Treaty of Lisbon, knowledge of the EU's external trade relations is a fundamental requirement for all economists working in business in all Member States, both now and in the future. It is also important to understand – as the author states in the trade policy chapter of his book – that possible disintegration, a backtrack from trade liberalisation, will cause prices to rise and competition to become less intense, with negative effects for all consumers. Although the time at which the research for the book was completed did not allow for an in-depth examination of the Brexit scenario[2] that was realised, all scenarios are outlined in the second chapter of the book. In the third chapter, similarly to the wide-ranging presentation of trade policy relations, the reader would have liked to see some specific examples of competition regulation.

The fourth chapter on the EU's common budget provides a remarkable overview and systematisation. In addition to a comprehensive analysis of the common budgetary system, a special attention is given to the development of Hungary's budgetary relations with the European Union.

The common agricultural policy is indeed one of the most controversial areas of European integration, but it is undoubtedly an important segment of European economic cooperation. Looking at the whole vertical integration, it makes a significant contribution to gross value added and is still the second largest item

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[2] The author has analysed the Brexit problem in several works, see e.g. *Halmai* (*2020a*).

of expenditure in the EU budget. Halmai, as one of, if not the most prominent expert on the European Union's agricultural system in Hungary, is in favour of a radical reform of the common agricultural policy, as opposed to a renationalisation or even – albeit highly unlikely from a social and political point of view – a complete dismantling of the policy area. The need for cohesion spending, which is the largest component of the common budget, is beyond dispute, although it is worth reflecting on the fact that even the most developed EU countries and regions can in practice benefit from these funds, even if only to a relatively small extent. The raison d'être of the regional (cohesion) policy is also confirmed by the author's convergence calculations:[3] on the one hand, the deepening of economic integration initially benefited only a limited number of regions, and on the other hand, the catching up of most less developed Member States also led to an increase in regional disparities within the country.

The Economic and Monetary Union, the most advanced stage of economic integration, was established on 1 January 1999 with 11 Member States as part of the European Union. The European Union is unique in this respect as well: although there are several monetary unions in the world (for example, the CEMAC or the WAEMU in Africa, or the ECCU in the Caribbean), none of them has the same number of members or the same economic power. As a result of continuous enlargement, there are 20 EU Member States in the single currency area from 1 January 2023. The Eurosystem is, in the author's words, the core integration of the European Union. At the same time, it is very important to be aware of not only the theoretical foundations of monetary integration (the theory of optimal currency areas, the impossible trinity), but also of the structure, functioning and shortcomings of the EMU realised in practice in the European Union. The EMU itself can be seen as an asymmetric integration with "variable geometry", complex institutional conditions and discretionary decisions. Halmai, who introduced the concept of deep integration[4] in the domestic EU literature, describes in detail and provides a professional critique of the form of integration established by the Maastricht Treaty, which did not strictly adhere to the provisions of the Stability and Growth Pact, already weakened compared to the original German concept, which cannot (could not) contribute to addressing asymmetric shocks and which even widened the gaps between the current account balances of the Member States. In addition to the construction of monetary integration, the monetary policy of the European Central Bank has been criticised for the lack of a sufficiently transparent monetary policy strategy mix at the outset, slow interest rate decisions, late application of quantitative easing (QE) or excessive purchases of sovereign debts of "crisis countries" on secondary markets. But crises (the global financial

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[3] See, for example, *Halmai* (*2019a, 2021a*)
[4] *Halmai* (*2020c*). The inclusion of differentiated integration in the analytical framework and its interpretation in economics deserves special mention. For further details, see for example *Halmai* (*2019b*).

and economic crisis of 2008–2009, the sovereign debt crisis in some euro area Member States) can lead to closer economic policy coordination in the context of core integration, the steps and context of which are described in Chapters 8 and 9 of the book. Equally important is the future of the Economic and Monetary Union too – even if the reform measures are implemented – the scenarios, risks and opportunities of which the author has already presented in several publications.[5] His position is clearly expressed in this book as well: the completion of the economic union and the development of economic governance represent a real chance to make the process of European integration more dynamic, while remaining outside the process of core integration entails the risk of being marginalised.

For Europe's role in the world economy and geopolitics, the factor discussed in the last two chapters of Halmai's book is of great importance: growth. It cannot be stressed enough that the average economic growth of the European Union has been steadily lagging behind that of the US since the mid-1990s, while China has emerged as a new challenger in the global economic race. Europe's growth potential is fading, and the potential growth rate of EU countries, as well as productivity growth, could remain at a persistently low level. Halmai has drawn attention to this in several previous publications.[6] The Lisbon Strategy could not change this at all, and the Europe 2020 Strategy has achieved only modest results. One can fully identify with the author's view that, in addition to comprehensive structural reforms to boost growth potential, macroeconomic policies aimed at growth and stability and much more innovation are needed.

Halmai's monograph is first and foremost a professional book, which draws on an extensive, largely foreign literature base, and also processes the author's decades of research, but it is also intended as a university textbook. The latter is underpinned by a large number of illustrative, colourful diagrams to help the reader understand the theoretical context of integration and the practice and experience of European integration, and by a set of concepts (more than 300 in total) to be reviewed at the end of each chapter to support the learning process. The eleven chapters may form the basis of at least eleven university lectures and/or seminars.

In my view, Halmai's book titled European Economic Integration is a must-read for undergraduate and postgraduate students and lecturers in economics, as it organically builds on the knowledge of micro- and macroeconomics and international economics acquired earlier. However, I recommend it to all lecturers, researchers, students and anyone interested in European (economic) integration, even only marginally, regardless of their field of study or training.

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[5] For further details from recent years see *Halmai* (*2020b, 2020c, 2021b, 2021c, 2022a*).
[6] See, inter alia, *Halmai* (*2020b, 2021c, 2022b*).

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Philosophical Questions of the Manifestation of Natural Intelligence*

Alexandra Prisznyák

Mihály Héder is an associate professor with habilitation and technophilosopher working on the processing of natural languages, the design of semantic annotation technologies and systems, and the philosophy of artificial intelligence.

The book's train of thought is structured around philosophical issues related to artificial intelligence (AI). Similarly to the theme of modern 'bestseller' books, it discusses in detail the criticisms, philosophical and ethical issues surrounding the development of AI in different eras and the potential future of AI. The success of the book is mainly due to the topicality of the subject, namely the market implementation of AI and robots, in a philosophical approach.

The beginning of the historical development of AI to support the increasingly human work of human workers is usually traced back to the Dartmouth Artificial Intelligence conference in 1956. In a narrower circle, it is known that work on machine intelligence in the UK began nearly a decade earlier, thanks to efforts to crack the Enigma code during World War II. *Alan Turing's* 1950 publication titled Computing Machinery and Intelligence drew attention to the potential of intelligent machines, which has been the subject of debate ever since. The imitation game known as the Turing test aims to measure the 'thinking'[1] of machines. Success in the

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[1] Regarding the concept of thinking, Turing considers it to be ill-defined, too general and recommends the Turing test instead. Turing, however, never claims that the successful operation of machines equals thinking. The test is a three-actor imitation game involving two agents (a human and a digital computer) and an interrogator. The interrogator cannot hear or see the other two actors, can only communicate via text and attempts to determine, by asking questions of the other two participants, which is the computer. The objective of the game is to mislead the interrogator, during which both the human and machine are allowed to lie. To avoid an accidental hit in the game more interrogators and criteria are applied. Its goal is for the machine to be able to deceive more than 70 per cent of the interrogator and make them believe that it is human.

