

LAW AND ECONOMICS YEARLY REVIEW

ISSUES ON FINANCIAL
MARKET
REGULATION,
BUSINESS
DEVELOPMENT AND
GOVERNMENT'S
POLICIES ON
GLOBALIZATION

Editors

F. CAPRIGLIONE – R. M. LASTRA – R. MCCORMICK
C. PAULUS – L. REICHLIN – M. SAKURAMOTO



in association with



LAW AND ECONOMICS YEARLY REVIEW

www.laweconomicsyearlyreview.org.uk

Mission

The “Law and Economics Yearly Review” is an academic journal to promote a legal and economic debate. It is published twice annually (Part I and Part II), by the Fondazione Gerardo Capriglione Onlus (an organization aimed to promote and develop the research activity on financial regulation) in association with Queen Mary University of London. The journal faces questions about development issues and other several matters related to the international context, originated by globalization. Delays in political actions, limits of certain Government’s policies, business development constraints and the “sovereign debt crisis” are some aims of our studies. The global financial and economic crisis is analysed in its controversial perspectives; the same approach qualifies the research of possible remedies to override this period of progressive capitalism’s turbulences and to promote a sustainable retrieval.

Address

Fondazione Gerardo Capriglione Onlus

c/o Centre for Commercial Law

Studies Queen Mary, University of

London 67-69 Lincoln’s Inn Fields

London, WC2A 3JB

United Kingdom

Main Contact

Fondazione G. Capriglione Onlus - fondazionecapriglione@luiss.it

Editor- in- Chief

F. Capriglione

Editorial Board

G. Alpa - M. Andenas - A. Antonucci - R. Olivares-Caminal - G. Conte - M. De Marco - M. Hirano - A. Kokkinis - I. MacNeil - M. Martinez - M. Pellegrini - D. Rossano - C. Schmid - M. Sepe - A. Steinhouse - V. Troiano - V. Uskov

Editorial Advisory Board

F. Buonocore - N. Casalino - I. Kokkoris - A. Miglionico - D. Siclari

ISSN 2050-9014

Review Process

1. Articles and case notes submitted to the Review will be reviewed by at least two reviewers (chosen among the Editorial Board members) and, where necessary, by an external advisor.
2. Any paper will be submitted by the Editorial Board – anonymously, together with an evaluation form – to the reviewers for an overall assessment.
3. In case of a single negative evaluation by one of the reviewers, the Editor-in-chief may assume the responsibility to publish the paper having regard to highlight this circumstance.
4. In any case, the submission of the paper or its positive evaluation does not provide any right to the author to ask for the publication of the paper. Fondazione Gerardo Capriglione Onlus may reproduce articles published in this Review in any form and in any other publications.

CONTENTS

Presentation	1
---------------------------	----------

Francesco Capriglione

Competition and stability in the digital paradigm.....	3
---------------------------------------------------------------	----------

Francesco Capriglione

Banks and shadow banks, reform of the EU crisis management framework, money and the digital euro: an overview of perspectives and challenges.....	32
--------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------

Rainer Maserà

Global thoughts on a resilient safety-net: preliminary lessons to learn from the recent bank crises in the US and Switzerland... ..	48
------------------------------------------------------------------------------------------------------------------------------------------------	-----------

Marco Bodellini – José Luis Colino

Organisation of corporate rights protection in the world and in Ukraine... ..	78
--------------------------------------------------------------------------------------	-----------

Anatoliy V. Kostruba

FOCUS ON GLOBAL PERSPECTIVES

Higher order moments portfolio optimization via deep learning... ..	97
----------------------------------------------------------------------------	-----------

Cosimo Izzo - Francesca Medda

PRESENTATION

Francesco Capriglione

1. The particular historical period that our country and the whole international community are experiencing is at the basis of any reflection for those who aim to examine topical issue of the financial industry and focus on the innovative scope of the change underway. Hence the need to revisit classic themes in light of the regulatory developments introduced by the most recent European regulation.

The essays presented here highlight some significant structural imbalances in the special legislation that currently characterise the correct conduct of financial activity, marked by the crises of two decades of this millennium. At the same time, the research carried out seems to look at the 'financial sustainability' of the remedies that should be adopted to achieve the objective of addressing the obstacles that prevent the possibility of ensuring the process of economic growth.

The positive results of this analysis aim, among other things, to highlight the risks and hazards deriving from failure to observe a correct evolutionary process, capable of seizing market opportunities. More generally, it is evident that, in line with law and economics studies, this evolutionary process cannot function without precise rules which guarantee its accountability to a liberal-democratic order.

2. In this context, it should be noted that the contributions aimed at identifying useful indications from some recent banking crises (I am referring to those which occurred in the US and Switzerland) and, therefore, at examining the consequences of inflation on the banking system and, in particular, on the crisis management framework.

Looking at the implications of these events on banks, the scholarly debate

questions the functioning of digital paradigm, which poses a significant challenge for financial operators when evaluating its impact on the Euro or the difficult relationship between “competition and stability” (which is traditionally considered at the basis of market equilibrium). On a comparative level, a contribution that focuses on issues being studied especially in countries (such as Ukraine) interested in the transition towards a market economy appeared equally significant; this process calls for the need to clarify the rights of corporate companies to avoid their violation and ensure an effective protection of shareholders.

Lastly, this issue dedicates adequate space to the problem of asset allocation through Deep Learning techniques, expression of a deterministic policy applied to different profit formulations. This is an investigation carried out through an empirical analysis of the various elements of deep learning (such as average variance, minimum variance, risk parity and hierarchical risk parity) with a view to the objective of optimizing the managed portfolio; analysis in which varied deep learning performances are compared aimed at using different objective functions (connected to the desired degree of approximation of a given utility).

This work is characterised by an empirical analysis which examines the relationship between the excess returns generated by selected strategies and the standard financial factors; it, therefore, denotes a highly technical content (related to the mathematical support of the research findings) to offer the reader an original interpretation on the opportunities of artificial intelligence which finds a natural field of application in the subject matter.

COMPETITION AND STABILITY IN THE DIGITAL PARADIGM

Francesco Capriglione *

ABSTRACT: *This article examines the implications of the digital process in the banking sector along with the innovations introduced by automated operations within internal management schemes. It also considers the challenges posed by the dynamics of artificial intelligence which faces evident limitations of robotics in replacing human intervention. Therefore, it raises the question of operational forms that allow the use of computer programmes to expedite access to the interconnection network, but do not eliminate the risks related to the functioning of mechanisms based on a software organised in separate 'blocks'. This is a reality characterised by the impact of digital technology on the traditional relationship between competition and stability and, therefore, on the competitive products aimed at the development of economic growth. In this context, the analysis advances a view of 'market power' in the use of automated mechanics to govern the balance between competition and stability which should be regulated by national and European authorities.*

SUMMARY: 1. Introduction. - 2. The governance of digital market. - 3. *Follows:* the regulatory intervention of the European authorities. - 4. Towards an innovative competitive paradigm: the impact of large dimension. - 5. *Follows:* computer automation and market competitiveness. - 6. Banking stability and systemic risk. - 7. Conclusion.

1. In recent years, the interest of credit institutions and large part of economic law scholars has focused on examining the transition process from analogue to digital which, as known, brings innovations for the use of automated

* Editor-in-chief

processes (based on IT mechanisms and techniques of artificial intelligence)¹.

In the aftermath of the pandemic crisis, the academic debate - in view of the implementation of consistent changes to the current legal order of the market - has revisited the ways in which law, economics and politics interact. Particular attention is paid to the implication of modern technology, whose instrumentation if, on the one hand, contributes significantly to the possibility of recovering from the stagnation deriving from a long period of operational stagnation, on the other, it accentuates the problematic solution of a responsible employment of the immense number of stored information in order to give content to the algorithmic elaboration. Specifically, the analysis focused on the bank transformation process, recognizing the strengthening of digital channels as one of the most important ways that can facilitate their development. In particular, the multilateral strategies adopted by the banks were highlighted and, with them, the functioning of the internal processes that introduce innovations through structured work paths that lead to the new management schemes². Hence the growing trust of industry members in the use of these tools, for which machine learning, big data analytics, artificial intelligence, blockchain ledgers, cloud-based core banking services, digital currency and a myriad of financial derivatives developed digitally have entered the daily life of credit institutions.

However, the mechanistic dynamics that characterize the methods of expression of artificial intelligence pose varied problems; this starting from the identification of the explanatory capacity of the operational cases in which an

¹ See CONSOB, *La digitalizzazione della consulenza in materia di investimenti finanziari*, January 2019; BANK OF ITALY, *Comunicazione in materia di tecnologie decentrate nella finanza e nelle crypto attività*, Rome, June, 2022; PANETTA, *L'innovazione digitale nell'industria finanziaria italiana*, speech at the inauguration of the FinTech District, Municipality of Milan - Ministry of Economy and Finance, Milan, 26 September 2017; CANEPA, *I mercanti dell'era digitale*, Turin, 2020; ALPA, *L'intelligenza artificiale. Il contesto giuridico*, Modena, 2021; CAPRIGLIONE, *Diritto ed economia. Le sfide dell'intelligenza artificiale*, in *Riv. Trim. dir. Econ.*, Supplement to n. 3, 2021; PELLEGRINI, *Transparency and Circulation of Cryptocurrencies*, in *Open Review of management, banking and finance*, 2021; MASERA, *Nuovi rischi e regolazione delle cryptovalute*, in *Bancaria*, 2022, n. 3, p. 5.

² See BASKERVILLE - CAPRIGLIONE - CASALINO, *Impacts, Challenges and trends of Digital Transformation in the Banking Sector*, in *Law and Economics Yearly Review*, 2020, p. 341.

activity attributable to the use of automated systems that make use of algorithms can find application. It is evident that such an assessment assumes particular importance for the purposes of assessing the interconnections between the innovative instrumentation in question and the traditional forms of negotiation of the financial market; therefore, we understand the particular attention dedicated to specifying the actual advantages brought to the markets and to retail investors, taking into account the potential reduction in costs (underlying the former) and the ease of access to the use of digital technology³.

It comes into consideration the fact that robotics has the evident limitation of an undoubted determinism in the options it is able to envisage. It, in fact, by definition can only express evaluations that reflect the outcomes of calculations made in reference to specific assumptions, which are identified in the programming of the machine that is to provide the service; the result is a tendency toward homogenization of the products offered to the market and, therefore, a kind of substantial uniformity of the activity carried out by members of the sector. There is, in fact, an objectification of operational forms which - by simplifying the processes of the action carried out subject to the use of technological platforms - facilitates investment opportunities; hence a growing favour of the interest that traditional financial institutions have in artificial intelligence mechanisms, such as to induce them to promote the emergence of online banks within their group.⁴ It should be noted that the use of IT platforms is not without its perplexities, which, with reference to the crypto sector, also find their inspiration in the failure of the FTX platform, which also had a wide

³ See ANNUNZIATA, *Retail investment strategy*, study required by the *ECON Committee, Policy department for economic, Scientific and Quality of life Policies, Directorate General for International Policies*, June 2023.

⁴ We refer, in particular, to the establishment of Isybank, a new digital bank of the Intesa Sanpaolo group, which came into being in June 2023, offering via app a current account, a digital debit card and a digital branch to call on for assistance; see the editorial entitled *Isybank: ecco la nuova banca digitale di Intesa Sanpaolo*, viewable on <https://www.aziendabanca.it/notizie/banche/isybank>.

resonance at the international level.⁵

It can be deduced from this that if, on the one hand, the application of digital if, on the other hand, it allows the use of computer programs suitable for facilitating access (of a plurality of subjects) to the same interconnection network, it does not eliminate the risks related to the operation of a mechanism that is based on a diffuse and unmodifiable register organized in separate “blocks” that group sets of transactions, which are interconnected in a sequential “chain” marked temporally.⁶ Therefore, the opening of the financial sector to new development prospects (which may change the traditional conformation of payment services and, more generally, of banking services) is matched by the unknowns arising from the new ways of securities circulation that “disregard the intermediation of authorized entities, central counterparties and, even, central banks themselves”.⁷

In this context, the market focuses on asset tokenization operations that are substantiated by a form of digitization of an asset that is transferred according to the automatism made possible by a sequence stored on the blockchain, which guarantees rapid execution times and full document portability⁸. Undoubtedly we are in the presence of a technology that allows for the implementation of varied investments through the purchase of a plurality of tokens, each associated with a distinct asset or fraction thereof (which results in the opportunity for operational diversification and a reduction of the risk assumed), however, it does not escape that the disruptive scope of this phenomenon, as has been appropriately underlined in the literature, involves “significant perplexities related ... to the

⁵ See ARNER – ZETSCHKE .BUCKLEY – KIRKWOOD, *The Financialization of Crypto: Lessons from FTX and the Crypto Winter of 2022/2023*, viewable on <https://ssrn.com/abstract=4372516>.

⁶ See SARZANA DI S. IPPOLITO - NICOTRA, *Diritto della blockchain, intelligenza artificiale e IoT*, Wolters Kluwer Italia, Milan, 2018.

⁷ See BANK OF ITALY, *Le nuove frontiere dei servizi bancari e di pagamento fra PSD2, criptovalute e rivoluzione digitale*, in *Quaderni di ricerca giuridica della Consulenza Legale*, n. 87, 2019, p. 14.

⁸ See SCAFURI, *La tokenizzazione degli asset come strumento per l'efficientamento delle operazioni di smobilizzo dei crediti deteriorati*, in *Riv. trim. econ.*, suppl. n. 1 del 2021, p. 112.

protection of confidentiality and competition”.⁹

In our opinion, the impact of digital technology on the competitive market is one of the most important aspects of the information revolution that concerns us here. As we will try to demonstrate in the following pages, the automation of processes that characterizes today’s operational reality reflects on the balance of the relationship between 'competition and stability', determining repercussions that perhaps have not yet been fully evaluated in their effective scope. Hence the need to point out both the results of the telematic innovation in question and the intervention guidelines referred to the sector authorities in order to avoid possible critical issues that can disturb the regular exercise of financial activity.

2. The search for optimal ways to govern the IT revolution, directing towards positive objectives, leads one first to refer to the disciplinary system in force and the potential use of the instruments available to the authorities in the sector.

Specifically, the techniques of decentralised finance are analysed, which must be taken into account when investigating virtual money. The research highlights an operational reality characterised by opacity and uncertainty due to the lack of transparency and reduced reliability of an activity carried out outside the perimeter of regulation; this is because the “stabilisation mechanisms based on automatic rules that adapt supply to variations in demand (algorithmic stablecoins)” - to which the Bank of Italy refers¹⁰ - while improving the efficiency of the ways in which these assets are offered, thanks to “distributed ledger technologies (DLT)”, do not remove users from risk¹¹. In addition to this, there are foreseeable situations of insolvency, destined to spread to the entire sector if forms of contagion are not prevented, as well as the conditioning of production

⁹ See BANK OF ITALY, *Le nuove frontiere dei servizi bancari e di pagamento fra PSD2, criptovalute e rivoluzione digitale*, cited., p. 148.

¹⁰ See BANK OF ITALY, *Considerazioni finali*, 2022, p. 19.

¹¹ See CAPRIGLIONE, *Le crypto attività tra innovazione tecnologica ed esigenze regolamentari*, in *Riv. trim. dir. econ.*, 2022, p. 234 ss.

processes and the same relations between states (think of the recent hacking episodes practised to block the structures of public apparatuses with a view to their subsequent submission to blackmail).¹²

It outlines an operational framework in which the need for a responsible use of technology that makes use of an immense amount of stored information in order to give content to computer processing is significantly felt. It is understandable why the national and European sector authorities are showing great interest in this phenomenology, offering with their interventions a significant contribution to the studies that international institutions and scholars of the subject have been undertaking for some time now to prevent 'dysfunctions' in the use of this instrumentation.

Therefore, the objective of using the mechanisms for automating activities with balance and discernment becomes pressing¹³; that is, avoiding the benefits of streamlining information flows and urging measures that, through a more complete assessment of credit risk in aggregate form (permitted by digital), stimulate the development of sustainable finance. Hence the indications of an acute scholar who, having regard to the "breadth of the subject of financial market governance" suggests that the analysis should be placed in an 'ESG' and sustainability dimension in order to build a 'new finance' that is less selfish and more supportive, and which is therefore parameterised on assessments that take into account the overall balance of the economic system and the validity of the objectives pursued.¹⁴

In this perspective, it should be considered how computerised processes can be coordinated with the ordering principles of existing law, hence the need to

¹² Consider the recent breach of the Lazio Region's information services, which is being investigated by the public prosecutor's office in Rome, see the editorial entitled *Attacco hacker Lazio, D'Amato: "E' partito dall'utenza di un dipendente in smart working"*, viewable on www.corrierecomunicazioni.it/cybersecurity/attacco-hacker-lazio-damato-e-partito-dallutenza-di-un-dipendente-in-smart-working.

¹³ See BASKERVILLE - CAPRIGLIONE - CASALINO, *Impacts, challenges and trends of digital transformation in the banking sector*".