AI test proves the error of pessimists who predicted the performative failure of AI. It also raises the fundamental problem of man's inability to recognise his own species.

The first chapter analyses the work and main critical comments of a number of AI critics. In the view of *Joseph Weizenbaum*, the computer is nothing more than the embodiment of systematic mathematics, which has nothing to do with human intelligence, it merely follows algorithmic instructions written by programmers. To prove this, in 1964 he began writing a computer program to demonstrate the intellectual capacity of man and the limited capabilities of machines. With the development of the chatbot ELIZA, Weizenbaum's aim was to change the initial positive impression of the chatbot to the impression of an illusion/communication with people, as the conversation progresses (when the machine's limitations are revealed in an unexpected situation). Contrary to his intentions, Weizenbaum was shocked by the enthusiastic reception of the market. The creation of ELIZA was seen by both the professional community and the market as a key moment that could open many doors for development, including in the field of the computer processing of natural languages. For the remainder of his career, Weizenbaum sought to raise awareness of the dangers of subservience to machines and criticised AI research. Through the example of Weizenbaum, the author illustrates the belief in AI of the period, a boom era that later led to the first and second AI winters[2] and finally to the dynamically evolving digital era of today and the rise of AI.

In order to systematise the types of critical comments, the author necessarily addresses three important areas of AI critique: the performative failure, the phenomenological failure and the dystopia associated with the development of AI. The performative failure is a critique on the inability of AI solutions to work, which has occurred in many cases during the AI winters, breaking the momentum of progress. The criticisms are based on the view that machines are not capable of performing tasks that require intelligent behaviour. The basis of phenomenological failure is provided by the 'imitative nature' of AI, as mentioned above. The operation of machines differing from the mechanism (biochemical principle) of the human mind (quantum computers are a binary exception) results in a critical type according to which the experience of consciousness (such as the experience of emotions) is not available to machines (see for example Searl's Chinese Room Argument). In the context of the phenomenological failure, Turing considers the starting point of investigation based solely on the non-human nature of the operation of machines to be wrong. Accordingly, he does not claim that they are similar to human functioning and have the same experience as intelligent humans. He focuses the investigation solely on the fact that thinking is not sufficiently defined to draw such a conclusion.

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[2] The AI winter marks a period when AI development results are stagnating, falling short of investor expectations, resulting in a halt in development and a public disengagement from enthusiasm for AI technology.

However, with the emergence of intelligent machines, the content of the concept necessarily requires a rethinking of the definition. Thus, the phenomenological approach should be interpreted as an arbitrary critical comment. The author draws attention to a very interesting fact in this respect: '[...] if phenomenological success is impossible, then the uploading of consciousness is the death of consciousness'. Philosopher *Hubert Dreyfus*, one of the most active representatives of AI critics, saw AI as a waste of resources. In his view, machines are only able to operate according to pre-programmed rules. Thus, a rule-based machine executing a set of instructions will never be able to demonstrate human behaviour. He backs up his standpoint by the failures of research projects carried out in the course of AI winters. He explains the persistence of the spirit of research despite this using four premises: (1) biological (the human brain processes information in discrete units, so there must be a biological element that resembles the elements of digital technology); (2) ontological (accessibility of information); (3) psychological (the information processing of the mind based on formal rules); and (4) an epistemological assumption (all knowledge can be formalised, Boolean functions). Dreyfus stuck to his opinion even after a machine (IBM Watson) beat humans for the first time in the quiz show *Jeopardy!* in 2011. Dreyfus's four premises are based on the – erroneous – assertion that both the human mind and the computer are general symbol-processing machines, and he makes a strong case for his position by questioning the formalisability of human knowledge. However, the properties of the general symbol-processing machine are typical of the Turing machine (epistemological understanding and design), and thus identifying it with that is as much a mistake as identifying a human with it. However, Turing does not identify the two in his model. Dreyfus argues that digital computers have shortcomings in terms of perception and action (which occur in the absence of a physical representation). The 'living' proof of the fallacy of the bases of his argument is the Deep Blue computer defeating world champion *Garry Kasparov*.

The problem area of what is a manifestation of natural intelligence (imitation) explores the ability of machines to be conscious. Machines, which operate without living and absorbing the internal experience (consciousness), are fundamentally different from intelligent human behaviour. *John Searle* denies the ability of machines to understand when he creates the Chinese room thought experiment. His assumption is that the ability of machines to understand is inconceivable without the simultaneous achievement of performative and phenomenological success. The counterarguments to the experience of understanding have addressed many aspects of the thought experiment, such as isolation, the limits of the agent (whether an isolated slice of the human brain is capable of understanding), extrapolation, learning, memory and others that can lead to an intellectual experience similar to understanding. As a counterargument, experts point to the fact that intelligent robots are equipped with sensors. Following on from Searle's thought experiment,

in the second chapter of the book the author details his main critique based on *Daniel C. Denett*'s 'intuition pumps' principle: the time factor.

Another dimension of the criticisms is the fear of the extent to which AI will free up manpower. Regarding the epistemic limits of AI escalation, the author stresses that AI beyond a certain point encounters a limit to the expansion of knowledge. Thus, a sudden escalation is highly unlikely. The gradual integration of AI into work is significantly determined in several ways. The friction created by optimisation, increased productivity and job creation/destruction (reallocation of tasks) can contribute to lowering the prices of goods/services and, along with this, to improving their accessibility – also for social groups previously excluded from consumption. However, the increasing use of AI is leading to labour market polarisation. Through its direct effect, well-defined tasks that can be described by rules (monotonic, routine) will be replaced, while through its indirect effect, new tasks will be created. Consequently, intensification of the human–robot interaction is inevitable, sometimes even in domains where the nature of the task would lead to automation, but the involvement of an expert and the review of the workflow require the presence of a human participant in the interaction process. In the new division of the work process, the following emerge as bottlenecks: (1) the ability to perceive and manipulate, (2) creative intelligence, and (3) social intelligence. The steady pace of AI development will largely determine how far in time we are from achieving the super-intelligence that is considered utopian in the present age. At the same time, there are also fundamental questions about the rights of artificial intelligence appearing alongside human intelligence. Thus, the mandate of intelligent AI for self-protection or protection against being shut down can now make sense.

The author illustrates the critical remarks made in the first chapter with examples of performative successes and areas of application discussed in the second chapter. It details, among other things, the successes achieved in SHRLDU (program), Shakey robot, MYCIN (program), Herbert (robot) and chess programming. The author also discusses the prominent role of neural networks in the blossoming of artificial intelligence, and then analyses the nature of computation by examining the nature of machines. Evolutionary processes are one of the most advanced types of computation today, leading to programs that can dynamically change and modify themselves. As examples, the Evolutionary Game of Life and AARON (the robotic artist) are detailed, demonstrating that if the output of the computation is accepted as an outcome product which also has non-physical nature, the examples just mentioned cannot be evaluated. In some cases (e.g. chess), the interpretation of the output may also be realised as symbolically represented data. Looking at the issue of formalisation, the author concludes that not only formalised problems can be solved by computation.

The final chapter discusses the present and future of ethics, the amoral agent and AI. Rejection of the moral capacity of artificial intelligence automatically implies rejection of its capacity to take responsibility. Consequently, companies that make, operate and own AI need to address the issues of ethical standards and the tangible (material compensation) / intangible (reputational) consequences of the redistribution of liability to be borne. In the author's view, ethical responsibility requires the joint responsibility of several market actors, including the regulator, the manufacturer, the maintainer/operator and even the consumer. Consensus on phenomenological and performative critiques could be an important milestone for further progress.

Héder's book provides a relevant starting point for approaching artificial intelligence and the related technologies from a business perspective. The book can be recommended to the community of economists and lawyers as it challenges researchers in a number of existing and emerging research areas, such as the impact of AI on productivity and the labour market, the business and ethical aspects of AI system design, the challenges of integrating AI into the organisational culture (change management), the role of visionary management, legal and technological issues of AI, the ways to measure AI-led efficiency, the impact of AI on corporate value, and other areas of interest.

Report on the Lámfalussy Lectures Conference 2023*

Anita Németh – Ferenc Tóth

Named after Alexandre Lámfalussy – the father of the Euro, a prominent Hungarian-born economist and renowned expert on European finance – the ninth Lámfalussy Lectures Conference organised by the Magyar Nemzeti Bank (the Central Bank of Hungary, MNB) was held on 6 February 2023, where high level decision-makers and leading global financial experts discussed the most topical issues in today's financial landscape: the prospects for central bank digital currencies (CBDCs) and the role of central banks in promoting a green economy. The goal was to engage in a comprehensive dialogue and prepare together for the economic challenges of the future. The title of the event was "New dimensions of central banking in the post-Covid era". The day before the conference, the Lámfalussy Award was presented to Robert Holzmann, Governor of the Oesterreichische Nationalbank, while Zsolt Kuti, Executive Director responsible for Monetary Policy, Financial Analysis and Statistics of the MNB received the Popovics Award.

1. Opening speech

In his opening remarks, *Mihály Patai*, Deputy Governor of the Magyar Nemzeti Bank, highlighted that we could not avoid talking about inflation, which was unquestionably "Public Enemy" Number One these days. He believed that the worst already was behind us worldwide and was optimistic for four reasons:

(1) demand management was working in relation to inflation, as demand last year fell worldwide and for example in Hungary retail sales were contracting;

(2) prices of key raw materials had already decreased in many cases;

(3) fiscal and monetary policies had started to converge, practically all around the world. In this changed international economic and financial situation, fiscal and monetary policymakers needed to cooperate and take unprecedented measures;

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(4) all over the world, but specially in Central Eastern Europe, part of the inflation was profit driven. In Hungary, in particular, inflation was partly rooted in the very high profitability of certain industries. Knowing this issue, there was a hope that the political elite would act accordingly.

In order to fight inflation, the MNB would definitely cooperate with the Hungarian government, harmonising each and every step with them.

He pointed out that the afternoon panel was about the green economic transition and the possible role of central banks in greening the economy to support more sustainable, environmentally-friendly development. The MNB received a green mandate in 2021 and therefore it was part of the central bank Hungary. It was important to see what others think of this issue.

The other panel was on digitalisation, particularly on central bank digital currency. For *Patai* personally, the most important issue was whether the central bank digital currency would serve the interest of the customer or serve it better than the existing payment system.

2. Lámfalussy Lecture

Lámfalussy Award recipient *Robert Holzmann* noted that the work of Lámfalussy was more relevant in the current circumstances than many people may think and underlined Lámfalussy's mantra: *"Monetary policy, like all other policies, remains an art, not a science."*

Holzmann's presentation had three parts: First, he looked back at the period preceding the current "return of inflation". He concentrated on one of the defining features of euro area monetary policy during the last decade: the highly accommodative unconventional measures, such as negative interest rates, asset purchases and funding for lending schemes. It was ten years ago this past July that *Mario Draghi* gave his famous "*Whatever it takes*" speech – so the time seemed ripe to reflect on the use and effects of unconventional measures. The standard view in policy circles is that unconventional monetary policy has a predominantly positive economic impact. At the same time, however, highly accommodative monetary policy could produce severe side effects, in particular on productivity. In the presence of financial frictions, very low interest rate levels could contribute to the survival or new market entry of low-productivity firms by easing their financing constraints and reducing incentives to repair their balance sheets, rather than promoting expansion and innovation. Therefore – by now – the majority view was that the euro area and others should officially discuss quantitative tightening. *Holzmann* stated that the European Central Bank (ECB) would begin with quantitative tightening from 1 March 2023.

Second, he looked at the present challenges. Monetary policy must be credible, now more than ever because it was crucial to keep inflation expectations anchored and to minimize the costs of disinflation. For precisely this reason, the members of the Governing Council of the ECB did not disregard the influence of the current inflationary surge by taking a "wait-and-see" approach. Ultimately, the losses euro area policymakers incurred by consistently missing the inflation target came at their own peril. Inaction – or weak action – in the fight against inflation would have backfired as it would have eroded the public's confidence in the commitment to price stability. The timely response was key in keeping inflation expectations close to the target. Nevertheless, current inflation rates in the euro area remained too high. Most importantly, people clearly continued to feel the impact of inflation in their daily lives. Hence, today, the risk of overtightening seemed dwarfed by the risk of doing too little. *Holzmann* considered himself at least partly "*Lámfalussyian*" when reaffirming that monetary policy must continue to show its teeth until there was credible convergence to the inflation target, which was also felt by the wider public.

Third, *Holzmann* looked ahead and reflected on the future of monetary policy, broadly speaking. Over the past few years, a lot had been said and written about economic and financial heterogeneity in the euro area, including its ramifications for monetary policy. The ECB certainly had the power to address short-run financial fragmentation in the euro area whenever it impaired the transmission of monetary policy. Still, in the medium to long run, the ECB's instruments could not substitute for a genuine, market-driven integration of capital markets. As the Committee of Wise Men, under Lámfalussy's chairmanship, highlighted: only a tightly knit capital market would create the level playing field necessary to absorb asymmetric shocks and to prevent the occurrence of diverging financing conditions across the euro area. Concurring with this vision, forging a European capital market should constitute an economic, political and regulatory priority of the European Commission and all EU member states. A unified capital market would ease frictions inhibiting firms' access to external finance, and most importantly, equity finance. Only a truly developed capital markets union can break the sovereign-bank nexus, revive cross-border transactions and thus facilitate risk-sharing in the euro area. A capital markets union would provide the best mechanism for funding promising endeavours, thereby boosting productivity growth. It would also contribute to more independence from central bank funding and thus reduce future risks linked to the asymmetric transmission of monetary policy in the euro area. A well-integrated capital markets union may also reduce the need for fiscal interventions in case an asymmetric shock hits a member state. In modern democracies, deep, liquid capital markets were best achieved through savings motivations that were common to all individuals over their life cycle – housing ownership and retirement financing – and the related financial market institutions.