¹⁴ See DE POLI, *La governance dei mercati finanziari*, on AA.VV., *L'ecosistema del mercato europeo tra diritto e innovazione*, edited by Passalacqua, Supplement to no. 4/2022 of *Riv. trim. dir. Econ.*, p. 125.

identify their interaction with the current paradigms of financial operations. It follows that the investigation should be oriented towards an assessment of the regulatory framework with which the European legislature has regulated the matter in recent years, and then to delve into the varied issues concerning the ways in which decentralised technologies are used.

The crux of the issue outlined above is the possibility of defining rules that allow for the benefits deriving from the use of the aforementioned IT mechanisms to be enjoyed, minimising the dysfunctions that may alter their functionality. In other words, regulation should oversee the proper functioning of algorithmic computation while preventing it from causing market abuse, as a result of conceivable manipulations.

The birth of the ‘single digital market’ responds to the need for renewal in organisations, in management, production, distribution and supply processes, based on the diffusion of information and communication technologies, giving a significant propulsive input to the definition, within the EU, of precise ordering criteria. Hence the issuance of a wide-ranging set of regulations, starting with the first directive on electronic payments (Directive 2007/64/EC), transposed by Legislative Decree No. 11 of 27 January 2010. This was followed by other regulatory interventions in which rules were set out to “establish a modern and coherent Community legal framework for payment services, which represents clear progress in terms of costs for consumers, as well as security and effectiveness compared to the systems currently existing at national level”.¹⁵

From these regulatory interventions of the European authorities emerges, in the opinion of the prevailing doctrine, the conviction of the same to proceed to a governance of the algorithms¹⁶; and this either through a conformity assessment of the data before their use, or by establishing canons of risk tolerability (correlated to the legal effects on the activities subjected to it). Hence the request

¹⁵ Recital no. 4 of the directive No. 2007/64/CE.

¹⁶ See LENER., *Intelligenza artificiale e interazione umana nel robo-advice*, in *Riv. trim. dir. econ.*, Supplement no. 2 to no. 3/2021, p. 110.

to intermediaries to “prepare sufficient documentation of the design system”, together with the imposition of the obligation to equip themselves with a comprehensive self-control system on the functionality of the algorithm, adopting a documented testing strategy aimed at clarifying the type of checks carried out.

In this context, at the national level, is to be seen the recent Bank of Italy Communication on decentralised technologies in finance and crypto-assets¹⁷, to which a representative of this institution refers in emphasising that the challenges posed by technological innovation must be faced by having recourse, in a complementary manner to the regulatory lever, to the 'definition of standards and practices developed according to a logic of public-private collaboration', so as to prepare a regulation by principles functional to the 'constantly moving technological frontier'.¹⁸ In this way, a logic of co-regulation is approached, which is considered consistent with the objective of enhancing the appropriate tools to enable the outcomes of IT processes to be channelled into optimal paths.

3. As mentioned in the preceding section, the EU showed a strong interest in the subject matter through regulatory interventions aimed at outlining a complete disciplinary framework. Fundamentally, the intention emerges of achieving market efficiency by using the technological instrument, the function of which - in addition to being consistent with the need to pursue appropriate lines of development - makes it possible to take advantage of an increasingly connected financial economic context.

An initial response to the challenges of network security, the organisation of information systems and the processes of data acquisition and processing on behalf of third parties is given by the Union with Directive No. 2016/1148 on Network and Information Security (NIS), which introduces harmonised rules and

¹⁷ This communication published on 15 June 2022, as the Bank of Italy itself points out, draws the attention of supervised intermediaries, supervised entities, and those operating in various capacities in decentralised ecosystems, including as users, to the opportunities and risks

¹⁸ See CIPOLLONE, *Speech at the Conference on Digital Platforms and Global Law*. Rome, 29 April 2022.

security measures for the cyber security of vital sectors of the economy and society, encouraging cooperation between national authorities to deal with possible cyber-attacks¹⁹. Specifically, the aim is to overcome the fragmentation of approaches to information systems that exist in the Union, so as to guarantee a uniform level of protection for consumers and businesses and, at the same time, the imposition of common obligations on operators of essential services and providers of digital services. This is a regulation that aims to promote and develop and a culture of risk management, creating a reliable level playing field to ensure collaboration of all Member States.

Significant relevance in the disciplinary context concerns the operational techniques of MiCAR regulation on crypto assets, launched on 5 October 2022 and recently approved by the European Council, which with this measure introduced a harmonised regulatory framework in the EU.²⁰ It is accompanied by an ancillary measure aimed at introducing some adjustments to the existing rules on market infrastructures and digital finance policy lines, an act on digital operational resilience (DORA), which includes service providers for crypto assets, and a proposal on the pilot scheme on distributed ledger technology (DLT) for wholesale use.²¹

This legislation aims to introduce remedies for cryptocurrency users who cannot turn to the authorities in the event of fraud, cyber-attack or accidental loss of funds. As has been pointed out, the MiCAR regulation 'aims to introduce uniform rules directly applicable to cryptoasset issuers and cryptoasset service

¹⁹ See *ex multis* LEMMA, *FinTech Regulation. Exploring New Challenges of the Capital Markets Union*, Cham (SW), 2020; CANALINI, *Il Fintech e le nuove frontiere dell'innovazione finanziaria*, in AA.VV., *Manuale di diritto bancario e finanziario*, Milan, 2019, p. 299 ss; BARBAGALLO, *Speech at the 2019 Winter Conference, 'FinTech: Role of the Supervisory Authority in a Changing Market'*, Naples, 8 February 2019.

²⁰ See *ex multis* CONSO – FERRETTI, *La disciplina dei cripto-asset nella proposta di regolamento MICA*, in *Bancaria*, 2022, no. 3, p. 61 ss; PARACAMPO, *I prestatori di servizi per le cripto attività. Tra mifidizzazione della MICA e tokenizzazione della Mifid*, Turin, 2023, *passim*.

²¹ See COM/2020/594 final, *Proposal for a Regulation of the European Parliament and of the Council on a pilot regime for market infrastructures based on distributed ledger technology*

providers²², which take precedence over national rules' on transparency and disclosure obligations, authorisation and supervision, management, organisation and governance of issuers of asset-referenced tokens, consumer protection, and prevention of market abuse; in short, to ensure the regularity of cryptoasset trading on a trading platform²³.

Recent analyses of the regulatory framework with which this regulation was recently approved emphasise the assimilation between the operational models already tested in MiFID 2 and the new services regulated by the MiCAR, highlighting the substantial lack of specialisation of the regulation recently introduced, which, on the contrary, in Article 2(4), "expressly codifies the operational margins" set by the legislator.²⁴

Regardless of this consideration, it is certain that the MiCAR is aimed at "providing clarity and legal certainty to promote the secure development of crypto-activities and the use of distributed ledger technology (DLT) in financial services", as the statement of the objectives pursued by the same punctually attests²⁵. At the core is the regulatory intent to ensure a high level of protection for consumers and investors, as well as, of course, the integrity of the market and, with this, the support of innovation and fair competition. Underlying the regulation in question is also the awareness that crypto-activities are a significant expression of technological application in the financial sphere, hence the need to examine the opportunities and challenges, so as to prepare appropriate conditions for the creation of a European market for digital activities, starting from the need to create 'certainty'²⁶.

²²See ŻUCHOWSKI - CAPRIGLIONE - CASALINO - SKRODZKI, *Crypto assets, decentralized autonomous organizations and uncertainties of distributed ledger technologies* (2022) 11(1) *LEYR*, p. 123.

²³ See CAMERA DEI DEPUTATI, VI Commissione permanente (Finanze), *Audizione* of the CONSOB Commissario Paolo Ciocca, 8 June 2021, p. 3.

²⁴ See PARACAMPO, *I prestatori di servizi per le crypto attività.....*, cit., p. 7.

²⁵ See EUROPEAN COMMISSION, COM(2020) 593 final 2020/0265s(COD), Context of the proposal, 1.4.1. General Objective.

²⁶ See EUROPEAN COMMISSION, *Proposal for a Regulation of the European Parliament and of the Council on crypto-assets markets*, amending Directive (EU) 2019/1937 COM (2020) 593 final, where it is stated: "This proposal, which covers crypto-assets that are not covered by existing

Similarly, the recent approval (June 2023) by the European Parliament of the Artificial Intelligence Act, designed to regulate Artificial Intelligence while respecting the rights and values of the European Union, is of note.²⁷ This measure, as can be seen from the text of Article 3, introduces ‘a system designed to operate with elements of autonomy and which, on the basis of data and input provided by machines and/or humans, deduces how to achieve a given set of objectives using machine learning approaches’. It is evident how the European regulator shows particular attention in highlighting the levels of risk that artificial intelligence systems can cause to people, affecting their fundamental rights and even their health.

There is need to prevent market failures that, as has been authoritatively argued, 'have revealed the complete inadequacy of the operational and governance schemes adopted...(with regard to)... crypto-activities'²⁸. It has become clear that without an adequate risk analysis, recourse to such instruments inevitably encounters the opacity that characterises the activities implemented. This finding is, moreover, confirmed by the doctrinal orientation according to which the centralised management structure of financial instruments tends to be incompatible with the use of decentralised technologies²⁹.

It follows that in order to defend the sector's efficiency values, the authorities are obliged to continually update the perimeter of regulation to meet the new challenges posed by AI. Indeed, the growing use of the digital channel leads to the identification of regulatory criteria that respond to the need to prevent savers/investors from incurring new risks due to the intensification of their participation in digital market activity. Hence the need to put in place a heterogeneous plurality of interventions aimed at prevention and, therefore, at

EU financial services legislation as well as e-money tokens, pursues four general and related objectives. The first objective is that of legal certainty'.

²⁷ See the editorial entitled *AI Act: EU pioneers in regulating artificial intelligence*, available at <https://www.affarinter-nazionali.it/ai-act-ue-pioniera-regolamentazione-intelligenza-artificiale>.

²⁸See PANETTA, *Crypto-domino: the bursting of crypto-asset bubbles and the fate of digital finance*, speech at the Insight Summit at the London Business School, London, 7 December 2022.

²⁹ See ANNUNZIATA - MINTO, *Il nuovo Regolamento UE in materia di Distributed Ledger Technology. Analisi del nuovo DLT Pilot Regime*, July 2022, available at www.dirittobancario.it.

protecting the financial activity carried out in the digital market, stimulating the confidence of operators. In another respect, it points to the need to bring about a change of mentality that induces market operators to critically review their current organisational set-up. And indeed, while there is no doubt that the sector's efficiency gains (due to the affirmation of digital technologies) entail greater earnings and growth prospects for those in the sector, it is equally certain that these positive results must be accompanied by the awareness that they must be underpinned by the creation of deep connections between intermediaries and consumers; this in order to promote a community spirit that encourages the activation of new jobs and retains talent in the countries of origin. It identifies a reality supported by a finance that looks to the future, ensuring a rational use of resources so as not to compromise their ability to continue producing value over time.

In this way, it is worth mentioning the consideration that underlines the “change [in] the functioning of the market” due to the growing use “of virtual instruments”, hence the input to the “emergence of ‘technological platforms’ that allow for faster and less costly ways of accessing payment and securities trading services than those offered by banks and other intermediaries”.³⁰ Hence the prospect of a necessary regulatory programme aimed at an orderly development of the phenomenon in question.

4. Ever since the earliest studies on the financial system, competition has been an issue that has been at the heart of scholarly research, since it - or, more precisely, the ways in which it interacts with the market - is responsible, on the one hand, for the protection of banking and financial services customers and, on the other, for authoritative interventions designed to ensure that the pre-eminence of some companies is not to the detriment of others.³¹

³⁰ See Speech of the President SAVONA held in Rome on 14 June 2021, p. 10.

³¹ See ALHADEFF-MOTTURA, *Concorrenza e controlli nell'attività bancaria. Studio sul controllo della concorrenza bancaria in Italia, Francia e Inghilterra*, 1970; PATRONI GRIFFI, *La concorrenza nel sistema bancario. Profili ricostruttivi*, 1979; FOCARELLI, *Il ruolo della*

Economic and legal analysis has highlighted the need for states to provide themselves with competition regulations to prevent operators from influencing prices, so that they are the result of the encounter between supply and demand. At the same time, regulation has been entrusted with the task of guaranteeing market transparency by counteracting the negative effects arising from information asymmetries and, therefore, ensuring a situation of potential parity between operators in the use of the services offered by the market and, more generally, in access to it³².

Therefore, the underlying rationale of the antitrust discipline appears evident, which at a European level finds its epicentre in Articles 101 and 102 of the TFEU, which sanction the prohibition of agreements between companies or the attainment of dominant positions that have the objective (and, therefore, the effect) of preventing, restricting or distorting competition within the market. Hence the configurability of ‘horizontal and vertical agreements’, on which the European Court of Justice has long dwelt and sanctioned the prohibition³³, as well as of abusive conduct connected with the attainment of a dominant position, with regard to which, however, it must be pointed out that Italian administrative case law has held the definition of ‘abuse of a dominant position’ to be non-existent in the legislation.³⁴

From another point of view, it should be pointed out that competition is the basis of the possible increase in profitability of members of the sector and,

concorrenza nell'evoluzione delle politiche di raccolta delle banche italiane, Editions Banca d'Italia, 1993; UBERTAZZI, *Banche e concorrenza. Scritti*, Giuffr , 2007; ALLEN, Gale, *Competition and Financial Stability*, in *Journal of Money, Credit, and Banking*, 2004, 36, 3; BERGER, *Bank Competition and Financial Stability*, in *Journal of Financial Services Research*, 2009, 35, p. 99.

More recently, VISCO, in the “Indagine conoscitiva sulle condizioni del sistema bancario e finanziario italiano e la tutela del risparmio” (Fact-Finding Study on the conditions of the Italian banking and financial system and the protection of savings), addressed this issue with reference to European supervision, crisis resolution and deposit guarantees; see *Hearing* held at the 6th Permanent Commission (Finance and Treasury) of the Senate of the Republic, Rome, 19 April, 2016.

³² See ALPA, *La trasparenza dei contratti bancari*, Bari, 2003, *passim*.

³³ See EU Court of Justice, 23/01/2018, no. 179.

³⁴ See T.A.R. Roma, (Lazio) sez. I, 01/08/2017, no. 9140, a judgment that remits to the interpreter the identification of cases characterised by conduct deserving of sanction.

therefore, has a close connection with the achievement of a situation of stability within the latter; with good reason already in the distant past, the doctrine, evaluating the function of a competitive market proposition, affirmed the existence of a trade-off between competition and soundness of the banks.³⁵ Competition has a significant connection with the banking dimension insofar as the opening to a market characterised by activate forms of aggregation in order to overcome the negative externalities arising from particularly risky forms of operation.

Hence a widespread conviction that large banking size constitutes an antidote to the possibility of banking crises developing, entailing “within certain limits... benefits in terms of economies of scale and scope”³⁶. This is a thesis, recently reiterated in some speeches by an eminent representative of the ECB³⁷, who shared the orientation in the past expressed by Visco³⁸ of favouring aggregations between banks, for the achievement of a large size of banks.

It goes without saying that the objective at which said thesis is aimed is believed to be functional in overcoming crisis situations, likely to be assumed in the post-pandemic era. It is assumed that large banks exhibit greater characteristics of efficiency and resilience than small- to medium-sized ones. It

³⁵ See KEELEY, *Deposit Insurance, Risk, and Market Power in Banking* in *The American Economic Review*, Vol. 80, n. 5, 1990; HELLMANN - MURDOCK - STIGLITZ, *Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?*, in *The American Economic Review*, 2000, vol. 90, n. 1, p. 147-165; MISHKIN, *Prudential Supervision: Why Is It Important and What Are the Issues?*, in *Prudential Supervision: What Works and What Doesn't* edited by Mishkin, *The University of Chicago Press*, 2001, p. 1-30.

³⁶ See BARBAGALLO, *Stability, customer protection, competition*, Conference held at the Lazio Regional Administrative Court on 26 November 2015..

³⁷ See *Interview* with ENRIA, published in the ECB Annual Report on Supervisory Activity 2020, available at <https://www.bankingsupervision.europa.eu/press/publications/annual-report/html/ssm.ar2020~1a59f5757c.en.htm>. Critical assessments of this banking policy orientation were made by me in a Parliamentary Hearing at the 'Commission of Inquiry into Banks', held on 15 February 2022, published in Riv. Trim. Dir. Econ., 2021, I, p. 496 ff.

The Bank of Italy's adherence to this thesis, reiterated on several occasions, was lastly confirmed in the Final Considerations of 2022, in which it emphasised that "the deterioration of the economic situation could have significant consequences for ...small and medium-sized banks, which are already experiencing difficulties in containing costs and are struggling to benefit from economies of scale" (p.17).