Finally, *Holzmann* stressed that non-monetary, structural policies should boost productivity that increased the labour force participation of the elderly to compensate for population aging and that reduced the savings glut in the global north by transfers for productive investments toward the global south. For example, a broadly conceived, effective green agenda would offer new opportunities in this regard.

3. Keynote Speech

Catherine L. Mann, External Member of the Monetary Policy Committee of the Bank of England, gave a speech entitled "*Turning Points and Monetary Policy Strategy*". She talked about how they use data to spot turning points in the economy and how that fed into her policy decisions. In her opinion, some central bankers were seeing a turning point in data to which they were responding with an inflection in their respective policy paths. Relevant turning points related to the mandate of the central bank. Inflation was key for all central banks, but some had to be equally mindful of other metrics of macroeconomic performance, for example employment. One approach to identifying turning points put substantial weight on forecasts from large macroeconomic models, because these took account of the complex inter-relationships among economic variables and policy. However, one must be humble these days about the stability of the relationships, for example of inflation dynamics and the monetary policy transmission mechanism. This meant that it made sense to complement the macro forecasts by looking at a range of more granular data. A closer inspection of data showed that inflation components particularly exposed to external drivers were not all moderating. Although energy prices were capped for now in the UK and goods prices were decelerating, but food prices continued to surge. Services inflation posted at a 30-year high, at or over six per cent for five consecutive months. The stabilization of headline inflation, therefore, was not yet the harbinger of a turning point towards a sustainable return to the 2 per cent target.

She presented charts indicating that the UK's demand condition was notable in failing to return to the pre-Covid level of GDP, much less approach its pre-Covid trend. Yet, inflation was stubbornly high in the UK, where there were other unique problems: increases in early retirement and long-term illness had reduced labour supply and Brexit had reduced trade and investment efficiencies. Turning to the labour market, rising unemployment was an ex-post indicator of the business cycle. But the early warning of turning points in the labour market could foreshadow a turning point in wage growth, which might herald a turning point in the rate of price inflation. The ratio of the number of vacancies to the number of unemployed, which was a leading indicator and summary statistic of labour market tightness, had fallen in recent months, but remained at record highs driven both by vacancy levels

and low unemployment rates in the UK. This was a unique combination historically in the UK labour market, highlighting why current labour market conditions did not resemble the behaviour after previous supply shocks. If there was a mismatch between UK labour demand and supply, wage growth could stay stronger for longer, presenting an upside risk to inflation.

The OECD's Composite Leading Indicator provided a qualitative assessment of early signals of turning points in business cycles, drawing on a vast amount of underlying data. A fall below the long-term average indicated a negative deviation from trend and thus warned of recession. This was consistent with the view that the UK was not only suffering from the Covid and energy shocks, but also from the negative supply shock, basically the "worst of all worlds".

Financial market measures, particularly the yield curve, could also be used to infer market participants' perceptions of turning points, for demand and inflation. When the slope turned negative, the yield curve was said to be inverted, which was viewed by some as an early indicator of a recession.

Mann emphasised that inflation expectations had played a particularly important role in her monetary policy decisions and that household expectations were particularly important for inflation dynamics. Only if households are willing to pay their prices could firms realize their expected pricing power; if there was a buyer revolt that could signal a turning point. She stressed that predicting inflation had been particularly difficult over the past few years. It was not surprizing that macroeconomic predictions had not been able to keep pace with the inflation shocks.

She concluded by asking "Why keep raising nominal rates now?" First, if there was uncertainty about the degree of inflation persistence, it was better to assume a high degree because the costs of making a mistake if the true inflation process was more persistent are larger, in other words more costly, in terms of the inflation output trade-off, than if the true inflation process was less persistent. Second, there were identified upside risks to the inflation outlook in the UK. From a risk management point of view, monetary policy had to lean against upside biases as wage and price inflation were still so high. Third, if inflation was more persistent, then the Bank Rate would need to rise again after the pause, to be followed later with reversal. In her view, a tighten-stop-tighten-loosen policy looked too much like fine-tuning to be good monetary policy. It was both hard to communicate and to transmit through markets to the real economy. Although there was uncertainty around turning points, this should not motivate a wait-and-see approach, as the consequences of under tightening far outweighed the alternative. In her view, the Bank needed to stay the course, and the next step in the Bank Rate was still more likely to be another hike than a cut or hold. Finally, she highlighted the tipping point on climate change.

The Bank of England had been a leader in assessing the implications of climate change for central bank policy and implementing greening of the corporate bond portfolio.

4. Morning panel: Money and technology – prospects for central bank digital currencies

In the video clip introducing the topic, the most relevant questions that arose were highlighted: The design of CBDCs is a global effort of collaboration rather than competition. Will central banks have a say in the future of money? What are the benefits of digital currencies for central banks and the economy? Are CBDCs the future of finance? Answering these questions, one needs to look at future currencies and money from different aspects such as digital transformation, revolution in payments, new financial architecture and digital currency experimentation.

4.1. Fireside chat on examining the recent research and application developments

In his introduction, the moderator, *Barnabás Virág*, Deputy Governor of the MNB, emphasized that central banks must do their best to deliver a low inflation environment for society and the economy, but that the key topic of this panel was the digitalisation of money. For central banks, there were many motivations behind the issue, such as the digital revolution, improving monetary transmission, crypto assets and financial inclusion. Currently, close to 100 central banks were dealing with the issue of CBDC and some were already running pilot projects. All of the major central banks – such as the Fed, the ECB and the People's Bank of China (PBoC) – were considering the introduction of CBDC.

China started a research team on digital currencies as early as 2014 and launched their Digital Currency Institute in 2016. This meant that China was among the first pioneers of CBDC and the country had started testing the asset in 2020. One year ago, the e-yuan had more than 260 million individual wallets, and there were a couple of million yuans worth of transactions every day during the winter Olympics. Based on these data, the e-yuan was one of the most advanced projects globally, in terms of CBDCs.

Regarding the motivation of the PBoC to start research and progress so early and the most important driving factors behind it, *Mu Changchun* Director of the Digital Currency Research Institute, PBoC explained that the aim was to improve the efficiency of the central bank payment system by building a faster payment system, widening access to it from different sectors, to extend the service hours to increase capacity and to meet the requirements of the digital era. Another motivation was to provide a backup for the retail payment system. Financial inclusion was also an important motivation since financial services should also cover the population in

remote and poor areas as well. The PBoC had managed to achieve these goals and digitalise the payment instruments and did not charge fees for individual users. Foreigners could have a digital wallet without opening a traditional bank account in China.

One less commonly known feature of CBDCs was that they could bear interest. There had been warnings against the dangers of this feature, foreshadowing a collapse of banking systems and financial intermediaries. The ever-widening literature, however, argued the picture was not nearly as dark as seemed at first glance. The interest-bearing feature could bring many benefits without distorting banking systems. In addition, it could significantly improve transmission of monetary conditions, giving a new tool for central banks and renewing how central banks could conduct monetary policy. In the view of *Morten Linnemann Bech*, Centre Head of BIS Innovation Hub in Switzerland, it seemed like a good idea potentially to have a continuous interest rate. In the case of a retail or a general purpose CBDC, it should be set at zero per cent but it would be wise not to eliminate that choice by design.

Regarding the issue of how the e-CNY could become a profound platform for new, innovative banking services, involving e.g. smart contracts, *Mu* pointed out that e-CNY was a universal payment instrument. It supported a variety of innovations and allowed individual and corporate services to be interoperated to realise synergy. Smart contracts were centralised and managed in order to provide a standard environment for the whole society and not to use for any illegal transactions. The key was to minimise costs of smart contracts and to ensure prepayments were secured.

According to *Bech*, the BIS had delved into the domestic uses of CBDCs as well, such as in projects involving automation – for example the project Mariana, which instead of intermediaries used automated market makers, practically programs taking care of settlements, in cross-border transactions. He stressed that programmability was one of the promises of this new digitalisation and could have great benefits. There were smart contracts in the BIS Innovation Hub. There was a big debate about who could program and what could be programmed. In the case of CBDC, there could a permission setup where only a limited number of participants were allowed in. Some argued that it should not be allowed for money to be programmed, because it would not be money anymore.

As far as privacy issues were concerned, the BIS Innovation Hub was trying to expose different type of privacies that could be implemented with the CBDCs. There was a project where the payer was private but the one who received the money was not private. It would also be helpful for tax purposes and manage some anti-money laundering concerns. Privacy was definitely a priority issue but without

constraints and with full anonymity without the necessary regulatory rules and risk control measures, CBDC might be used for criminal activities and therefore it would never be the right choice. In China, managed anonymity was applied, i.e. only the authorised operators could collect and store necessary data for services and operational purposes only. The PBoC only processed the transferred inter-institutional transaction information.

Relating to geopolitical issues, according to *Bech*, the hope and the vision for CBDCs were that they should be able to help solve issues in cross-border payments starting on the regional and later on a more global level. CBDCs could restrengthen globalisation. Agreeing with that view, *Mu* explained that CBDCs should also improve international settlements and payments. The PBoC was taking part in one of the most important projects with regards to the international use of CBDCs, the mBridge.

Virág concluded the conversation by saying that it was quite certain that CBDC would be a part of our lives in the near future, but that we needed a cautious approach and a well-designed project to take the advantages of new technologies.

4.2. Panel discussion

The moderator of the panel, *Dániel Palotai*, Executive Director, IMF introduced that CBDS is hotly debated among the central bankers in the global community, as either in a retail or a wholesale form, but it is very likely to affect everyone's life. The introduction of the future form of money is a very complex and overarching area. This topic is also high on the agenda of international organisations like the IMF and BIS. This is not surprising, as it has serious repercussions and significant implications for monetary policy, financial stability, cybersecurity, competition, but even geopolitics. However, it is not just an intellectual exercise, as directly or indirectly, it will definitely influence the financing of the real economy going forward. To implement a successful CBDC, central banks have to make sure that the new instrument will be broadly used. Making it happen, central banks have to be in close cooperation with vendors, technology providers, payment market participants and not least, with the future users themselves. This requires a very complex project management attitude from the central banks. They have to be very coherent in decision-making and, in some regard, need to act like FinTechs, as they have the ambition to disrupt the current payments market with a strong value proposition, they have to ensure that their new product will react to valid market needs on time. Some of the central banks will live up to these expectations, some will be less successful, and likely most of them will be copying the forerunners. In this regard, Palotai highlighted two more messages from the IMF's perspective: he firmly believes that a policy should aim to leverage all the benefits of the digital technologies but at the same time decision-makers have to make sure to be able to mitigate the risks that come with innovation and change. The IMF has also adopted

a very comprehensive digital money strategy in 2021. The IMF aims at helping the efforts of central banking community in a coordinated manner and concentrates on areas close to the Fund's core mandate, like implications of digital money for the international monetary system, or what should be the modalities to improve cross-border payments and what are the effective policy responses to crypto assets.

The key messages of the participants were the following: *Marius Jurgilas*, Senior Vice President, Super How: As the world becomes increasingly digital, the concept of central bank digital currencies has gained a lot of attention. While the idea of a retail CBDC, where consumers can use a digital version of their national currency for everyday transactions, has been widely discussed, he had doubts about its practical use case. On the other hand, the use of CBDCs in wholesale transactions, such as securities transactions, holds a lot of potential. Not only that, CBDCs should also facilitate and not impede innovations in the space of Decentralized Finance. *Shu-Pui Li*, Advisor to the Governor, Central Bank of the UAE: Learning from the experience of 3 CBDCs projects, especially the recent real-value CBDCs pilot transactions of mBridge involving about 160 cross-border transactions with total value of USD 22 million, the promising benefits of CBDCs and the power of the new technology and development approach can be realized. *Petia Niederländer*, Director Payments, Risk Monitoring and Financial Literacy, Oesterreichische Nationalbank (OeNB): Advanced technology and change in customer behaviour are shifting payment preferences towards digital payments. The last two years of pandemic has allowed innovations in payments to leapfrog the usual adoption phases, creating competitive advantage for companies and markets with strong investments in technology. On the other side, payments infrastructure and processes did not change and felt behind in terms of resilience, robustness, fraud prevention and efficiency. Retail CBDCs – such as digital Euro – allow central banks to offer resilient, robust and efficient infrastructure to pay with central bank digital money in a digital economy. *Thammarak Moenjak*, Chief Representative, Bank of Thailand, London Representative Office: New technologies (including the Distributed Ledger Technology) seem to offer great potential for a new form of digital money, in terms of efficiency, financial inclusion, and innovation. Central banks thus have the duty to help bring key stakeholders together to explore such potential, to ensure that benefits could be effectively reaped and possible harmful effects minimized. Here, different jurisdictions have different contexts and concerns. What can be learnt so far from the Proofs of Concept is that to roll out CBDC in practice requires an ecosystem-wide effort, and many issues remain to be addressed to ensure a successful rollout.

Niederländer shared some results of the survey made by the OeNB: (i) two-thirds of the participants never heard about digital euro, (ii) half of them said there may be some personal interest about the idea, (younger people expected personal benefit, but there was a very diluted understanding of it) (iii) cash as a mean of payment

should remain, (iv) people were strongly satisfied with the existing payment options. The conclusion was that there was a necessity of thorough discussion with the general public, with the decision-makers and with the financial intermediaries, the banks, which would distributing it. However, this kind of conversation is still not happening, but it should happen very quickly. Another issue is the regulation, which is expected to be published in the second quarter of this year.