³⁸ See VISCO, *L'economia italiana e le banche: implicazioni della pandemia e prospettive*. speech delivered at the ABI (16 September 2020) published by the Bank of Italy.

should, moreover, be noted an authoritative economic doctrine which argues that banking biodiversity represents the organizational model best suited to the size of industrial enterprises, which in Italy see the prevalence of SMEs.³⁹

For true as we have pointed out on another occasion, economic science does not bear clear evidence on the circumstance that the large banking size per se represents an optimal safeguard for dealing with crisis situations. This, assuming that there are equal conditions (with reference to the quality of governance and the validity of the industrial project), as well as the presence of regulation that does not supinely apply the *one size fits all* principle.⁴⁰ Even at the legal level, the large size of banks does not translate into a greater degree of efficiency and resilience than those of medium-small institutions; so that the favour of the supervisory authorities for overcoming subjective credit fragmentation with aggregations designed to increase the “weight” (including international) of those belonging to the sector seems unjustified.⁴¹

Specifically, with regard to the Italian case, it should be pointed out that since the 1936the Banking Act, one of the founding cornerstones of the Italian financial system has been banking pluralism, desired by the legislator "in the logic of linking the operating forms of those belonging to the sector to the varied needs of an industry made up of diversified subjective structures";⁴² a principle that is matched in the euro area by a very high number of non-significant banks, which in 2020 amounted to 2,400 subjects (80% of which in Germany and Austria).

It is well true that- as has been pointed out on another occasion ⁴³-at least on a statistical level, in the face of a large number of LSIs an increase in the

³⁹ See MASERA, *Community banks and community banks: can the hiatus on the two sides of the Atlantic be bridged?*, Rome, 2019

⁴⁰ See CAPRIGLIONE - SEPE, *La spinta della Banca Centrale Europea per la grande dimensione*, in *IlSole24Ore*, 7 April 2021

⁴¹ See CASELLI, *Banks. Maxi, slim or tech? E' tempo di scegliere la taglia*, published in *L'economia* of 23 August 2021.

⁴² See TROIANO, *La banche*, in AA.VV., *Manuale di diritto bancario e finanziario*, Milan 2019, p. 328, where, with regard to the previous regulatory regime of 1936, the considerations of CASSESE, *La "divisione del lavoro bancario". Distribuzione funzionale e territoriale del credito dal 1936 ad oggi*, in *Econ. ital.*, 1983, p. 375 ss.

⁴³ See CAPRIGLIONE – SEPE, *La spinta della Banca Centrale Europea per la grande dimensione*, cit.

number of banking crises that the Authorities would be called upon to manage can be assumed; likewise, it is conceivable that the increase in impaired loans as a result of the pandemic induces the prospect - due to the stringent NPL ratio imposed by the ECB - of new conceivable credit failures. It is believed, however, that the ECB's intention to leverage bank mergers to solve the problem of their pathology - implementing an invasive policy towards LSIs, which goes beyond the rationale of Article 6 of EU Reg. 1024/2013 - ends up, on the level of concreteness, being negatory of the principle of proportionality, in addition to reaching the denial of the pluralistic criterion mentioned above.

The ECB's propensity for mergers that include small banks in aggregates that base their stability on large size, though it may represent a solution to banking pathologies, in our view does not justify the Authority's preventive intervention going so far as to steer the market toward "well-planned" size arrangements, to use Andrea Enria's words.⁴⁴ Such *modus agendi* appears inconsistent with competitive logic and, therefore, with EU regulations.

That said, it is the case to refer to what an authoritative doctrine wrote at the beginning of this millennium about the concept of competition, which was reconstructed in terms of "a dynamic process, the constituent elements of which are freedom of entry, freedom of innovation, variation in supply and also dimensional growth, within the framework of a market that must remain contestable".⁴⁵ Thus, one has regard to a market reality characterized by an operational dynamism, an expression of a freedom of action, which is followed by growth based on the competitiveness that must characterize the market. This is a paradigmatic indication that, as is pointed out by a careful scholar, rejects the idea of static competition in order to link its essence to the innovation underlying the functioning of the market; this in order to ensure, in line with EU guidelines, economic development through the emergence of new technologies, the flow of

⁴⁴ See the *Interview* given by Andrea Enria to Francesco Manacorda, published in *La Repubblica* on 18 May 2022.

⁴⁵ See LIBERTINI, *Le riforme del diritto dell'economia: regolazione e concorrenza*, in *Giorn. dir. amm.*, 2002, p. 804.

human and financial resources “towards initiatives with the greatest potential for growth”.⁴⁶

It is evident how such a model of competition surpasses the neoclassical concept of perfect competition, criticized by Schumpeter with regard to the inadequacy to incorporate process innovation.⁴⁷ The dynamism is rooted in certain founding principles, such as the freedom of the forms of operation to be practiced in the market and the pluralism of the interveners; it is expressed through a competitive race that makes use of the knowledge brought in the continuum by innovation, hence the ability to “make use of elements functional to the efficiency of the activity carried out.

In light of the above considerations, the risks inherent in the market reality proposed by the ECB are clear. It tends, in fact, to achieve market equilibrium with the affirmation of the large size to which the elimination of the critical issues is attributed; this disregards the pluralistic logic and freedom of the market - and, therefore, the original rationale of the principle of dynamic competition - in order to make room for an oligopolistic type of situation. It is undeniable that a quantitative restriction of market players is being met, compressing the principle of freedom of access to the market, which presupposes autonomy of decision-making and equality of economic operators. More generally, on this point, the consideration of a distinguished doctrine is relevant, according to which, since the oligopolistic regime is based on an authoritative logic, the prospect of a democratic guarantee in the functioning of the market is lost, which opens up, instead, to the “dangers ...(of)... commingling between economic power and political power”⁴⁸.

5. Contributing to the creation of an innovative competitive model is the impact of the digital reality on the dynamics of the market; in fact, it interacts with

⁴⁶ See ARGENTATI, *Il principio di concorrenza e la regolazione amministrativa dei mercati*, Turin, 2008, p. 48.

⁴⁷ See SCHUMPETER, *Teoria dello sviluppo economico*, Florence, 1947.

⁴⁸ See ROSSI G., *Antitrust e teoria della giustizia*, in *Riv. soc.*, 1995, 1, p. 14.

the (unanimously recognised) ordaining canons of competitive tendering, introducing elements that change some of its characteristic features. As we will attempt to demonstrate below, digital technology affects the operating methods previously practised, bringing about a sort of flattening of the financial agere, whereby the observer is offered a static-structural vision of the market, contrary to the declination of the principles that, until recently, guided the assessment of conformity to the competitive logic. Add to this the changed methodology underlying the competitive tender to “evoke the theme ... of the restrictive agreement of competition”⁴⁹.

At the basis of such a change are certainly the ways in which information technology processes are expanding, using automation mechanisms based on sophisticated models⁵⁰, for which - as pointed out on another occasion⁵¹- the need arises to identify their interaction with the current paradigms of financial operations.

In this regard, it is worth noting what has been pointed out in the literature regarding the functioning of the markets in which digital platforms operate, characterised by certain network effects that are summarised in the ability to bring together subjects that, in their absence, "would be impossible to be unable to capture the value generated by their interaction"⁵². In other words, in the aforementioned markets, a peculiar positive value must be ascribed to the platform that promotes the conclusion of negotiating relationships, bringing together groups of different operators who aggregate among themselves. This is determined on the basis of a process that should be considered removed, by its intrinsic nature, from any type of external interference, insofar as it unfolds in a

⁴⁹ See CONSOB, *AI e abusi di mercato: le leggi della robotica si applicano alle operazioni finanziarie?*, in *Quaderni giuridici*, n. 29, may 2023, p. 9.

⁵⁰ See PELLEGRINI, *Il diritto cybernetico nei riflessi sulla materia bancaria e finanziaria*, in AA.VV. *Liber amicorum Guido Alpa*, Milan, 2019, p. 354

⁵¹ See CAPRIGLIONE, *Regolazione e controllo finanziario nell'era del digitale*, report delivered at the Unitelma Sapienza University on 19 May 2023.

⁵² See MAGGIOLINO, *I big data e il diritto Antitrust*, Milan, 2018, p. 60.

mechanistic manner⁵³.

In the presence of such a reality, one wonders whether such a configuration of the market's structural order - regardless of the beneficial effects on the possibility of interchange emphasised by the doctrine⁵⁴ - does not result, in concrete terms, in a limitation of the freedom of choice of consumers, who for different reasons may encounter difficulties in accessing the platforms.

In the first place, the lack of adequate information to the market is taken into consideration, as is the case in a system characterised by the presence of authorised financial intermediaries, whose performance must be known to savers/investors in order to allow them to make informed transactions. In this regard, it is worth noting that the platform identifies a decentralised manager whose profile is characterised by the neutral proposition of a financial service that is characterised by a significant dimensional amplitude and by the multiplicity and variety of its potential recipients⁵⁵. The consequence of this is that it is necessary to exclude the possibility of the platform intruding on users' portfolios, an interventionist limit that is sometimes exceeded on a technical level, as shown by some specialised studies⁵⁶.

It is no coincidence that in assessing the structural elements of platforms, an authoritative exponent of the Italian central bank, referring to certain indications of the European Commission, has highlighted their characteristics, tracing their essence back to 'a federated and cooperative mechanism', founded on the interaction between finance and technology, which - by allowing forms of

⁵³ See CAPRIGLIONE, *Le crypto attività tra innovazione tecnologico ed esigenze regolamentari*, cit. On the non-attributability to humans of the outcomes of the most advanced artificial intelligence systems, see FILIPPELLI, *La collusione algoritmica*, in *Orizz. dir. comm.* (orizzontideldirittocommerciale.it), 2021, p. 375; MANZINI, *Algoritmi collusivi e diritto antitrust europeo*, in *Mer. Conc. Reg.*, no. 1, 2019, pp. 163 ff; COLANGELO, *Artificial Intelligence and Anticompetitive Collusion: From the 'Meeting of Minds' towards the 'Meeting of ALgorithms'*, in *Stanford-Vienna TTLF Working Paper*, in *Stanford-Vienna*, n. 74, viewable at <http://tlf.stanford.edu>.

⁵⁴ See AA.VV., *Diritti e mercati nella transizione ecologica*, edited by Passalacqua, Milan, 2021.

⁵⁵ On the variety of existing platforms see BUSCH – SCHULTENOLKE - WIEWIÓROWSKA-DOMAGALSKA - ZOLL, *The rise of the platform economy: a new challenge for Eu consumer law?*, in *Eu CML*, n. 1, 2016, p. 3 ss.

⁵⁶ See CHIAP - RANALLI - BIANCHI, *Blockchain Tecnologia ed Applicazioni per il business*, Milan, 2019, p. 171.

operational connection between those who participate in it - creates and exchanges value⁵⁷. On closer inspection, the function of platforms, however similar it may be to the intermediary one, cannot be identified with the latter. Indeed, the automatism that characterises the operational mechanics of these technological structure (which does not require an express authorisation in order to allow access to the recorded data) is centred on the use of the information apparatus at their disposal; hence the conclusion that the possibility of recognising, in the present case, the elements of an intermediary action carried out in a special manner must be excluded. It is worth noting, in this regard, the lack of a personalised contribution by the intermediary subject that confers that *quid pluris* to the negotiation case that the machine - to date - is not yet able to provide.

It follows that the algorithmic capacity of the platforms has a value that, on the one hand, does not extend to the profiling of the user's risk (in addition to not being able to modify or block the operation once the software programme supporting it has been launched), and on the other hand, does not allow consumers to benefit from information on the functioning and intrinsic capacity of the intermediaries; hence an obvious reduction in the guarantees offered to the former that presumably results in a limitation of access to the digital market.

Add to this, then, the difficulty of assimilating computer language and activating the relationship with the platforms (think, for example, of digital identity authentication aimed at the identification and online verification of the client's personal details, necessary to achieve the initial registration and proceed to the complete management of the contractual relationship); one can understand how the propensity for these operational forms is certainly not appreciated by those who are unfamiliar with technological mechanisms and, therefore, by the majority of those living in the third age.

From another point of view, the substantial homogenisation of the forms of

⁵⁷ See CIPOLLONE, *Conference on Digital Platforms and Global Law*, Rome, Villa Aldobrandini, 29 April 2022.

negotiation found in the digital process, which makes use of a set of data (big data) and technologies that allow for their processing, the results of which, as anticipated, are provided and distributed "with minimal interlocution with the service provider"⁵⁸. This supports a process innovation that feeds what has been defined in doctrine as 'a new category of financial operators represented by the platforms' which, unlike traditional management systems, entrusts the processing of information, rather than to the professional skills of the intermediary, to evaluations achieved through recourse to the algorithmic instrumentation of data processing systems, today increasingly based also on artificial intelligence technologies⁵⁹.

As is unanimously acknowledged, we are in the presence of a substantial subversion of the methodology that for decades characterised the operations of the financial markets⁶⁰; the implications of this event are not yet fully defined, as they can be traced back to the determinations that will be made within the EU for the regulation of Artificial Intelligence. The fact remains that, in the face of a progressive disintermediation of credit, there are "risks of opacity of decisions" and, at present, also a lack of regulation of "subjects ... who carry out activities to assess creditworthiness ... in outsourcing on behalf of those who offer credit to consumers"⁶¹.

That being said, one can understand the reason why, in evaluating such a reality, a few years ago an acute scholar, recognised the specific importance of the modularity of information technology, noting the tendency of digital platforms to enter ever new markets, availing themselves of data from different sources with the intention of enriching the experience of their users⁶². Hence the configurability

⁵⁸ ⁵⁸ See BANK of ITALY, *Indagine fintech nel sistema finanziario italiano*, november 2021, p. 38.

⁵⁹ See CANEPA - AMMANNATI, *Introduction to AA.VV., La finanza nell'età degli algoritmi*, Turin, 2023, p. IX.

⁶⁰ See *ex multis* SCIARRONE ALIBRANDI, *Innovazione tecnologica e regolazione dei mercati*, in AA.VV., *Mercati regolati e nuove filiere del valore*, Turin, 2020, p. 5 ss

⁶¹ See AMMANNATI – GRECO, *Piattaforme digitali, algoritmi e big data: il caso del credit scoring*, in *Riv. trim. dir. econ.*, 2021, p. 296.

⁶² See MAGGIOLINO, *op. cit.*, p. 174 ss.

of a competitive relationship between rival platforms that underlies a particularly fluid market characterised by a high rate of change (due to the circumstance that technologies are exposed to a process of rapid obsolescence)⁶³. Hence the configurability of a competitive relationship between rival platforms that underlies a particularly fluid market characterised by a high rate of change (due to the circumstance that technologies are exposed to a process of rapid obsolescence) . Hence the configurability of a competition essentially oriented towards limiting the risk of losing part of the operation, whereby platforms are induced to keep prices as low as possible, even going so far as to admit free participation.

It is evident how we are experiencing a change of the traditional principles of competition, so that it is perplexing to recognise the characterising features of a competitive process similar to that found in an institutionalised market. Indeed, while it is evident that a competitive regime remains in this case, there is no doubt that the activation of an operational criterion based not on price contestability but on the business model gives rise to an innovation that postulates a new regulatory model.

In conclusion, it can be said that a new equilibrium is emerging in the financial sector related to a different vis-à-vis the expansion of the principle of competition; in fact, the activity of platforms limits 'market power' due to the presence of new risks. Further, new forms of conditioning are identified that circumscribe the interdependence of the operators; more generally, there is the possibility that the criterion of technological neutrality in the regulation of the financial sector may be disappplied. Hence doubts and questions as to the resilience of the current regulatory framework and, therefore, the need for clarification, which will come soon given the timely action by the financial institutions and the academic contribution.

⁶³ See EVANS, *Multisided Platforms, Dynamic Competition, and the Assessment of Market Power for Internet-Based Firms*, viewable at https://papers.ssrn.com/sol3/papers.cfm?Abstract_id=2746095

6. The changes in competition, mentioned above, affect the balance of the “principles-institutions-regulations” criteria; this in view of the implications they have on the role traditionally played by banking intermediaries in supporting entrepreneurial activity. Basically, there is a growing interest in the presence of a set of rules capable of ensuring stability, efficiency and competitiveness to the financial sector in view of an action aimed at achieving development objectives that allow for a continuous socio-economic renewal of the country. Indeed, a flattening of the competitive system within the financial system interacts negatively with the control mechanisms that are responsible for assessing the potential risks to financial stability arising either from macroeconomic processes or from the assumption of inappropriate behavioural lines in market operations. In other words, the use of automated mechanisms - and, therefore, the substantial downsizing of the level of competitiveness - seems resulted in a situation that the function of the public interventions is reduced to the organisation of those belonging to the sector. Hence the determination of ratios and technical rules to raise the levels of efficiency and profitability of intermediaries while ensuring stability in a competitive environment.⁶⁴

It can be said, therefore, that the ways in which the supervisory authorities - after having experimented for a long time with a different operating system - carry out their action seem destined to change. We refer, in particular, to the prevention of regulatory arbitrage (pursued by reinforcing the soundness, effectiveness and consistency of regulation, as well as through careful and rigorous supervision), to risk control (implemented by activating constant monitoring of markets and financial activities) and to the protection of service users (to which is linked a substantial obligation of crisis management and analysis of systemic stability).