Jurgilas explained the ECB had issued a consultation on the functionalities of the digital Euro. One particular function will be switched off, that is the store of value, meaning that holding significant amounts of digital Euro will not be allowed because of the concern draining liquidity from the commercial banking system. The question is what the money is without the function storing value and how that differs from programmability, because it is a conditionality of payment for example, however the ECB said there would be no programmability in case of digital Euro.

About the potential programming of digital currencies, *Moenjak* mentioned that it can be on three levels: (i) at the issuer level of the money; (ii) at wallet level in case of retail CBDCs; (iii) at the actual money unit level. Some benefits are e.g.: (i) programming can lower the counterparts risk, allowing peer-to-peer trading; (ii) the automation of complex transactions; (iii) innovation allows many use cases in terms of programmability, like simplifying supply chain financing. For the successful rollout one needs (i) good governance; (ii) soft and hard infrastructures, including appropriate legal background, proper accounting rules, what kind of technology to use and (iii) the most important is the preparedness of the stakeholders. Whether wholesale or retail CBDC would be rolled out first depends on (i) access to cash in the economy, (ii) reliability of the existing payment systems and (iii) the desire to leapfrog the already efficient existing systems (e.g. Real Time Gross Settlement System).

Mr. Li stressed that central banks could learn from FinTechs. In five-years' time, there could be a kind of tokenized financial world and the traditional account based financial world. He believed that the tokenized world would come very fast driven by the innovations of the FinTechs. If we do not provide a medium exchange for them then FinTechs will use crypto currencies for settlements. The FinTech evolution is coming, central banks cannot "wait and see" but to get themselves prepared from regulatory and infrastructure perspective.

Finally, *Jurgilas* indicated that as far as the raised question of financial inclusion is concerned, everything had a price. If we want every citizen of the society to be included on a particular service, it has a cost, and we have to balance if that cost is adequate to our society.

5. Afternoon panel: The role of central banks in enhancing the green economy

5.1. Fireside chat on central bank green issues

The afternoon discussion focused on finding the answer as to what extent central banks needed to be involved in climate policy and what steps needed to be taken to tackle the consequences of climate change. In the first round, a fireside chat took place with *Sean Kidney*, CEO of Climate Bonds Initiative and Professor for Sustainable Finance at the SOAS Centre for Sustainable Finance. At the MNB's Green Finance Conference in October 2022, Professor *Kidney* was awarded the International Green Finance Lifetime Achievement Scientific Award, which was received by him in person on the occasion of the fireside chat with *Csaba Kandrács*, Deputy Governor of the MNB. The Lifetime Achievement Scientific Award, established by the MNB in 2021, honours those professionals who have exhibited outstanding performance in green finance research.

Kidney shared his thoughts on the special role and toolkits of central banks in the field of the environmental sustainability. He emphasized that we have more predictive power than ever before in human history, and so the first part of our job was to understand and assess the risks and then to react quickly. On the one hand, central banks could regulate the markets (for example via capital ratio requirements and asset purchasing programmes for green bonds), but more importantly they could use their soft power and engage in the discussion. That was how we could provide guidance and leadership towards decarbonization. He also pointed out that there was no shortage of capital: nowadays, the challenge was how to mobilize the capital in the right direction. *Kidney* highlighted that the world was facing extraordinary changes. In the midst of adapting to these changes, we needed to understand how to render our economies successful and resilient. In recent years, a series of crises had shown that all events can be traced back to the disruption of our natural environment. Therefore, the popularity of green bonds was a strong indication that there was demand for change and that change had already started.

The moderator, Deputy Governor *Kandrács* emphasized that central banks in most countries had now embraced fight against climate change and other sustainability issues. He underlined that the MNB remained committed to enhancing the sustainability agenda in Hungary. Deputy Governor *Kandrács* agreed that the MNB's green mandate anchored in law in 2021 was a huge opportunity and we must take advantage of it.

5.2. Panel discussion

Regarding the approach of the United Nations Environment Programme Finance Initiative's (UNEP FI), the moderator of the afternoon panel discussion, *Gábor Gyura*, Sustainable finance consultant at UNEP FI, underlined that UNEP had been working with commercial banks, asset managers and insurance companies for more than 30 years now. It had a convening power, trying to convince private sector entities to embrace sustainability.

Henner Asche, Deputy Director General at the Deutsche Bundesbank, pointed out that in central banking it was advisable to follow a clear top-down approach on green finance. The Bundesbank fulfilled the climate action plan of the Eurosystem with strict timelines and participated in producing the global climate scenarios. As regards financing the transition, he emphasized that addressing the climate change required massive investments and therefore it was important to mobilize private capital and that the public and private sector must work hand in hand to find the right funding mix. The impact of very high prices for fossil fuels could be twofold: it created incentives to speed up the transition to green energy and also enhance energy security, but on the other hand the high prices made the extraction of fossil fuels more profitable for a longer period. He believed that the risk of greenwashing – which was a real problem for the financial market – could be reduced with better quality data. To touch upon the issue of current challenging inflationary environment, he highlighted that climate change and inflation were inextricably linked. We could see that climate change affects inflation via three channels: i) climate change caused shocks to the economy ("climateflation"); ii) high energy prices accounted for a substantial share of headline inflation and this was unlikely to change in the near term ("fossilflation"); and iii) the increased capital investment to comply with climate objectives also caused inflation ("greenflation").

Linda Zeilina, Founder and CEO of International Sustainable Finance Centre (ISFC), emphasized the importance of data and research activities regarding green finance. The ISFC did not necessarily work together with central banks currently: its main role was to conceptualize different types of learning activities and education. In her opinion, even starting a conversation on the sustainability topic was very important, which the central bank of Hungary had recognized correctly and in a timely manner. She added that there was a growing consensus that we should move from a voluntary to a mandatory approach regarding climate-related financial disclosures.

As regards the key policy areas of the International Institute of Finance (IIF), *Sonja Gibbs*, Managing Director and Head of Sustainable Finance, highlighted that the IIF was working together with central banks regarding sustainable and transition finance. Among the biggest achievements in green finance, she mentioned two key results: on the one hand, we now had a much better understanding of the climate

risks and opportunities than five years ago, and on the other hand the development of sustainable finance markets had increased rapidly. Besides its excellent technical work on climate scenario analysis, the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) had galvanized the private sector and encouraged them to develop a climate risk toolbox. According to IIF's data, global climate flows had grown to USD 1 trillion last year and ESG flows had tripled since 2020.

In China, the outstanding volume of green loans had reached more than USD 3 trillion. This was added by *Cheng Lin*, Director of Center for International Collaborations at Beijing Institute of Finance and Sustainability. He gave a short summary on the work of the People's Bank of China (PBoC) in the field of green activities. Besides launching green finance guidelines, the PBoC headed the China Green Finance Committee with a top-down approach. He emphasized that the equity market would play an important role in green and sustainable finance.