From another point of view, it is worth noting that the Consolidated

⁶⁴See KAI JIA - SHAOWEI CHEN, *Global digital governance: paradigm shift and an analytical framework*, in *Global Public Policy and Governance*, 2022, n. 2, p. 283.

Banking Law marks the culmination of more than ten years of pursuit of stability in the sector, sometimes even at the expense of a proper logic of competition. The long period of time characterised by the application of the so-called structural supervision has, in fact, seen the affirmation of a free market, any decision as to entry into the latter being referred to the exclusive and discretionary will of the financial authorities.⁶⁵ In this respect, it should be recalled that the T.U.B, on the one hand, liberalised access to the credit system by making it subject to the fulfilment of a series of parameters (assets, the integrity of the members of the corporate structure, the professionalism of the representatives and, finally, the business plan);⁶⁶ and on the other hand, it has made the conduct of credit activities subject to compliance with prudential criteria providing for the maintenance of adequate capital ratios necessary to ensure the “sound and prudent management” (also in terms of the assumption and “production” of risks) of the credit institution and thus to safeguard the intermediary and the system as a whole.⁶⁷

In other words, the legislative innovation of the early 1990s overturned the logic that had in the past led the supervisory authorities to favour stability (in order to avoid systemic crises), with the following restriction of competition and a significant ‘stifling’ of the activities of intermediaries (limited in the search for

⁶⁵ See ONADO, *Evoluzione dei criteri di vigilanza nel sistema bancario italiano*, in *Banca impresa società*, 1983, p.141 ss; see also BRESCIA MORRA, *Le forme della vigilanza*, in AA.VV., *Manuale di diritto bancario e finanziario*, p. 131.

⁶⁶ See *ex multis* DESIDERIO, *Le norme di recepimento della direttiva comunitaria n. 780/77 in materia creditizia*, in *Quaderni di ricerca giuridica della Consulenza Legale della Banca d'Italia*, n. 6, Roma, 1986; PATRONI GRIFFI, *Accesso all'attività bancaria*, in *Banca e borsa*, 1990, I, p. 457 ss.; MEZZACAPO V., *Commento sub art. 1 del d.p.r. n. 350 del 1985*, in AA.VV., *Codice commentato della banca*, Milano, 1990, II, p. 1402 ss; TIZZANO, *La «seconda direttiva banche» ed il mercato unico dei servizi finanziari*, in *Foro it.*, 1990, c. 430 ss; PADOA-SCHIOPPA T., *La trasformazione dell'ordinamento bancario in Italia e in Europa: reciproche influenze*, introduction to GODANO, *La legislazione comunitaria in materia bancaria*, Bologna, 1996.

⁶⁷ See CAPRIGLIONE, *Commento sub art. 5 tub*, in AA.VV., *Commentario al Testo Unico delle leggi in materia bancaria e creditizia*, Tomo I, Milano, 2018, p. 52. See also SEPE, *La sana e prudente gestione dei soggetti regolati*, paper presented at the conference «Nuove frontiere della finanza: operatività, supervisione, tutela giurisdizionali», University of Sassari, June 2016; SARTORI, *Sana e prudente gestione dei soggetti vigilati e protezione della clientela*, paper presented at the conference «Il mercato assicurativo nell'Unitarietà dell'ordinamento giuridico», University of Camerino, September 2016.

innovations capable of promoting development and sometimes oriented towards forms of oligopoly). In fact, an excessively restrictive view of the special regulations has been overcome, which in practice had prevented the establishment of an adequate competitive system in our financial system, as has been pointed out in the economic literature.⁶⁸

Therefore, a balanced relationship between competition and stability, long sacrificed in the last century, has found a fair balance with the T.U.B., the first paragraph of Article 5 of which states that ‘the credit authorities shall exercise the supervisory powers attributed to them ... having regard to the sound and prudent management of the supervised entities, the overall stability, efficiency and competitiveness of the financial system’. This is the clear *modus operandi* to which the appointed authorities must adhere even in the presence of a reality that profoundly changed with respect to the past, which through updates and amendments, have been overseeing the performance of banking activities for thirty years.

Turning to the consideration formulated above, it should be considered risky, if not downright reckless, to predict what the effects will be, at the disciplinary level, of the changed relationship between competition and stability. The specific attention that the authorities devote to the issues connected to the affirmation of the digital paradigm is certainly indicative of the need to proceed in the light of appropriate evaluations and only after having acquired full knowledge of the phenomenology that concerns us.⁶⁹

This does not exempt us, however, from formulating some reconstructive hypotheses to which the analysis should be oriented. They concern both the general context in which the subject matter of the present examination finds its place, and the need to preserve an adequate balance in the relationship between competition and stability, avoiding a hybrid form of market, characterised by a

⁶⁸ CIOCCA, *La nuova finanza*, Torino, 2000, ch.6.

⁶⁹ See BANK OF ITALY, *The role of banks' technology adoption in credit markets during the pandemic*, Branzoli, Rainone and Supino (eds) *Temi di discussione (Working Papers)*, n. 1406, March 2023.

relationship that leads to the increase in the stability of the system to that of the level of competition.

From the first point of view, the research being proposed here considers the 'governance of complexity', a terminology by which - as I have pointed out - is usually used to describe actions taken in a context characterised by the proliferation of problems due to the substantial inadequacy of the guiding criteria;⁷⁰ hence the peculiarity of the research as possible solutions capable of counteracting and reducing the occurrence of complex phenomena.

It is necessary, in fact, first of all to clarify the sphere in which the impact of complexity on behaviours and, therefore, its inevitable repercussions in the financial field. In this premise, in an attempt to define the dimension and attributes of the subject in question, it must be said that, as a rule, this term refers to a plurality of socio-economic figures which are different from each other, but which interact and - in particular relational situations - overlap. Reference is also made to aggregate forms concerning the individual-person, society and the multiple 'organisation-system' models in which the latter is articulated (here including, obviously, the representative schemes of the digital reality).

Hence the hazards arising from a hypothetical drift of operational processes characterised in the aforementioned ways, dangers occur in the digital paradigm. Such scenario is linked to the possibility of automated mechanisms related to utilitarian interpretations, so that the lack of space for adequate forms of protection of operators becomes probable, as well as the realisation of techniques aimed at realising profits, sometimes after resorting to instruments characterised by opacity and lack of transparency.

Further, the configuration of a complex reality emphasises the interaction existing between the various elements present in the aforementioned aggregates, hence the peculiar structural value of the same that is expressed in properties that cannot be otherwise assumed. Therefore, the need to find new methods of

⁷⁰ See CAPRIGLIONE, *Clima energia finanza. Un difficile incontro*, Milano, 2023, ch.5.

investigation that allow - through the simplification of what constitutes the object of analysis - to overcome the interpretative obstacles found in the various cases under observation; so as to achieve positive results that make use of the possibility of implementing the programmatic development of complexity.

Moving on to the attempt to identify an adequate reconciliation in the relationship between competition and stability, it is believed that a significant contribution could be offered in this regard by appropriate regulatory initiatives of a structural nature aimed at reducing the disintermediation process found in the transition from analogue to digital. In other words, it will be necessary to prevent the application of technological mechanisms from changing the relationships between intermediaries, debtors and creditors. As appropriately highlighted in an analysis promoted by the supervisory authority “the existing regulatory perimeters could be usefully expanded to monitor the risks associated with the activity of new financial service providers”. This should lead, on the one hand, to a greater availability of monitoring tools, on the other the introduction of operational criteria aimed at “promoting the correct functioning, competition and efficiency of the overall financial system”.⁷¹

Furthermore, it is our belief that the achievement of an adequate level of competition, functionalized to the connection with stability, is not favored by a credit policy aimed at achieving an increase in concentrations in relation to the well-known ‘too big to fail’ principle. The planning of consolidations - or even their imposition - does not help to improve the efficiency of the market in terms of competition; and this, regardless of the fears related to the affirmation of oligopolistic tendencies, due to the fact that “the benefits of mergers can be substantial, but they are not taken for granted” as was reiterated in the past by a member of the Bank of Italy.⁷²

It should be added that such an approach to market restructuring - based

⁷¹ See BANK of ITALY, *Financial intermediation and new technology: theoretical and regulatory implications of digital financial markets*, edited by Lanotte and Trapanese, in *Questioni di Economia e Finanza*, April 2023, n. 758, *Introduzione*, p. 5.

⁷² See BARBAGALLO, *op. cit.*, p. 7.

on a change in the ownership structure and banking governance achieved through aggregation - refuses to observe the criterion of subjective banking pluralism mentioned above and, with it, the principle of proportionality of European origin, notoriously connected to the protection of competition. And indeed, while the former makes it possible to adapt the subjective banking typology to the varied size of the clientele, the latter postulates, according to the jurisprudence, not only the suitability of the measure of the credit institution to achieve the aim pursued, but also the correspondence of this last to the situation under consideration.⁷³

Lastly, it should be noted that inappropriate forms of aggregation end up, in concrete terms, with a negative impact on the managerial autonomy of those belonging to the sector, as can be seen with regard to the establishment of the cooperative banking group, implemented by law no. 49 of 2016. This unequivocally subordinated the activity of the participating mutual banks to the parent company, whose centralized management does not find an adequate balance with the provisions of the membership agreement.⁷⁴

7. In recent decades, economic law has advanced interesting views on the interaction between the normative reality and the factual along with the relationship between events of crisis and innovation of processes.

In this context, the relationship between 'law and history' has experienced rapid increase and the 'transition phases' in their various types: environmental, energy and, more generally, socio-political which have followed one another with intensity that makes difficult to clarify the "complexity" of current phenomena.⁷⁵ The analysis addressed in this article fits into this logical context. Specifically, the impact of digitalisation in the traditional trade-off existing between competition and stability remains a challenge for the supervisory authorities and policymakers.

Therefore, this contribution examined the 'market power' by highlighting

⁷³ See TAR Lazio, Sez. II-*Quater*, 19 february 2013, no. 1828.

⁷⁴ See CAPRIGLIONE, *Profili di attenzione per un intervento normativo volto a migliorare l'attuale assetto disciplinare delle BCC*, in *Riv. trim. dir. econ.*, 2021, I, p. 496.

⁷⁵ See CAPRIGLIONE, *Clima energia finanza. Un difficile incontro*, ch.5, cit.

the relationship reached by the Italian regulation through a tiring process which, over time, has seen the transition from a financial reality characterised by the presence of structural and operational constraints (imposed on members of the financial sector) to another in which levels growth are ensured by the application of prudential criteria.

Problems that currently affect the balance ratio, today subjected to varied stresses from the operating methods of automated mechanisms based on mathematical calculation (hence the ability of ‘decision-making algorithms’ to undertake human tasks). On the other hand, the inadequacy and opacity that currently characterise certain operational schemes emerged from the analysis, on the other hand the need to find disciplinary remedies aimed at preventing digital from being the cause of management imbalances or alterations among market players. This raises new challenges for the Italian and European legislator related to the proliferation of digital technology. Hence the perspective of regulatory interventions which aims at promoting technological innovation in the financial sector, removing the obstacles that impede its development. It also identifies the frontier to “new business models ... to new approaches, alternative to traditional regulation, such as, by way of example, ... the EU laboratory for financial technologies (FinTech Lab 7) and, at national level, the so-called regulatory sandbox”, as it is underlined in the literature.⁷⁶

The digital market is facing a difficult task since the growing of information technologies, connected to new operational opportunities, which cannot result into an imbalance of the market actors and distortion of the principle of investor protection.

⁷⁶ NOGAROTTO, *Social lending: un trade-off tra digitalizzazione e riserva di attività*, in *Riv. trim. dir. econ.*, suppl. n. 2 no, 1, 2022, p. 164.

BANKS AND SHADOW BANKS, REFORM OF THE EU CRISIS MANAGEMENT FRAMEWORK, MONEY AND THE DIGITAL EURO: AN OVERVIEW OF PERSPECTIVES AND CHALLENGES

Rainer Masera *

ABSTRACT: This paper deals with the issues of financial stability and the complex institutional/operational design to manage banking crises. Specific reference is made to the EU proposed reform of the CMDI. Suggestions are offered to overhaul the framework, also with a view to preserving the viability of small and medium-sized banks, whose demise characterized the Euro area in the past ten years. Attention is focused on the IPS, currently under threat. More generally, attention is drawn to the vulnerabilities and risks of the rapid growth of the shadow banking system, which accounts now for 50 per cent of global financial assets, as against 25 per cent ten years ago. The potential for peril arises from many concurrent factors, notably contagion risks. The intertwining and amplification of economic and financial stress are also the reflection of the rapid pace of technological and digital innovation. The new system will be characterized by the presence of CBDCs, in particular the digital Euro. The perspective changes in the institutional architecture represent a crucial facet of the complex transfer process under way of real, monetary, and financial activities to the Infosphere.

SUMMARY: 1 Introduction. – 2. The EU proposed reform of the Bank Crisis Management framework: too late or too early? – 3. Importance, challenges and perspectives of the Institutional Protection

*Dean Business School, Guglielmo Marconi University Rome.

Revised text of a paper presented at the summer school “Risks, regulation and financial stability”, Cagliari University, June 2023. The author is especially grateful to the organizers of the school, Riccardo De Lisa and Giuseppe Boccuzzi, to Paolo Savona and Mario Stella Richter for important indications, and to other participants for significant suggestions. The paper also benefits from the comments received by Francesco Capriglione, Francesco Gaspari, Sergio Gatti, Franco Masera, Giancarlo Mazzoni, Massimiliano Rimarchi, Diego Rossano, Marco Rossi and two anonymous referees: their recommendations are gratefully acknowledged. Responsibility for the views expressed and any remaining errors is exclusively of the author.

Scheme for “Less Significant” banks. – 4. Bailouts, Bail-ins, and Living Wills: a critical review. – 5. Financial Technology and Intermediation, Cryptoassets, CBDCs and the Institutional Architecture of Money. – 6. Concluding remarks: looking backwards and forwards.

1. Tsunamis are hardly visible in the open seas: the waves displace huge amounts of water and reach very high speeds. They become devastating when the water shallows near the coast.

Something similar has happened in financial regulation and supervision. The tsunami is centered on recent events of bank failures, contagions and runs on deposits. Contagions brought to the fore the strong links between technological changes in financial intermediation, the crypto system and the banking industry. The turmoil was centered, in May 2023, on Credit Suisse in Europe and on some key mid-size banks in the US (Spring 2023 Bank Events, in brief hereinafter Spring Events). The demise of these institutions has wide ranging implications, which must be fully assessed to work out the implications of morphing financial risk.

Many alternative and partially overlapping definitions can be used to refer to credit/deposit intermediation outside the regular and regulated banking system. The Spring crises were linked to/triggered by the monetary and/or quasi-monetary liabilities of the banking and the shadow banking systems.

A decade ago the Financial Stability Board¹ adopted the reference to the “shadow banking system (SBS) as credit intermediation involving entities and activities outside the regular banking system”². The breadth and width of the approach led many authors/institutions to suggest more precise definitions, by making reference to funding techniques (secured funding, securitization) and/or to lack of access to public forms of insurance and of liquidity.

It soon became evident that these more focused approaches came at the cost of concealing sources and drivers of growth and risk of “non-bank financial

¹ See FSB, *Global Shadow Banking Monitoring Report*, Basle, 2012.

² See also ADRIAN and ASHCRAFT, *Shadow Banking: A Review of the Literature*, Federal Reserve Bank, New York, 2012.

intermediaries” – an even broader definition. Upon reflection, it appears therefore preferable to revert to shadow banking. It is however necessary to emphasize the differences and the new aspects which must be explored.

To start with, there is a two-way causal relationship between banks and non-banks in idiosyncratic and systemic risk creation. The Chair of the Supervisory Board of the ECB Enria³ has overthrown the key causal link, by stressing the role of banks (and bank regulators) in mitigating risk arising in the less stringently regulated non-bank financial sector.

The FSB⁴ had estimated that globally the SBS represented on average 25% of total financial assets; ten years later the percentage has doubled. The growth accelerated after the Great Financial Crisis and over the years of low/negative interest rates, compressed volatility and very large liquidity: the period of monetary ease. Also the IMF⁵ warns about the vulnerabilities and risks of the rapid growth of non-bank financial intermediaries (NBFIs). Stress and vulnerabilities are signaled by high leverage – directly and using derivatives -, liquidity shortcomings and mismatches.

The potential for peril arises from many concurrent factors. The timeline and operational profile of “monetary normalization” are the source of inevitable uncertainties and risks⁶. In particular, the second theorem of Minsky’s financial instability hypothesis⁷ shows the potentially systemic adverse consequences of abrupt monetary tightening, account being taken of the long and variable lags of monetary policy. It is also a reminder of the perils of maintaining policy rates below “neutral” for very long periods.

³ See ENRIA, *The role of banks in mitigating systemic risks arising in the non-bank financial sector*, ECB, Frankfurt, 2023.

⁴ See FSB, 2012, op. cit.

⁵ See PASCUAL et. al., *Nonbank Financial Sector Vulnerabilities Surface as Financial Conditions Tighten*, IMF, Washington D.C., 2023.

⁶ These points are examined in SAVONA and MASERA, Eds., *Monetary Policy Normalization*, Springer Nature, 2023.

⁷ See MINSKY, *The Financial Instability Hypothesis*, Levy Economics Institute, 1992, Retrieved June 13 2023.

The intertwining and amplification of economic and financial stress are also the reflection of the rapid pace of technological and digital innovation in financial intermediation. The digitization of the economy and of finance presents opportunities and risks for policymakers. The explosion of data requires supervisory technology to avail itself of artificial intelligence (AI) and Machine Learning (ML), which are at the same time the object of regulation ⁸.

In sum, attention must be drawn to the dangers of the Spring Events and to the vulnerabilities of the SBS spilling over to banks. Hence the need for regulators to closely monitor developments in a global perspective.

As will be shown, the complexity of the scenario is enhanced, on the one hand, by the effects of technological changes on banks and shadow banks, and, on the other, by the prospect of the birthday of CBDCs (Central Bank Digital Currencies) as operational moneys.

2. In the EU, largely thanks to the prudent and realistic behavior of the ECB banking supervision in the past few years, banks are remote from collapse and resolution. Paradoxically, the very recent EC proposal⁹ to amend and strengthen the existing EU framework for bank Crisis Management and Deposit Insurance (CMDI) came at the right time but appears now dated and hardly relevant to meet today's challenges in some key aspects. This is a tenet of this note, with suggestions for update, revision, and correction.

To recall, the proposed EC package contains amendments to the:

1. Bank Recovery and Resolution Directive 2014/59/EU (BRRD)
2. SRM Regulation EU No 806/2014 (SRMR)

⁸ See BOOT et al., *Financial Intermediation and Technology: What's Old, What's New?*, IMF Working Paper, 2020; BAREFOOT, *The case for placing AI at the heart of digitally robust financial regulation*, Brookings, 2022, Retrieved June 13 2023; MASERA, *The challenges eurozone stagflation poses for households, businesses and high debt countries: some possible solutions*, International Economics, Genova, 2023.

⁹ See EC, *Reform of Bank Crisis Management and Deposit Insurance Framework*, Finance, Bruxelles, April 18 2023.

3. Deposit Guarantee Schemes Directive 2014/49/EU (DGSD)
4. Regulation EU 2022/2036, which came into force on 14 November 2022 and partially amended the Capital Requirement Regulation EU 575/2013 (CRR) and the BRRD itself.

After the Great Financial Crisis of 2007-2008 and the subsequent large bailouts, banking regulation was based fundamentally on the assumption that the best course of action would be the combination of zero bailouts and various bail-in options¹⁰.

Distressed banks would restructure by imposing losses upon the managers, shareholders, and creditors, including, to some extent, depositors, according to predetermined schemes (the living wills approach). A failing bank with prospects for survival would have to be restored to financial viability through the BRRD instruments and schemes.

In practice, both options proved unworkable, as many had anticipated¹¹.

The zero-bailout creed met with unsurmountable difficulties mainly because of the systemic risks of bank runs and contagions, and of the strong political pressure to avoid failures and economic/social distress. The May 2023 experience is a clear reminder of these facts, but a key reference goes back to the demise of Northern Rock in the UK in February 2008, when a major crisis could be avoided only with the nationalization of the bank, also because of the fundamental shortcomings of the Basel II standard¹².

The bail-in process, partly intertwined with the zero-bailout scheme, ran and runs against many difficulties. To start with, the very concept of imposing upon a failing bank the restructuring of liabilities, while continuing operations, is paradoxical.

¹⁰ See MASERA, Ed., *The Great Financial Crisis*, Bancaria Editrice, ABI, Rome, 2009.

¹¹ See, for instance, CAPRIGLIONE, MASERA e ROSSANO, *Interventi*, in ROSSANO, a cura di, *La supervisione finanziaria dopo due crisi: quali prospettive*, CEDAM, Milano, 2022.

¹² See KAY and KING, *Radical Uncertainty: Decision-making for an Unknowable Future*, Bridge Street Press, London, 2020. The weaknesses of Basel II are explored also by GOODHART, *Monetary regimes: then and now*, in DOW et al., Eds., *Money, Methods and Contemporary Post-Keynesian Economics*, LSE Research Online, London, 2018, and by MASERA, *Leverage and Risk-Weighted Capital in Banking Regulation*, The IUP Journal of Bank Management, 2020.

Whatever the capital structure of the bank, liquidity fears become rapidly overwhelming and doom the recovery process¹³.

A constant lesson – confirmed and reinforced by the Spring Events – is that ample and immediate liquidity support is necessary both to effectively enact a resolution and to cope with recovery and return to viability for going concern banks in difficulty. These points have been underlined by the Chair of the Single Resolution Board Laboureix¹⁴; but the interpretation offered here suggests that the SRB – which is mainly competent for significant and cross-border banks – may represent a time-absorbing mechanism, compared to swift, large and direct (monetary base) central bank action.

The overhaul of the CMDI framework should also comprise a fully integrated analysis of the proposed payments regulations (PSD3/PSR), of the Financial Data Access (FIDA) scheme¹⁵, and of their joint impact and challenges for EU banks.

The digital transformation of the European banking system is based on two ongoing processes: (i) the importance of electronic payments which are approaching € 250 trillion and (ii) the strong growth of “open banking” services, with the sharing of financial data between banks and financial technology firms (fintechs). The EC legislative proposal is very timely, it should better focus not only the opportunities, but also the risks of the asserted need to boost “open finance”.

The interaction of payments changes, open banking and financial data access will profoundly affect the activities and prospects of incumbent banking firms. All payments institutions (PIs) will be granted direct access to the EU system. The independence of non-bank PIs will be enhanced. This is likely to lead to a structurally different financial framework, with likely disruptive repercussions for many

¹³ See MASERA, *Political economy of liquidity: The European Economic and Monetary Union*, in *The Palgrave Handbook of Political Economy*, London, 2018.

¹⁴ See LABOUREIX, *Speech at ECON Hearing*, European Parliament, Bruxelles, 2023.

¹⁵ See EC, *Financial data access and payments package*, Bruxelles, 2023.

traditional banking firms¹⁶.

Finally and more analytically, the proposed revision of the CMDI cannot avoid the declination according to the “moneyness” of securities in a world of financial innovation, as had been originally indicated by Hicks. The relevance of these issues for banks’ crisis management is underlined by Masera (2018, op. cit.) and Ingraio et al.¹⁷.

The CMDI framework has considerable implications for small and medium-sized banks. The Commission proposals do not clarify the boundaries of SRB operations for smaller banks. A clear divide has opened up. The German banking industry has indicated that, in their view, the proposals would undermine the functioning and effectiveness of the Institutional Protection Scheme (IPS) regime, highly relevant in Germany (and in Austria), where “traditional” small banks continue to represent an important share of total banking assets, in contrast with the rest of the Eurozone.

According to an IMF Financial Assessment Program¹⁸, Germany accounts for 1,324 of about 2,400 total Less Significant Institutions (LSIs) in the Euro area. They represent 40 per cent of Germany’s banking sector assets and some 55 per cent of total Euro area LSI assets.

The demise of smaller banks with a “traditional” business model in the Euro area constitutes a critical feature of the CMDI, which started operation in 2014. The combined EU interpretation of the principles of subsidiarity and proportionality and the EC transposition of Basel III standards played a major role in the sharp contraction of total banking firms in the EU, which fell from around 8,300 in 2013 to

¹⁶This scenario is outlined and cogently explored by THEODORE, *PSD3/PSR: proposed regulations will challenge EU banks*, Scope, 2023.

¹⁷ INGRAIO et al., *The search for moneyness in an era of financial innovation*, Università Sapienza, Rome, WP, 2021.

¹⁸ IMF, *Germany: Financial Sector Assessment Program Technical Note-Regulation and Supervision of Less Significant Institutions*, Washington D.C., 2022.

some 2,100 as of Q4 2022¹⁹.

3. IPS schemes are a contractual or statutory liability arrangement which protects institutions, in particular in respect of liquidity or solvency risks²⁰. They represent a key framework in the EU to help preserve the operation, the viability, and the efficiency of small and medium-sized banks. At the end of 2022, IPSs had a total of 2234 affiliated banks in the EU, with a heavy concentration in Germany, Austria and Poland. The IPS Europe Association recently expressed preoccupation concerning the EC review of the CMDI Framework²¹. To start with, it is contended that the proposal represents a shift towards resolution for smaller banks and expansion of the “public interest”. Criticism is also expressed on the earlier begin envisaged for resolution activities, together with the exclusive competence of resolution authorities. This would reduce the capacity of IPSs to act, thereby impairing their functioning and effectiveness.

The exclusive competence of the SRB would thwart the ability of the IPS to act timely, and to use its financial resources already before a failure becomes even probable. The forward displacement in the time horizon for IPS interventions would undermine their effectiveness.

This would run counter to the utilization of the full toolbox of an IPS, including the drawing of recovery plans for its members, which is based on the audit system in place that allows in depth examination of the economic situation and resources of

¹⁹ Comparisons over time are made difficult by many factors. To start with, the reference aggregates showed changes during the sample period, as well as the accounting/statistical treatment of the banks. An important source of difference is due to the fact that supervisory banking statistics are consolidated at the highest level in the SSM (which started operation in November 2014), while monetary statistics are calculated on “non consolidated host-country data” (see ECB BANKING SUPERVISION, *Euroarea Monetary Statistics, LSI Supervision Report*, ECB Website, 2023).

An analysis of small banks in the Euro area and of the EU regulatory approach is offered by MASERA, *Per una vera proporzionalità nella regolazione bancaria dell’Unione Europea*, ECRA, Roma, 2021. The implications of technological advances and of CBDCs for the consolidation of the banking industry are explored in Par. V.

²⁰ See ECB BANKING SUPERVISION, *Guide to institutional protection schemes (IPS) for prudential purposes*, Frankfurt 2016.

²¹ IPS EUROPE ASSOCIATION, *Declaration and Call for Action*, Frankfurt, 2023.

affiliated institutions. It is also contended that, contrary to EC recommendations, applying MREL (Minimum Requirement for own funds and Eligible Liabilities) to small banks is neither desirable nor feasible. It is finally argued that, by basing its mission and operation on private funds provided by members, the history of IPSs with failing banks is also an example of protecting taxpayers.

The IPS declaration ends with two calls for action in the forthcoming legislative negotiation. The cogency of the arguments presented is enhanced when account is taken of the need to update and revise the entire EC approach in the light of the “tsunami” considerations developed here.

The two calls are as follows: (i) the current prerogative of IPS measures having priority over actions of a resolution authority should be maintained; (ii) as to preventive measures, the DGSD should distinguish between mere DGSs and DGSs that are also recognized as IPS, pursuant to Art 113(7) CRR. In any event, the current formulation of the EC proposal would violate the statement of the Eurogroup of June 2022²² that the CMDI framework should preserve the ability for IPS to enact preventive actions.

IPS frameworks create links between affiliated banks of different size and significance. This has important implications for the efficient financing of IPSs, also in the perspective of pan European schemes.

There is a partial overlap of roles between IPS and national DGS²³. More generally, in Germany, Austria and Poland, IPS systems could be regarded as “banking groups” with features of “systemic” importance. This reinforces the direct links (supervision and liquidity) with the central banks and weakens the case for an independent primary role of a single resolution board. This crucial point warrants further elaboration. If an IPS - recognized as DIS – was equivalent to a conventional banking aggregation of systemic importance, the boundaries of Reg EU 2022/2023

²² See EUROGROUP, *Future of the Banking Union*, Consilium.europa.eu, 2022.

²³ See IPPOLITO et al., *Institutional Protection Schemes in the Banking Union*, European Parliament, Bruxelles, 2022.

would be broadened, but partially blurred. Systemic relevance would not be anchored to the participation of single systemic banks. Art CRR 113(7) might become subject to scrutiny, and the field of application of the Eurogroup statement of 22 June 2022 less precisely defined.

4. As already anticipated, the neat zero bailout/bail in distinction, and the clear separation of resolution tools were not a plausible scenario (even less credible after the Spring Events). A more reliable framework is based on the concurrence of two building blocks: the takeover of the failing bank by a healthy peer, indicated and selected by the central bank; ample liquidity support decided over a very short time span.

As aptly summarized by Theodore²⁴, the traditional living wills should be rewritten with a view to facilitating credible and enforceable marriage contracts, as in the case of the takeovers by UBS of Credit Suisse and by JP Morgan of First Citizens. Also the cases of Banco Popular in Spain and of the Veneto Banks in Italy in 2017 suggest that the takeover model is the most realistic.

The main drawback of this approach – which requires careful supervisory probe – is excessive concentration, usually measured and evidenced by the Herfindahl-Hirschman index. The risks of oligopoly in banking are evident, notably in national markets.

The issues considered in this paragraph should be examined also in terms of two broader perspectives.

- The European Deposit Insurance Scheme (EDIS), the Banking and the Capital Markets Unions require forward steps to overcome the inherent fragility of a money without a state²⁵. Institutional changes are

²⁴ See THEODORE, *Bank resolution: living wills should come with marriage contracts*, Scope, 2023.

²⁵ See ISSING, *The Birth of the Euro*, Cambridge University Press, 2008, and DONOHOE PLAN, Agence Europe, Bruxelles, 2022.

necessary²⁶; their need has been forcefully reiterated very recently by Draghi²⁷.

- Proportionality and biodiversity are a clear priority of regulation. For instance, in Italy Less Significant Institutions (LSIs) fell from 530 at the outset of the SSM in 2014 to 80 now (excluding the 39 Raiffeisen banks in South Tyrol, which are linked by an IPS). Often only lip service was paid to the concept of proportionality.

The Italian system of Cooperative Banks - Federcasse - has developed forward looking solutions²⁸, which passed a difficult EU test. In July 2023 the Trilogue approved (with publication expected by year-end) the amendment proposed by Federcasse to Art. 97.4 of the CRD legislative package to correct the legislative treatment of small banks. The revised text should now be fully supported at national political level. Cooperatives can be seen as an exit strategy for economic and social crises²⁹.

5. Digital transformation, technological change and information innovations are opening a new era in terms of sovereign money, geopolitical equilibria, central banking, macroeconomics, finance and commercial banking³⁰.

In the system generally in operation during the past century money is created by the commercial banks when they issue loans and/or purchase securities; conversely it is destroyed when the loans are repaid, and securities are sold in the market. In other words, the existing model of money creation is based on the

²⁶ See MASERA, 2023, op. cit.

²⁷ See DRAGHI, *The next flight of the bumblebee*, NBER, 2023.

²⁸ See GATTI, *Beneduce Lecture: dalla finanza civile alle banche cooperative*, Confindustria, Caserta, 2023.

²⁹ See SCHAFFAUSEN-LINZATTI and BALK, *Are Cooperatives Seen as an Exit Strategy out of Economic Crises?*, University of Vienna, Academia Letters, 2021; see also BECCALLI, *Credito cooperativo. Anche nell'era digitale la prossimità sostiene le Pmi*, Università Cattolica, Milano, 2022, and PACELLI et al., *Too useful to Fail*, ECRA, Roma, 2022.

³⁰ See MASERA, *Economics and Money. Political and Epistemological Perspectives of Connecting and Fault Lines: A Fil Rouge from Keynes to Digitization*, in SAVONA and MASERA Eds., *Monetary Policy Normalization. One Hundred Years After Keynes' Tract on Monetary Reform*, Springer Nature, 2023.

traditional multiplication process of the monetary base (currency in circulation and commercial bank reserves). In the absence of 100 per cent reserves bank credit creates deposits and money. This is generally a powerful model. The Achille's heel represented by the fragility of partial reserve banking under stress has been underlined over time by many economists, notably by Fisher³¹.

Technological and communication changes amplify vulnerabilities, which could lead to vertical and horizontal disintegration of the traditional banking model, as indicated in the cited research paper of the IMF³².

An even more in-depth criticism of the resilience of the existing institutional architecture has been developed by Savona³³: more specifically, the “traditional” markets of money and finance should be integrated with the “virtual” markets of cryptoassets/cryptocurrencies and of tokenized assets, which operate in the Infosphere³⁴. It is only through this integration – which should comprise regulation and supervision – that it would be possible to prevent idiosyncratic/systemic bank and financial crises. The vulnerability is enhanced by: (i) the risks of contagion/contamination between banks and shadow banks, and (ii) the introduction of CBDCs.

A fully convertible safe CBDC would tend to replace cash and bank retail deposits (the analogy with a 100 per cent reserve framework is evident). These effects could be mitigated in various ways, notably by an appropriate design and by introducing limitations to wholesale and retail access to the digital currency³⁵, as suggested (and promised) by many central banks.

Savona's analytical framework suggests that these attempts could be ultimately ineffective and counterproductive, with an inherent risk of digital bank

³¹ FISHER, *The Theory of Interest*, MacMillan, New York, 1930.

³² See BOOT et al., 2020, op. cit.

³³ See SAVONA, *Rischi, regolamentazione e stabilità finanziaria*, Lectio Magistralis, Università di Cagliari, 2023.