6. Closing remarks

In his closing remarks, Deputy Governor *Mihály Patai* expressed his hopes to welcome the distinguished guests again on the unique occasion of next year's Lámfalussy Lectures Conference in the spring of 2024. In his special announcement, he revealed that the MNB would be celebrating a double anniversary in 2024: the centenary – the 100th anniversary of the reestablishment – of the central bank of Hungary and the 10th edition of the Lámfalussy Lectures Conference series.

Report on the Workshop 'Financing the Energy Transition in Hungary'*

Dóra Fazekas – Boglárka Molnár

The online workshop 'Financing the energy transition in Hungary' was co-organised by Cambridge Econometrics Hungary, in collaboration with the British Embassy Hungary and the Hungarian Economic Association (Magyar Közgazdasági Társaság) in December 2022. A range of experts and industry stakeholders from the UK and Hungary came together to discuss key aspects of the energy transition to net zero in Hungary. This brief report summarises the key takeaways from the online workshop.[1] The note is structured around the four topics which were the focus of the online roundtable discussions, namely: (1) the issuance of green bonds and their role in financing the transition; (2) ESG-risk measurement and data requirements; (3) buildings decarbonisation; and (4) renewables policies and subsidies.

Issuance of green bonds and their role in financing the energy transition in Hungary

The topic of the first roundtable discussion was the issuance of green bonds in Hungary and their role in financing the energy transition in the country.

In his keynote speech, *Gireesh Shrimali*, Head of Transition Finance Research at the Oxford Sustainable Finance Group, gave an overview of sustainability-linked financial instruments (SLF instruments). *Norbert Kiss-Mihály*, Head of the Monetary Policy Instruments, Foreign Exchange Reserves and Risk Management Department at the Magyar Nemzeti Bank (the Central Bank of Hungary, the MNB), discussed the current state of affairs in the Hungarian green bond market and recent steps taken to develop the domestic green bond market.

The panellists of the roundtable discussion were: *Gábor Gyura*, Sustainable Finance Consultant at the United Nations Environment Programme Finance Initiative (UNEP FI), *Domonkos Kovács*, Director of M&A and Capital Markets at Alteo Nyrt., *John Martin*, CEO of Plutus Consulting Group, and *Gergely Pókos*, Director at OTP Bank

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[1] A recording of all four events can be watched at: https://www.mkt.hu/en/2022/12/16/a-zold-atallas-finanszirozasa-magyarorszagon-visszanezheto/

Green Program Directorate. The panel session was moderated by *Richárd Végh*, CEO of the Budapest Stock Exchange.

The first topic of the roundtable discussion was the current state of play in the Hungarian green bond market and the role of the MNB in paving the way in sustainable financing. The Hungarian government first issued a green bond in 2020. Since then, the volume and number of corporate issuances have both increased dynamically. Over two years, between November 2020 and 2022, the total issuance amount increased from zero to HUF 2,260 billion. At the sector level, green bonds are mostly associated with real estate, construction and manufacturing companies. Participants agreed that the so-called greenium, i.e. the price premium based on the logic that investors are willing to pay extra for a bond with a sustainable impact, is indeed present in the Hungarian market.

In the following part, participants discussed the UK experience with green bonds and sustainable finance. The UK has already made more progress in advancing the alignment of finance with sustainability outcomes. This is illustrated by the fact that green issuance has been underway since 2013, with a very dynamic increase over the past five years (with around USD 1.7 bn worth of sustainable debt products issued in 2021, which is about five times the 2017 volume).

One clear consensus in the roundtable discussion was that green bonds and other forms of sustainable financing will become business as usual over the coming years. The biggest challenge will be the lack of standardization on the reporting side, as too many methodologies are available. The new CSRD (Corporate Sustainability Reporting Directive)[2] is expected to support this process. Another challenge is the lack of knowledge and information on the companies' side. Hence, the education of stakeholder groups will be key in achieving climate goals. Data collection, standardisation and disclosure are also essential. If green bonds are not green enough (either because not enough data is available or data is not reported properly), emissions are locked in, instead of eliminated.

ESG-related risks, their measurement and data requirements in Hungary

The topic of the second roundtable discussion was ESG-related risks, their measurement and data requirements in Hungary.

In his keynote speech, *Barnabás Ács*, Global Head of Sales Strategy in Sustainable Finance & Investing at the London Stock Exchange Group, highlighted that many types of risk fall under ESG risks; however it is the environmental factor that entails the transition risk itself, including physical risks due to the changing climate,

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[2] https://www.carbontrust.com/news-and-insights/insights/corporate-sustainability-reporting-directive-csrd-explained

biodiversity and circularity. He emphasized how quickly ESG-risks can turn into financial risks.

This was followed by the keynote presentation of *Rita Szalay*, General Manager of ESG Capital Solutions, who talked about the Hungarian ESG reporting practice and the lack of sustainability-related investment products in the market. She underlined that there are currently not many sustainability-related investment products on the domestic market and the volume is also very low. She also highlighted that, first of all, leading companies with significant market power and influence should provide adequate quality data to manufacturers, consumers and investors (i.e. to all stakeholder groups).

In the last keynote speech, *Gwil Mason*, Lead Associate in Sustainable Finance at the Financial Conduct Authority of the UK, spoke about ESG data and ratings. He underscored that ratings can be useful in the development of sustainable financial products and portfolios, but more importantly they can serve as a benchmark and reference base for businesses.

The panellists in the roundtable discussion were: *Barnabás Ács*, Global Head of Sales Strategy – Sustainable Finance & Investing at the London Stock Exchange Group, *Irén Márta*, Managing Director of the Business Council for Sustainable Development in Hungary (BCSDH), *György Szege*, Head of ESG Department at Hungarian Bankholding, and *Zoltán Török*, Head of Research at Raiffeisen Bank. The panel session was moderated by *Ákos Lukács*, Partner of Climate Change & Sustainability Services at EY Hungary.

The lively panel discussion revealed that the "E" part of ESG (the environmental aspects) is often the most problematic to measure and to change performance in. Larger companies often lack data on the environmental impacts of their operations, and during their own data collection, the companies on which data could and should be collected are not motivated to measure their own operations. The "S" (social) and "G" (governance) aspects often show better performance in ratings and scorings because these aspects of operation can be changed more easily via company policies and regulations, while decreasing the environmental footprint often requires larger-scale transformations in business operations. The panellists agreed that there are three important European regulations to pay attention to in the near future: the CSRD (Corporate Sustainability Reporting Directive),[3] the EU Taxonomy[4] and the SFDR (Sustainable Finance Disclosure Regulation).[5]

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[3] https://www.carbontrust.com/news-and-insights/insights/corporate-sustainability-reporting-directive-csrd-explained
[4] https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en
[5] https://www.eurosif.org/policies/sfdr/

This panel session benefited from two UK-relevant keynote speeches which successfully set the stage for the discussion of UK-specific experiences in the panel discussion. Not surprisingly, one key observation was that the UK is already more advanced in the ESG space and regulation than Hungary. As the discussion revealed, as a key action the FCA (Financial Conduct Authority, the regulator) has made available a suggested standard factsheet template to use for businesses for reporting. The FCA's ESG strategy is set out with the goal of building trust in the ecosystem and thus supporting the quality and availability of financial products.

One key takeaway of the discussion was that, first and foremost, there is a great need for transparency in the emerging regulations in the Hungarian market, especially regarding the ESG rating methodology so that it is transparent and clear what exactly is measured and how. The most important and primary need for all stakeholders would be a standardised reporting template and guidelines to be used by everyone during reporting, which could also enable a more standardised use and aggregation of data, which is currently only available in a highly fragmented manner.

Buildings decarbonisation and its financing in Hungary

The topic of the third roundtable discussion was the decarbonisation of the buildings sector and its financing options and perspectives in Hungary.

In the first keynote speech of this panel session, *Szabolcs Mizsei*, Executive Director of the Hungarian Energy Efficiency Institute, presented the energy efficiency improvements of residential buildings in Hungary. In the second keynote presentation, *Paul Smyth*, Strategy Director of SALIX Finance, a public institution set up in the UK to cut the public sector's emissions, discussed good examples from the UK of how energy can be saved by changing the heating system of buildings and with proper insulation.

The panellists in the roundtable discussion were: *Ada Ámon*, Chief Advisor to the Mayor of Budapest on Climate Affairs at the Budapest City Hall, *László Balogh*, Chief Business Expert at ingatlan.com, *Zsombor Barta*, Director of the Hungary Green Building Council, and *James Hooton*, Programme Director at the UK Green Finance Institute. The panel session was moderated by *Áron Horváth*, Head of Centre at ELTINGA Centre for Real Estate Research.

The panel discussion focused on four topics of interest: (i) the Hungarian building stock's current energy use and efficiency; (ii) the targeted goals to be achieved in the same; (iii) options for financing the transition in the buildings sector; and (iv) the potential financial innovations that are needed for decarbonisation.

The panel discussion revealed that currently 40 per cent of the energy used in Hungary is consumed by buildings and their users, and Hungarian homes use 60 per cent more energy for heating than the EU average. However, the participants made the point that these high shares also present a great opportunity in the market. For instance, as one of the participants pointed out, energy consumption could be cut in half just by improving the energy efficiency of buildings. Hence, incentivising deep renovations, through which significant energy savings can be achieved, is extremely important.

Although the energy ratings of domestic buildings are based on EU principles, the methodology may differ from country to country, which makes international comparison difficult. Nonetheless, the proportion of really energy efficient homes is very low in Hungary, accounting for less than 10 per cent of total stock. The lack of publicly available data causes many problems and makes it difficult to obtain an accurate picture of the situation in the Hungarian housing market. In addition to the lack of data, an even more worrying issue is the lack of public money for the renovation of residential properties with poor energy efficiency, while most of the Hungarian population has no savings to carry out the critically important energy efficiency renovations. It is assumed that approximately HUF 20 thousand billion, i.e. around one third of Hungarian GDP, would be needed for the reconstruction of the Hungarian residential stock to a cost-efficient level. Participants agreed that in order to achieve the climate goals and improve the situation of people living in energy poverty, a quick and targeted mobilization of resources would be needed, ideally as a private-public partnership.

The discussion also highlighted that the core problem with the modernization and decarbonisation of buildings in Hungary is clearly an infrastructure issue, and therefore large-scale infrastructure investment is needed and for that to happen, public money is indispensable. Participants agreed that policy measures are often short-sighted in the sector, while for lasting results, a more systematic approach, and foreseeable, longer lasting programmes would be needed.

Renewables policies and subsidies in Hungary

The topic of the fourth, final roundtable discussion was renewables policies and subsidies in Hungary.

This panel session opened with the keynote speech of *Ede Borbély*, Head of Renewables and Energy Efficiency at MOL Group, who presented what the market perspectives look like in green power generation from the businesses' point of view in the CEE region. One key statement of the speech was that the greenest energy is the energy that we are not consuming, and hence it is vital to focus on energy

efficiency investments. MOL Group, for example, has been leading the way on the market, putting more and more emphasis on such efforts in its operations lately.

As the second keynote speaker, *Simone Cooper-Searle*, Head of Hydrogen Strategy, Department for Business, Energy and Industrial Strategy (BEIS), presented why and how the UK envisages a really important and significant role for hydrogen in its net-zero strategy. The UK's ambition is to have 10 GW of low carbon hydrogen production capacity installed by 2030, with one half of this coming from electrolytic hydrogen (green hydrogen). Hydrogen has a significant role to play in the UK economy, by covering 20–35 per cent of final energy consumption by 2050. The first production projects will be supported by revenue support (via contract for differences) and CAPEX co-funding, and they expect 2 GW of production to be in construction or operation by 2025 already.

The panellists of the roundtable discussion were: *Attila Aszódi*, Professor at the Department of Nuclear Energy of the Budapest University of Technology and Economics, *Edward Jones*, Senior Policy Manager at Energy UK, *Anita Simon*, Deputy CEO responsible for Sustainability and Circular Economy at the Alteo Group, and *László Szabó*, CEO of the Regional Centre for Energy Policy Research (REKK) at Corvinus University of Budapest. The panel session was moderated by *Claudia Patricolo*, Editor-in-Chief at CEEnergyNews.

The panel participants agreed that, especially in light of the current energy crisis, security of supply is one of the key considerations in the field of renewables as well. Money and time will be the decisive factors for further improvements in renewables, but at the same time, the diversification of energy sources will also be key. In Hungary, the renewables roll-out focused almost exclusively on solar PVs over the past years. Participants agreed that while somewhat controversial and debated in the decarbonisation topic from an environmental perspective, nuclear is also key to decarbonisation, providing stable base load for the increasing energy demand from industry.

As a key observation, the discussion revealed that technical issues can effectively limit the potential for renewables expansion: increasing the deployment of renewables will not be possible without improving the necessary control systems, significant grid developments and large-scale storage development. At the same time, demand-side policies will also play an important role: the examples of Spain and Portugal show, for example, that renewables producers are not asking for subsidies, yet they pay to have access to the grid.

With regards to financing, a key suggestion from the UK side was that governments should do their best to keep country risk at the lowest level possible. This can be done via announcing changes in advance and by keeping the pre-set terms and

conditions of the available renewable energy schemes. The stability of policies and regulation, and a consistent tax system are crucial for investors and other stakeholders in the market as well. Public-private partnerships (PPPs) should play a central role in further developing the market and in boosting investments.

The participants agreed that energy efficiency measures and improvements are not only necessary but unavoidable if the climate targets are to be met. Furthermore, the discussion concluded that the decarbonisation of district heating systems and improvement of geothermal capacities present important opportunities in Hungary – both financially and from a transition perspective.

The moderator of this last panel session, *Claudia Patricolo*, Editor-in-Chief at CEEnergyNews, summarised the takeaways of the discussion with four C-s: *Commitment* is needed so that all key stakeholders (government, industry, consumers) understand the need and relevance to play an active role in the energy transition. *Cooperation* is required from the different actors to work together towards the shared goals. *Cost-efficiency* will be key to make the business case behind the targeted aims. Finally, a *Combination* of these solutions is needed to really achieve a clean energy transition.

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- 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.
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