³⁴ See FLORIDI, *The Fourth Revolution: How the Infosphere is Reshaping Human Reality*, Oxford University Press, 2014.

³⁵ See PANETTA, *Digital euro: widely available and easy to use*, Committee on Economic and Monetary Affairs of the European Parliament, Bruxelles, 2023.

runs and contagions, of which we had a preview. The effects of technological/digital financial changes and the primary objective of systemic stability would eventually lead to commercial banks exiting the circuit of traditional money creation. In any case the introduction of a digital Euro would have important repercussions on banking activity and on the endogenous creation of money³⁶.

Only three years ago Mersch³⁷, then ViceChair of ECB Banking Supervision, had concluded that the risks of commercial bank disintermediation would be high and, ultimately, also legally untenable in view of the EU Treaty provisions in respect of the principles of proportionality and subsidiarity (Art 5 of the TEU).

The scenario is rapidly changing. Savona's innovative and path-breaking views require close, in depth, study and debate in the academic world and among policy makers.

6. As indicated in this paper, the existing monetary and banking architecture is under profound revision. The most important factor of change – and even of potential fracturing – is represented by digital advances and technologies, notably the crypto system (Boot et al., 2020, op. cit.).

Current and perspective changes should be viewed in a long term, holistic framework. The concept and the measure of money are time and space dependent. The morphing of money presents key common features: the links with banks and with the sovereign/political context, the “legal tender” of sovereign currency, the intertwining with public debt, the international domain of national currencies (e.g. “the exorbitant privilege of the dollar”); the inverse relationship between the price level and the value of money in economic systems.

Looking back for one century and focusing on monetary economics, at the cost of oversimplification, two great economists can be singled out for their analytical and

³⁶ See MASERA, 2023, op. cit.

³⁷ MERSCH, *An ECB digital currency – A flight or fancy*, ECB, Frankfurt, 2020, Retrieved June 13 2023.

policy approaches: J. M. Keynes and I. Fisher.

Their contributions represent a *fil rouge* with the past; they are especially relevant because they can be projected into digital finance and digital central bank operations, which represent the new frontier and challenge for money, banking, and central banks.

The controversy between full-vs.-fractional-reserve banking was centered on the possibility for commercial banks to lend out funds deposited in demand accounts. In this case, commercial banks could separate in time depositary activities from lending and investment.

In other terms, fractional reserves are the mechanism which allows banks to activate the endogenous lending/deposit creation process. Loans can be made with deposits due at some later date. On the contrary, full-reserve banking would prevent bank runs and depositors' attempts to withdraw demand deposits from commercial banks at times of crises.

The 100% reserve requirement against demand deposits has many historic precedents. It was commonly enacted in Italy and in Holland during the 16th and 17th centuries. In Great Britain it became the legal standard under the Bank Charter Act of 1844, known also as the Peel Banking Act, which restricted the powers of private banks and gave exclusive note issuing possibility to the Bank of England³⁸.

The analytical backing of the Act was that the public control of the currency (monetary creation) ought to be separated from banking (the endogenous creation of credit/deposits). The debate was therefore a manifestation of the long-standing controversy between the currency and the banking schools. The Peel Act itself is often regarded as epitomizing the currency school, following the suggestions of Ricardo³⁹.

The full reserve system came again into the forefront of analytical and policy

³⁸ See legislation.gov.uk, *Bank Charter Act 1844, London*, Retrieved July 15 2023.

³⁹ RICARDO, *Plan for the establishment of a National Bank*, London, 1824. For a critical analysis of this complex heritage see MOTYOVSKI, *Banking School vs Currency School Money Creation as State Monopoly?*, History of Economic Theory, EUI, 2016, and GOODHART, 2018, op. cit..

attention at the time of the Wall Street Crash of 1929 and the Great Depression of the 1930s, and later in the aftermath of the Financial Crisis of 2007-2009⁴⁰. Advocates of 100% banking held that the system was safer, because it would prevent bank runs and contain business cycle fluctuations.

The full reserve banking model is easily grafted upon the quantitative money approach, as synthesized by the famous equation of exchange: $MV = PT$, where M-money supply, V-velocity of money, P-average price level, T-volume of transactions in the economy over a given time period. Fisher offered a sophisticated version of the transaction quantity theory of money in path-breaking articles, later partly revised in his *Theory of Interest* (1930, op. cit.).

The intertwining of the quantity framework and the reserve banking regulation was further explored by Frank Knight, who later became the key supporter of the Chicago Plan for full reserve banking after the Financial Crisis of 2007-2009⁴¹.

Along similar conceptual lines important contributions were offered by Friedman⁴², who opened the vistas of his analysis to the interaction with fiscal policy and with the workings of the international monetary system. The Friedman approach became a two-pronged suggestion for economic policy: the stock of money would be automatically linked to government deficits/surpluses, arising from cyclical or special circumstances. In any event the fiscal balance would be maintained under strict limits. Public debt would only be temporary and of limited amount. This built-in stability mechanism would apply to both monetary and fiscal policies.

Keynes initially supported the quantitative theory, but later⁴³ reconsidered his position in light of his guarded acceptance of the banking principle, as against the

⁴⁰ See MASERA ed., 2009, op. cit.

⁴¹ For a comprehensive analysis of these issues and of the relevant references the reader is referred to TAVLAS, *On the controversy over the origins of the Chicago Plan for the 100 per cent reserves*, Bank of Greece, Athens, 2020.

⁴² FRIEDMAN, *The role of monetary policy*, American Economic Review, 1968.

⁴³ KEYNES, *Tract on Monetary Reform*, MacMillan, London, 1924, and *The General Theory*, MacMillan, London, 1936.

100% reserve approach⁴⁴. These issues are intertwined with the debate between risk and uncertainty, where Keynes and Knight had similar views, but took different lines on 100% versus fractional reserve banking.

Unraveling the *fil rouge*, and looking forward, CBDCs, if appropriately designed and regulated, would prevent the use of private CCs as legal tender, thereby avoiding significant systemic risks. Bank deposits would witness a decline of their monetary character, but banks would be freed from the perils of sudden contagious deposit flights and could concentrate skills and resources in the primary task of managing savings: these points are forcefully made by Savona (2023, op. cit.), as indicated in the previous paragraph.

The perspective changes in the institutional architecture represent a crucial facet of the complex transfer process under way of real, monetary and financial activities to the Infosphere (Floridi 2014, op. cit.; Savona and Masera Eds. 2023, op. cit.).

⁴⁴ The interplay in the past century of some of the most brilliant minds on the quantity theory and the banks' reserve framework encompassed the approach to probability theory. The views evolved over time, but some reference points merit clarification. Fisher's approach to risk was based on a Bayesian framework. KEYNES (*A Treatise on Probability*, MacMillan, London, 1921), and KNIGHT (*Risk, Uncertainty and Profit*, Houghton Mifflin Company, Cambridge US, 1921) contributions to probability theory were based on a radical separation of measurable risk and unmeasurable uncertainty. They rejected extensive applications of Bayesian and Frequentistic approaches. Friedman instead gave a broader support to risk measurement. This was put into question by HICKS, *Causality in Economics*, Blackwell, Oxford, 1979. After a century of heated debates "Radical Uncertainty" has (or should have) become the standard of reference (KAY and KING 2020, op. cit.).

GLOBAL THOUGHTS ON A RESILIENT SAFETY-NET: PRELIMINARY LESSONS TO LEARN FROM THE RECENT BANK CRISES IN THE US AND SWITZERLAND

Marco Bodellini * – José Luis Colino **

ABSTRACT: *Over the first months of 2023, three rather large US banks and one Swiss G-SIB collapsed. Interestingly, in each of these cases an attempt was made to deviate (more or less remarkably) from the application of the regime created in response to the global financial crisis of 2007-2008 and based on the assumption that shareholders and creditors should be the ones bearing losses.*

This paper discusses such recent cases, with a view to identifying some key lessons to learn, focusing on the main causes triggering those crises, the unwanted consequences of fighting inflation on the banking system, and the inherent interaction between increasing interest rates for monetary policy purposes and accounting rules applicable to banks.

SUMMARY: 1. Introduction. – 2. The crisis of SVB. – 3. The crisis of Signature Bank. – 4. The crisis of First Republic. – 5. The crisis of Credit Suisse. – 6. The main causes for the recent crises and some preliminary takeaways. – 7. EU-driven considerations. 8 – The unwanted consequences of fighting inflation. 9. – Interest rates and accounting rules: is that a *fictio iuris*? – 10. Concluding remarks.

1. Over the first months of 2023, three rather large US banks and one Swiss G-SIB collapsed. Interestingly, in each of these cases an attempt was made to deviate (more or less remarkably) from the application of the regime created in response to the global financial crisis of 2007-2008 and based on the assumption that shareholders and creditors should be the ones bearing losses.

* Lecturer in Banking and Financial Law at the University of Bergamo.

** Profesor Titular de Derecho Mercantil at the Universidad Complutense de Madrid.

Although jointly elaborated, this article has been drafted as follows: paragraphs 1, 2, 3, 4, 5, 6, 8, 9 and 10 by Marco Bodellini and paragraph 7 by José Luis Colino.

When Silicon Valley Bank (SVB) and Signature Bank (which were not qualified as US SIFIs) failed, full protection of depositors (including uninsured depositors) was provided by the Federal Deposit Insurance Corporation (FDIC) by relying upon the so-called systemic risk exception, which allows the FDIC to reimburse every depositor and then call for extra contributions to the Deposit Insurance Fund (DIF) from the industry.

On the other hand, First Republic was placed into receivership and then all of its deposits and nearly all of its assets were transferred to JP Morgan, with the FDIC entering into a loss-sharing agreement with the latter and the DIF expected to lose nearly 13 billion USD.

In dealing with Credit Suisse, the Swiss Government, on one side, provided guarantees to the benefit of UBS to persuade it to buy the ailing institution for approximately 3 billion Swiss Francs, and, on the other side, through emergency legislation, AT1 instruments, amounting to 17 billion Swiss Francs, were wiped out.

On these grounds, this paper discusses such recent crises, with a view to identifying some key lessons to learn and is divided as follows. After this introduction, paragraphs 2, 3, 4 and 5 analyse the key facts of the crises of SVB, Signature Bank, First Republic and Credit Suisse. Paragraph 6 explores the main causes triggering such recent events and identifies some preliminary takeaways. Paragraph 7 provides some EU-driven considerations. Paragraph 8 looks at the unwanted consequences of fighting inflation on the banking system, while paragraph 9 deals with the interaction between increasing interest rates for monetary policy purposes and accounting rules applicable to banks. Paragraph 10 concludes.

2. On Friday March 10, 2023, SVB was closed by the California Department of Financial Protection and Innovation and the FDIC was named receiver.⁴⁵ To protect

⁴⁵ On the US legal framework on bank crisis management see Avraham – Selvaggi – Veckery, A Structural View of U.S. Bank Holding Companies in FRBNY Economic Policy Review Federal Reserve Bank of New York, July 2012; Gelpert – Véron, An Effective Regime for Non-viable Banks: US Experience and Considerations for EU Reform, Study Requested by the ECON committee of the

depositors, the FDIC transferred all the deposits and substantially all of the assets of SVB to Silicon Valley Bridge Bank, National Association (N.A.), a full-service bank (so-called bridge bank) that was operated by the FDIC.⁴⁶ Through the so-called systemic risk exception, full protection of every depositor (both insured and uninsured) was provided by the FDIC.⁴⁷ On March 26, 2023, the FDIC entered into a purchase and assumption (P&A) agreement for all deposits, excluding Cede & Co. deposits, and loans of Silicon Valley Bridge Bank with First-Citizens Bank & Trust Company, Raleigh, NC.⁴⁸ As part of this transaction Silicon Valley Bridge Bank was placed into receivership.⁴⁹

The failure of SVB was initially regarded as rather surprising since it was considered one of the best regional banks in the US.⁵⁰ In the view of many, SVB failed because of mistakes made by the bank's management, financial authorities, and the bank's clients.⁵¹

SVB had a number of peculiarities which, to a large extent, contributed to its collapse. First, the bank had expanded significantly during the period 2019-2022, with total assets and total deposits tripling and total revenues and net income growing more than two-fold.⁵² Remarkably, assets grew from 116 billion USD at the

European Parliament, Economic Governance Support Unit (EGOV) - Directorate-General for Internal Policies of the Union, July 2019.

⁴⁶ See Federal Deposit Insurance Corporation, FDIC Acts to Protect All Depositors of the former Silicon Valley Bank, Santa Clara, California, Press Release, 13 March 2023; on the conditions to set up a bridge bank to deal with an ailing institution in the US see Bodellini, *Old Ways and New Ways to Handle Failing Banks across the Atlantic*, *Journal of Comparative Law*, 2021, 2.

⁴⁷ See Federal Deposit Insurance Corporation, Joint Statement by the Department of the Treasury, Federal Reserve, and FDIC, Press Release, 12 March 2023.

⁴⁸ See Federal Deposit Insurance Corporation, FDIC Acts to Protect All Depositors of the former Silicon Valley Bank, Santa Clara, California, Press Release 26 March 2023; with regard to purchase and assumption (P&A) transactions in the US legal framework see Bodellini, *International Bank Crisis Management – A Transatlantic Perspective*, Oxford, 2022.

⁴⁹ See Federal Deposit Insurance Corporation, Failed Bank Information for Silicon Valley Bank, Santa Clara, CA, 26 March 2023.

⁵⁰ See Van Vo – Thi Thu Le, *From Hero to Zero – The Case of Silicon Valley Bank*, *The CLS Blue Sky Blog*, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

⁵¹ See Danielsson – Macrae – Tchouparov, *Lessons from the collapse of Silicon Valley Bank*, *Economics and Finance*, London School of Economics Blog, 15 March 2023.

⁵² See Van Vo – Thi Thu Le, *From Hero to Zero – The Case of Silicon Valley Bank*, *The CLS Blue Sky Blog*, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

end of 2021 to 216 billion USD at the end of 2022, making SVB the 16th largest bank in the US.⁵³ Nevertheless, its financial performance declined, while its cost of funding earning assets increased from 0.30% to 0.55%, (which was higher than for its peers). Also, the bank's equity capital ratio was 7.39% in 2022 and therefore was lower than its peers' ratio of 9.34%.⁵⁴ The bank's proportion of loans and leases to total assets dropped from 46.95% in 2019 to 35.22% in 2022; even this figure was significantly lower than the industry average of 50.98%. In contrast, the total debt securities ratio increased from 39.68% to 56.12%.⁵⁵

Importantly, SVB mainly depended on deposits to finance its assets.⁵⁶ Although the deposit-to-total assets ratio decreased from 89.99% to 83.90% over the year before its failure, it was still higher than its peers' ratio of 81.42%. Moreover, crucially more than 94% of its deposits were uninsured.⁵⁷

In 2021, when interest rates were very low, the bank invested extensively in debt securities, which accounted for 60.07% of its total assets. The held-to-maturity (HTM) securities grew six-fold from 2019 to 2021, thereby representing 47.08% of its total assets, while the available-for-sale (AFS) securities doubled during the same period.⁵⁸

In early 2022, interest rates experienced a significant surge.⁵⁹ The yield on the three-year Treasury Notes increased from less than 1% at the end of 2021 to around

⁵³ Accordingly, its failure was the third largest bank failure in US history after Washington Mutual and First Republic.

⁵⁴ See Van Vo – Thi Thu Le, From Hero to Zero – The Case of Silicon Valley Bank, The CLS Blue Sky Blog, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

⁵⁵ Id.

⁵⁶ See Board of Governors of the Federal reserve System, Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank, 28 April 2023.

⁵⁷ See Van Vo – Thi Thu Le, From Hero to Zero – The Case of Silicon Valley Bank, The CLS Blue Sky Blog, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

⁵⁸ Id., also pointing out that at the end of 2021, the weighted average duration of SVB's debt securities was 3.97 years. This figure increased to 5.7 years at the end of 2022, while the weighted average duration of the HTM securities was 6.2 years.

⁵⁹ See Board of Governors of the Federal reserve System, Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank, 28 April 2023.

4.20% at the end of 2022.⁶⁰ As a result of the interest rate increase, SVB was exposed to the risk of unrealized losses of at least 15.76 billion USD (equivalent to 12.61% of its 125 billion USD debt securities). This could have resulted in a negative market value of the bank's equity capital by the end of 2022. However, since the bank did not (plan to) sell its securities, most of these (potential) losses were not realized, as accounting rules do not request banks to mark to market securities that they intend to hold until maturity.⁶¹

Another key weakness of SVB was the lack of diversification in its depositor base, as 89.38% of total deposits came from a small group of depositors primarily operating in the venture capital industry. Given the concentration of depositors, most likely they knew each other. In the event of poor bank performance, there was consequently a considerable possibility that many depositors would withdraw their deposits at the same time because most of those deposits were uninsured, thus increasing the risk of a bank run.⁶²

On these grounds, when deposits started to outflow, possibly due to concerns about losses on its assets, SVB had to sell some of its HTM securities to meet depositors' demand, and the sales forced it to recognize 1.8 billion USD in losses. SVB had a plan to cover the loss through a 2.25 billion USD equity offering. Yet, that offering failed and at that point the venture-capital community and their portfolio companies started massively withdrawing their deposits, which led to a textbook case of run on the bank, that has been gauged as the fastest one in history.⁶³

The collapse of SVB can, therefore, be attributed to several factors. First, SVB invested significantly in debt securities during a low-interest-rate period and did not properly hedge the risks arising from interest rates fluctuation, which led to losses

⁶⁰ See Van Vo – Thi Thu Le, From Hero to Zero – The Case of Silicon Valley Bank, The CLS Blue Sky Blog, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

⁶¹ See Board of Governors of the Federal Reserve System, Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank, 28 April 2023.

⁶² See Van Vo – Thi Thu Le, From Hero to Zero – The Case of Silicon Valley Bank, The CLS Blue Sky Blog, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

⁶³ See Danielsson – Macrae – Tchouparov, Lessons from the collapse of Silicon Valley Bank, Economics and Finance, London School of Economics Blog, 15 March 2023.

after the repeated increases decided by the FED. Second, SVB had a highly concentrated depositor base, with a small group of depositors providing most of the bank's funding, and an extremely high proportion of uninsured deposits, increasing the risk of a bank run. Finally, SVB had less equity capital than its peers, which further exacerbated the bank's risk.⁶⁴

All in all, SVB collapsed because of poor liquidity management which gave rise to maturity mismatch issues that could not be handled. Interestingly, the SVB case showed the most rapid bank run in history prompted by online banking, social media and an excessively concentrated depositor base.

3. On Sunday, March 12, 2023, Signature Bank, New York, NY, was closed by the New York State Department of Financial Services and the FDIC was named receiver.⁶⁵ To protect depositors, the FDIC transferred all the deposits and substantially all of the assets of Signature Bank to Signature Bridge Bank, National Association (N.A.), a full-service bridge bank operated by the FDIC, relying upon the same systemic risk exception applied also to SVB.⁶⁶ On March 20, 2023, the FDIC entered into a purchase and assumption agreement for substantially all deposits and certain loan portfolios of Signature Bridge Bank with Flagstar Bank, National Association (N.A.), Hicksville, NY, which is a wholly owned subsidiary of New York Community Bancorp, Inc., Westbury, NY.⁶⁷ As part of this transaction, Signature Bridge Bank, N.A., was placed into receivership. Depositors of Signature Bridge Bank,

⁶⁴ See Van Vo – Thi Thu Le, From Hero to Zero – The Case of Silicon Valley Bank, The CLS Blue Sky Blog, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

⁶⁵ See Federal Deposit Insurance Corporation, Failed Bank Information for Signature Bank, New York, NY, 20 March 2023; Signature Bank had total assets of 110.4 billion USD and total deposits of 88.6 billion USD as of December 31, 2022.

⁶⁶ See Federal Deposit Insurance Corporation, Joint Statement by the Department of the Treasury, Federal Reserve, and FDIC, Press Release, 12 March 2023; see also Federal Deposit Insurance Corporation, FDIC Establishes Signature Bridge Bank, N.A., as Successor to Signature Bank, New York, NY, Press Release, 12 March 2023. Against this background, the FDIC pointed out that as receiver, they will operate Signature Bridge Bank, N.A. (a bridge bank) to maximize the value of the institution for a future sale and to maintain banking services in the communities formerly served by Signature Bank.

⁶⁷ See Federal Deposit Insurance Corporation, Subsidiary of New York Community Bancorp, Inc., to Assume Deposits of Signature Bridge Bank, N.A., From the FDIC, Press Release, 19 March 2023.

N.A., other than depositors related to the digital banking business, automatically became depositors of the assuming institution. All deposits assumed by Flagstar Bank continued to be insured by the FDIC up to the insurance limit.⁶⁸

As the transfer of all the deposits was completed under the systemic risk exception, all depositors of the institution were made whole, while no losses were borne by taxpayers. By contrast, shareholders and certain unsecured debt holders were not protected, whereas senior management was removed. The FDIC estimated the cost of the failure of Signature Bank to its DIF to be approximately 2.5 billion USD, even though the exact cost will be determined when the FDIC terminates the receivership.⁶⁹

4. On Monday, May 1, 2023, First Republic Bank was closed by the California Department of Financial Protection and Innovation and the FDIC was appointed receiver.⁷⁰

The first signals of the crisis were shown in mid-March, when over a week the shares of First Republic dropped by 62%. The bank's management failed to calm investors about the institution's outlook, and a consortium made up of the 11 largest American banks was formed upon request of the authorities and required to inject 30 billion USD in uninsured deposits.⁷¹

On April 24th, following a relatively quiet month (the share price rose nearly 25%), the bank published an extremely negative earnings report, disclosing that it suffered a 41% outflow in deposits during the first quarter of 2023 (from 170 billion USD to 70 billion USD). The situation quickly deteriorated, thereby prompting the

⁶⁸ See Federal Deposit Insurance Corporation, Failed Bank Information for Signature Bank, New York, NY, 20 March 2023.

⁶⁹ See Federal Deposit Insurance Corporation, FDIC Establishes Signature Bridge Bank, N.A., as Successor to Signature Bank, New York, NY, Press Release, 12 March 2023.

⁷⁰ Federal Deposit Insurance Corporation, Failed Bank Information for First Republic Bank, San Francisco, CA, 1 May 2023; as of April 13, 2023, First Republic Bank had approximately 229.1 billion USD in total assets and 103.9 billion USD in total deposits.

⁷¹ See Humphery-Jenner, What went wrong with First Republic Bank?, UNSW Sydney, Business Think, 2 May 2023.

authorities to intervene by submitting the institution to receivership. In the context of the receivership, JPMorgan Chase Bank, National Association (N.A.), Columbus, Ohio (JP Morgan) acquired all First Republic Bank's deposit accounts and substantially all of its assets. As a result of the transaction, First Republic Bank's 84 offices in eight states reopened on 1 May 2023 as branches of JPMorgan and all depositors of First Republic Bank became depositors of JPMorgan, with full access to all of their deposits.⁷² Significantly, the FDIC and JPMorgan entered into a loss-share transaction on single family, residential and commercial loans that the latter purchased from the receivership. On these grounds, the FDIC, as receiver, and JPMorgan, as acquirer, will share in the losses and potential recoveries on the loans covered by the loss-share agreement. The loss-share transaction is projected to maximize recoveries on the assets by keeping them in the private sector. The transaction is also expected to minimize disruptions for loan customers.⁷³

The FDIC stated that the resolution of First Republic Bank involved a highly competitive bidding process and resulted in a transaction consistent with the least-cost requirements of the Federal Deposit Insurance Act. Yet, the FDIC estimated that the cost to the DIF will be about 13 billion USD.⁷⁴

The commonalities between the crisis of First Republic and the crises of SVB and Signature Bank result from each of them having a business model that did not adapt well to rising interest rates. Yet, while SVB's (and to a certain extent Signature Bank's) main problem was primarily their stock of Treasuries, First Republic's issues were more in its loan portfolio, where its business model of providing cheap financing to wealthy customers led it to large paper losses on its mortgage book when rates rapidly went up. On the funding side, customers also started demanding higher deposit rates to keep their money with the bank. As First Republic was more

⁷² See Federal Deposit Insurance Corporation, JPMorgan Chase Bank, National Association, Columbus, Ohio Assumes All the Deposits of First Republic Bank, San Francisco, California, Press Release, 1 May 2023.

⁷³ *Id.*

⁷⁴ *Id.*

diversified than SVB's heavily tech sector-dominated client base, it faced a couple of years of poor earnings, but could allegedly have survived had it not suffered a run on its deposits.⁷⁵

5. For decades Credit Suisse ranked as one of Europe's 25 largest banks, being also the second Swiss lender, with a balance sheet of 531 billion Swiss francs.⁷⁶ Yet, despite its size, over time the Swiss lender got involved in several scandals as well as in cases of mismanagement forcing it to record substantial losses, while also affecting its reputation. Such issues exacerbated at the beginning of 2023.

A plan to raise equity was not successful⁷⁷ and after an emergency credit line provided by the Swiss National Bank (SNB) on March 15th failed to end Credit Suisse's funding troubles,⁷⁸ on March 19th the SNB refused to provide additional liquidity and UBS was asked to step in to buy its former rival for 3.25 billion USD.⁷⁹ While financial regulators claim that this was a market solution, UBS benefited from a federal default guarantee and a liquidity line of 100 billion Swiss francs.⁸⁰

Interestingly, the Swiss Government, on one side, provided guarantees to UBS to persuade it to buy Credit Suisse, while, on the other side, through emergency

⁷⁵ See Humphery-Jenner, What went wrong with First Republic Bank?, UNSW Sydney, Business Think, 2 May 2023.

⁷⁶ See Beck, The Credit Suisse crisis and the contradictions of global finance: Three fallacies and a proposal, London School of Economics Blog, 24 March 2023.

⁷⁷ The announcement from the Saudi National Bank that it would not offer any further financial assistance accelerated the crisis. The acquisition of its 9.9% stake in October 2022 played a large part in funding Credit Suisse's massive strategic overhaul, while the Qatar Investment Authority became the bank's second-largest shareholder after doubling its stake to 6.8% in 2022.

⁷⁸ See FINMA and the SNB issue statement on market uncertainty, available at <https://www.finma.ch/en/news/2023/03/20230315-mm-statement/>, where on the afternoon of Wednesday March 15, the SNB and the Swiss banking regulator (FINMA) expressed unambiguous confidence about the stability of Credit Suisse. SNB and FINMA unequivocally stated that Credit Suisse 'meets the higher capital and liquidity requirements applicable to systemically important banks'. SNB also pledged to provide Credit Suisse with liquidity if necessary. As of the end of 2022, Credit Suisse had a common equity tier one (CET 1) capital ratio of 14.1% and a liquidity coverage ratio of 144%. These figures might also suggest that the bank was solvent and had ample liquidity, possibly leading one to question whether the bank should have been deemed failing in the traditional sense.

⁷⁹ See FINMA approves merger of UBS and Credit Suisse, available at <https://www.finma.ch/en/news/2023/03/20230319-mm-cs-ubs/>.

⁸⁰ See Beck, The Credit Suisse crisis and the contradictions of global finance: Three fallacies and a proposal, London School of Economics Blog, 24 March 2023.

legislation, AT1 instruments, amounting to 17 billion Swiss francs, were wiped out.⁸¹ Most likely, the Government took into account the risk of litigation being successfully brought forward by AT1 holders, thereby disguising a bail-out behind the decision of reverting the creditor ranking. The government also agreed to absorb up to 9 billion Swiss francs of potential UBS losses.

As a result of the rescue deal, UBS is now the world's largest wealth manager with 5 trillion USD of invested assets globally.

Against this background, it could be argued that the actions that the Swiss authorities took on March 15th and on March 19th cannot be both right. If the SNB's March 15th statement about Credit Suisse's capital solidity was justified, then it follows that its assets substantially exceeded liabilities so as to enable it to meet the capital requirements applicable to systemically important banks. Yet, if that were to be the case, then SNB's subsequent choices to reject the request for extra liquidity and then to force the acquisition by UBS were at least controversial. In other words, if SNB's March 15th statement was correct that the lender was still solvent and viable, then SNB could have acted accordingly by providing Credit Suisse with all necessary liquidity.⁸² With the value of assets substantially exceeding the value of liabilities, the provision of liquidity would have represented a classic lender-of-last resort move that, given the significant capital cushion, would not have been expected to affect public finance through losses for the central bank.⁸³

⁸¹ Importantly, despite some contractual clauses allegedly permitting to wipe out AT1 instruments, the Swiss law was changed to give FINMA specific powers to write down AT1 instruments without any constraint.

⁸² See Bebchuk, *The Credit Suisse Collapse and the Regulation of Banking*, Harvard Law School Forum on Corporate Governance, 27 March 2023.

⁸³ On central bank's emergency liquidity assistance see Hofmann, *Reconsidering Central Bank Lending of Last Resort*, *European Business Organization Law Review*, 2018, *passim*; Steinbach, *The Lender of Last Resort in the Eurozone*, *Common Market Law Review*, 2016, 53, 361–384; Garicano – Lastra, *Towards a New Architecture for Financial Stability: Seven Principles*, *Journal of International Economic Law*, 2013, 13, 3, 597–621; Dietz, *The ECB as Lender of Last Resort in the Eurozone? An analysis of an optimal institutional design of Emergency Liquidity Assistance competence within the context of the Banking Union*, *Maastricht Journal of European and Comparative Law*, 2019, XX, 1–41; Bodellini, *The financing of problem banks: critical issues and challenges ahead*, in Bodellini – Gimigliano – Singh (eds.), *Commercial Banking in Transition: a Cross-Country Analysis*, New York, forthcoming.

Moreover, if Credit Suisse met capital requirements as the Swiss authorities stated on March 15th, then SNB subsequently forcing a low-price sale of its shares could be regarded as detrimental to its shareholders. Furthermore, AT1 holders whose securities were selected to be wiped out lost even a higher fraction of value than shareholders, and this is surprising given that AT1 instruments rank(ed) higher than shareholders in the creditor priorities ladder.

Conversely, if the SNB's choice on March 19th to force a sale of Credit Suisse for a small amount was justified, then its assets could not have significantly exceeded liabilities. In this case, however, SNB's unequivocal statement on March 15th about its adequate capitalization was misleading provided that the Swiss authorities were in a good position to assess the bank's assets and the latter unlikely lost most of their value over just four days.

For the two opposite positions taken by SNB to be both correct, SNB had to be right in concluding on March 15th that Credit Suisse was well-capitalized but also to conclude on March 19th that, due to a subsequent rapid deterioration, Credit Suisse could no longer be rescued. On paper, a well-capitalised bank could face a depositor run relying upon central bank's emergency liquidity assistance. This seems to have been the SNB's view on March 15th.⁸⁴ However, when SNB chose on March 19th to refuse the provision of additional liquidity, the Swiss Central Bank might have lost confidence that a run on Credit Suisse could be avoided. The dividing line between illiquidity and insolvency is often just a time line and that could possibly explain such a remarkable change in the approach of the Swiss authorities.⁸⁵

6. The main causes for the recent crises discussed above can be, primarily, identified in: 1) supervisory failures, 2) poor risk management at the institutions

⁸⁴ See Bebchuk, *The Credit Suisse Collapse and the Regulation of Banking*, Harvard Law School Forum on Corporate Governance, 27 March 2023.

⁸⁵ See Bodellini, *The financing of problem banks: critical issues and challenges ahead*, in Bodellini – Gimigliano – Singh (eds.), *Commercial Banking in Transition: a Cross-Country Analysis*, New York, forthcoming.

involved, and, 3) in the US cases also relaxed regulations to the benefit of banks with assets in the region between 100 billion USD and 200 billion USD.

Looking at the key facts of such crises, the first takeaway is that authorities and governments do not want depositors (neither covered nor uncovered) to suffer any losses. While such goal was achieved in the cases of SVB and Signature Bank through the systemic risk exception, in the crises of First Republic and Credit Suisse it was part of the overall strategy. Yet, this also means that there is in place a full implicit *ex post* guarantee protecting every deposit which goes well beyond the actual deposit coverage. Despite this being understandable from a financial stability perspective, its impact on moral hazard (and in the Swiss case on public finance as well) should not be underestimated.⁸⁶

The second takeaway is that the way these crises have been handled has led to some acquiring banks becoming even bigger. This is particularly the case for UBS acquiring Credit Suisse and for JP Morgan acquiring First Republic. However, the approach of relying upon large banks to take over failing institutions might become an issue going forward, as there will be less institutions on the market which will be increasingly larger. Yet, if authorities are so reluctant to apply bail-in, finding a strategy to deal with gigantic systemic banks should they fail in the future might become very difficult if not impossible at all.

While the deal with JPMorgan concerning First Republic might look positive for the short-term stability of the US banking sector, the weeks-long bleeding out of First Republic that took place before the intervention probably increased losses to the FDIC. Also, removing restrictions that would otherwise bar the largest US lenders from making acquisitions in the context of crises could be detrimental to competition. And in any case, although consolidation might be beneficial, to a certain extent, also to the US system, it would be preferable for mid-sized lenders to

⁸⁶ For a similar argument see Bodellini – Lintner, The impact of the Covid-19 pandemic on credit institutions and the importance of effective bank crisis management regimes, Law and Economics Yearly Review, 2020, 9.

consolidate among themselves.

7. From a theoretical perspective it could be argued that should similar cases occur in the European Union with the current legal framework in force, the final outcomes would be different.

In the case of a crisis involving a bank similar to Credit Suisse and on the assumption of the authorities wanting to avoid the application of bail-in, provided that the institution were to be considered still solvent and not failing or likely to fail, probably a suitable option would be a precautionary recapitalisation.⁸⁷ Where, due to a rapid subsequent deterioration, the institution would be deemed failing, there would be no problem in applying the resolution tools best suited to the situation if this did not require the allocation of losses to claims the sacrifice of which would disrupt financial stability, in particular uninsured deposits. This seems to be the case of Credit Suisse, which could have been sold in the European Union resolution procedure by sacrificing shareholders and AT1 holders, without the need to affect uninsured deposits, although with the nuance that in the Union there seems to be no doubt about the need to respect the creditor ranking, *i.e.* that shareholders are the first to bear losses, and bear them in full.

If the situation were more serious, with regard to an institution of that size, resolution would require the sacrifice of shareholders, hybrid capital holders and subordinated debt holders for loss coverage and recapitalisation to reach the 8% of total liabilities, including the institution's own funds (TLOF), threshold, that in turn would allow uninsured deposits to be excluded from bail-in, with the resolution fund assuming the corresponding losses in order to preserve financial stability.

However, at least from a theoretical point of view, the opposite hypothesis

⁸⁷ See Bodellini, Greek and Italian 'Lessons' on Bank Restructuring: Is Precautionary Recapitalisation the Way Forward?, Cambridge Yearbook of European Legal Studies, 2017, 19; see also Bodellini – Gortsos – Siri, A proposal for a temporarily amended version of precautionary recapitalisation under the Single Resolution Mechanism Regulation involving the European Stability Mechanism, EBI Working Paper Series, 2020 no. 73.

can be considered as well, that is the scenario where it would not be possible to absorb losses of at least 8% of TLOF without including uninsured deposits, the sacrifice of which however would likely cause financial instability. The impossibility to access the resolution fund would most likely preclude resolution action from being taken, as bailing-in uninsured deposits would in turn compromise financial stability. On the other hand, the search for the external funding necessary to handle the crisis without affecting uninsured deposits most likely would be unsuccessful even through the alternative procedure to resolution, that is the orderly winding-up of the institution in the national procedure, where the financing of the transfer of business can be carried out not only with funds from the deposit guarantee scheme but also with taxpayers' funds, through the granting of a so-called liquidation aid,⁸⁸ without the need to bail-in at least 8% of TLOF.⁸⁹ Given the size of the institution, and despite the fact that the flexibility and discretion of the public interest assessment (PIA) to choose the applicable procedure⁹⁰ would unlikely allow for this solution, there would still be a certain contradiction with the design of the system, in which resolution is the procedure functionally intended for large and very large institutions.⁹¹ Hence, while resolution would be impossible due to a lack of funds to finance it, the transfer of the business in the orderly winding-up according to national law could be

⁸⁸ State aid rules for banks allow the use of public funds to finance the transfer strategy in orderly winding-up procedures, with a prior allocation of losses to shareholders and subordinated creditors (burden sharing) lower than that required to access resolution funds and without any quantitative requirement of loss absorption in relation to total liabilities and own funds. See Communication from the European Commission on the application, from 1 August 2013, of State aid rules to support measures in favor of banks in the context of the financial crisis (Banking Communication 2013), paragraphs 65-88.

⁸⁹ See Bodellini, *International Bank Crisis Management – A Transatlantic Perspective*, Oxford, 2022, 56.

⁹⁰ See Morais, *Perspectives for Reform of the European Crisis Management Framework for Banks and the Completion of European Banking Union*, available at https://cirsf.eu/site/uploads/noticias/documentos/B163EC0B-B8E60_1.pdf, 5-9; Tröger – Kotovskaia, *National interests and supranational resolution in the European Banking Union*, SAFE working paper n° 340, February 2022, 12-19; Clarich, *Presupposti per la risoluzione e interesse pubblico nella gestione delle crisi bancarie*, in *Le crisi bancarie: risoluzione, liquidazione e prospettive di riforma alla luce dell'esperienza spagnola e italiana*, Quaderni di Ricerca Giuridica della Banca d'Italia, n. 95, April, 2023, 105-121.

⁹¹ See Bodellini, *Impediments to resolvability: critical issues and challenges ahead*, *Open Review of Management, Banking and Finance*, 2019, 5.

performed because the necessary funds would be available, albeit, it should be noted, at the expense of taxpayers. Still, in practice in the European Union, finding a buyer able to buy a very large failing institution might be challenging. This contradiction with the design of the system would also manifest itself in the fact that, given the diversity of winding-up regulations in national procedures, some of them will not allow for the transfer of the business financed with public funds and others will probably require some tweaking to meet the specific demands posed by the solution of the crisis of such a large entity. In other words, the impossibility to submit the bank to resolution due to the lack of funds for its external financing would seem to lead in most cases to emergency legislation being needed to articulate an *ad hoc* solution, thereby altering to a greater or lesser extent the existing regime. This would be an exceptional, alternative solution to the ones currently contemplated by the system, similar to what was orchestrated in the Credit Suisse case.

For medium-sized and small institutions, which are primarily funded through deposits, complying with the 8% threshold without sacrificing uninsured deposits could end up being absolutely impossible. Yet, making uninsured depositors bear losses could be incompatible with the objective of preserving financial stability. In this case, the impossibility of obtaining external financing in the resolution procedure to solve the crisis while preserving financial stability would likely lead to the application of the transfer of business in the orderly winding-up in the national procedure, with the support provided by deposit guarantee schemes and/or the State itself.⁹² The potential problems arising from the greater or lesser inadequacy of national regulation are the same as those outlined above, but the application of this solution to small and medium-sized institutions does not contradict the design of the system.

Against this backdrop, it is worth recalling that in the crises of Veneto Banca and Banca Popolare di Vicenza in Italy in 2017, the Single Resolution Board

⁹² See Bodellini, The optional measures of deposit guarantee schemes: towards a new bank crisis management paradigm?, *European Journal of Legal Studies*, 2021, 1.

determined that there was no risk of negative impact on financial stability; however due to concerns that their failure could have affected their region, Italian authorities decided to inject public money to ensure their orderly liquidation after being authorised to do so by the European Commission.⁹³ The cases of Signature and SVB where the systemic risk exception was activated to provide full protection to every depositor despite the two banks not being considered SIFIs might show some similarities with these Italian cases. However, it is important to note that while in the US cases the cost was borne by the DIF, in the Italian cases, taxpayers' funds were injected. From a different perspective, the FDIC decision to use the DIF resources to protect every depositor of Signature and SVB and then to ask the other banks for extra contributions to replenish the DIF resembles to a certain extent the decision of the Italian DGS to set up a voluntary arm, funded through extra contributions paid by banks, to finance the transfer of assets and liabilities from Banca Tercas to Banca Popolare di Bari.⁹⁴ Nevertheless, the voluntary *vis-à-vis* compulsory nature of the extra contributions differentiate these cases.

In the European crisis management and deposit insurance framework (CMDIF), the requirements for accessing the external funding needed to solve the situation of non-viability, with funds coming from the industry or the public budget, and the diversity in the regulation of orderly winding-up in the different Member States have led to a fragmentation in the application of the current system, preventing an adequate level playing field and wasting more public funds than would be desirable.

Given the current lack of political will to establish the European Deposit Insurance Scheme (EDIS),⁹⁵ the European Commission has presented in April 2023 a

⁹³ See Bodellini, To bail-in, or to bail-out, that is the question, *European Business Organization Law Review*, 2018, 19; Bodellini – Lastra – Russo, Stock Take of the SRB's activities over the past years: What to Improve and Focus On?, *Policy Paper Drafted for the European Parliament*, 29 March 2019.

⁹⁴ See Bodellini, Alternative forms of deposit insurance and the quest for European harmonised deposit guarantee scheme-centred special administrative regimes to handle troubled banks, *The Uniform Law Review*, 2020, 2-3.

⁹⁵ See Eurogroup statement on the future of the Banking Union, 16 June 2022.

proposal to reform the CMDIF which, in general, aims to strengthen the whole regime and, in particular, pursues the objectives of reducing the aforementioned fragmentation, lack of level playing field and excessive use of public funds in bank crises, with special attention to medium and small institutions.⁹⁶

To achieve the latter goals, given that it is currently not possible to sufficiently harmonise winding-up in national procedures, the intention is to minimise its application by extending the scope of resolution. To reach this objective: a) the PIA is modified by establishing, among other adjustments, that in its application, the use of funds provided by the industry should be preferred to the use of funds from the State budget; b) the use of funds from national deposit guarantee schemes is facilitated, establishing a general privilege for all deposits and harmonising and making the least cost test (LCT) more flexible; c) it is established that the use of national DGSs funds is computed for the purposes of meeting the requirement that shareholders and creditors must contribute to loss coverage and recapitalisation at least in the amount of 8% of TLOF in order to have access to resolution funds.⁹⁷

Yet, the use and computation of national DGSs funds to reach the 8% of TLOF threshold poses problems from a governance perspective, because national DGSs might end up simply providing resources to implement a resolution strategy which has been designed and engineered elsewhere, and this might not necessarily be the ideal outcome from a decision-making point of view. In addition, although the general privilege of deposits in relation to the LCT will allow using more funds from national DGSs to reach the 8% of TLOF threshold, there may still be cases where,

⁹⁶ See Colino, The reform proposal for the European bank crisis management and deposit insurance regime: the issue of medium-sized and small banks, *Journal of Insolvency & Restructuring* 10/2023.

⁹⁷ See Avgouleas – Ayadi – Bodellini – Ferri – Lastra, Reform of the CMDI framework that supports completion of the Banking Union, Policy Paper for the European Parliament, 17 May 2023, 16-18; Brescia Morra – Pozzolo – Vardi, Completing the Banking Union. The case of crisis management of small-and medium-sized banks, In-depth analysis requested by the ECON committee, May, 2023, 26; Ramos-Muñoz – Lamandini – Thijssen, A reform of the CMDI framework that supports completion of the Banking Union. Transfer, funding, ranking and groups, In-depth analysis requested by the ECON committee, May, 2023, 16-17; Colino, The reform proposal for the European bank crisis management and deposit insurance regime: the issue of medium-sized and small banks, *Journal of Insolvency & Restructuring* 10/2023, 192-200.

even computing funds from national DGSs will not allow to reach such threshold without sacrificing uninsured deposits. In such cases, the impossibility to access the resolution fund will lead to winding-up in national proceedings with the provision of taxpayers' funds in compliance with the State aid regime.⁹⁸

The lack of a systemic exception to the requirement that, to access the resolution fund, losses must be absorbed internally and with national DGS funds in the amount of at least 8% of TLOF, is due to the resistance in the Banking Union to loss mutualisation through the Single Resolution Fund, as the industry in some member states would bear the cost of the crisis of banks in others.⁹⁹ Nevertheless, the quantitative and functional inadequacy of the Single Resolution Fund and the European Stability Mechanism to deal with all imaginable crises, including those of the largest institutions or the simultaneous crises of several institutions, does not allow for funds from national budgets to be left out of the equation.¹⁰⁰ Consequently, not only in the Banking Union, but across the European Union, if the 8% of TLOF requirement is not met, the burden of providing the necessary external funds to supplement those provided by national DGSs will not be borne by the industry through resolution funds, but by the States, through the granting of state aid in orderly winding-up in national proceedings.

A comparison of the recent crises in the US and Switzerland with the solutions that could have been found under the existing EU framework and the 2023 reform proposal seems to offer the following lessons.

1. The 2023 reform proposal confirms that there is still no political will in the Banking Union for the Single Resolution Mechanism to reach a sufficient degree of

⁹⁸ See Colino, The reform proposal for the European bank crisis management and deposit insurance regime: the issue of medium-sized and small banks, *Journal of Insolvency & Restructuring* 10/2023, 197-198.

⁹⁹ See Tröger – Kotovskaia, National interests and supranational resolution in the European Banking Union, SAFE working paper n° 340, February 2022, 21-24; Tirado – Thijssen, Unidroit's Project on Bank Insolvency: how to deal with the failure of small-and medium-sized banks, in *Le crisi bancarie: risoluzione, liquidazione e prospettive di riforma alla luce dell'esperienza spagnola e italiana*, Quaderni di Ricerca Giuridica della Banca d'Italia, n. 95, April, 2023, 133.

¹⁰⁰ See Tröger – Kotovskaia, National interests and supranational resolution in the European Banking Union, SAFE working paper n° 340, February 2022, 24-26.

integration to overcome national interests, being key the absence of a full mutualisation of the costs of crises through the Single Resolution Fund (8% of TLOF requirement) and the insufficiency of both the latter and the European Stability Mechanism; this means that the current framework still provides incentives to implement solutions affecting national budgets when it is necessary to preserve the stability of the financial system and the economy.¹⁰¹

2. In the European Union, inside and outside the Banking Union, it has not yet been accepted that avoiding the use of taxpayers' resources requires that, when necessary after the internal absorption of losses, the cost of external financing for the preservation of the stability of the financial system should be covered by funds provided by the industry, without prejudice to the need for an ultimate and unlimited support with (recoverable) public funds, so that there are no doubts about the safety of the system. This results from the fact that, once the contribution of national DGSs has been exceeded, if resolution funds cannot be accessed (8% of TLOF requirement), external financing must be sought in funds from the national budgets.

3. The recent CMDIF reform proposal will likely lead to a postponement of the implementation of the third pillar of the Banking Union (*i.e.* EDIS) and also ensure only a limited progress in overcoming the current inadequacy of the supranational solution through the Single Resolution Mechanism, so that, to the detriment of the desired level playing field, there will still be a certain degree of fragmentation and use of taxpayers' resources in the resolution of banks. The limited progress cannot be attributed to technical problems with the Commission's proposal, but rather, as with EDIS, to the lack of political will to move forward in the construction of the Banking Union, in the face of which the Commission simply proposes what it can propose.¹⁰² Therefore, if Banking Union is to be successfully completed, it seems that future efforts should be directed towards the implementation of the third pillar (EDIS) in

¹⁰¹ *Id.*, 21-26.

¹⁰² See Colino, The reform proposal for the European bank crisis management and deposit insurance regime: the issue of medium-sized and small banks, *Journal of Insolvency & Restructuring* 10/2023, 202-204.

coordination with the further development of the second pillar (Single Resolution Mechanism), as the two are closely related and could even be considered as a single pillar, complementary to the Single Supervisory Mechanism.

8. The other big issue emerging from these recent bank crises relates to the interplay between two key objectives that several central banks are expected to pursue, *i.e.*: price stability and financial stability.¹⁰³ The US cases have shown the tension existing between these two objectives; a restrictive monetary policy aimed at lowering inflation through increasing interest rates has negatively affected banks making some of them fail and potentially generating financial instability. In the view of some commentators, central banks did not sufficiently appreciate new types of risk created by the low interest policy which they implemented for long time after the global financial crisis of 2007-2008.¹⁰⁴ As firms adapted to the new low interest rates environment, they eventually became dependent on such low rates. Yet, when the rates had to be increased to tackle inflation, banks started facing significant difficulties and authorities realised with delay that the changed interest rate environment would have had a detrimental impact on the former.¹⁰⁵

Also, this issue was exacerbated by poor communication as the FED had signalled during the pandemic period to the public that it would have kept interest rates low for the foreseeable future. In other words, the Fed's public communications conveyed the message that by keeping interest rates low, debt instruments value in banks' balance sheets would have not been affected. This however started changing in 2022, when the FED progressively increased interest rates to fight inflation. Importantly, this sudden reversal, according to Nobel Laureate Douglas Diamond, was not well-telegraphed by the Fed, and this is the reason why

¹⁰³ On this tension see Bodellini – Singh, Monetary policy in the face of the covid-19 crisis: the interesting case of the United Kingdom, Open Review of Management, Banking and Finance, 2020, 2.

¹⁰⁴ See Capitalisn't, SVB: The End of Banking as We Know It?, 16 March 2023, available at <https://www.capitalisnt.com/episodes/svb-the-end-of-banking-as-we-know-it/transcript>.

¹⁰⁵ See Danielsson – Macrae – Tchouparov, Lessons from the collapse of Silicon Valley Bank, Economics and Finance, London School of Economics Blog, 15 March 2023.

the market value of SVB's securities quickly dropped.¹⁰⁶ This in turn led to unrealised losses, which prompted depositor withdrawals, that were addressed by the lender through offloading debt instruments on the market thereby realising almost 2 billion USD losses.¹⁰⁷

But what is even worse from the regulatory perspective is that even in the Fed's 2022 stress tests, banks were not tested at treasury yield rates above 2%. Although SVB was not subject to a stress test, it would have likely passed it under those parameters.¹⁰⁸ This is to say that monetary policy and bank supervision did not get properly coordinated in the US. On these grounds, it was pointed out that 'One of the Fed's reasons for existing is to promote financial stability ... But when the Fed moves real and nominal rates around, that has a spill-over effect on financial institutions and their borrowers that the Fed better not ignore. The Fed left rates too low for too long with no spinouts going around the track. Now, they have to ease on the brakes. But if they slam on the brakes, they will cause a crash'.¹⁰⁹ This is to say that central banks cannot fight inflation by making the banking system collapse.

Of course, when the FED signalled the change in monetary policy, good risk management practices at banks would have required to find ways to adapt to the changed environment. This was not the case with SVB, Signature and First Republic which highlights poor risk management practices.

Diamond also argued that good supervision, in light of new restrictive monetary policy measures being implemented to fight inflation, would have required to look at each single bank to see whether they were able to withstand the changed interest rates environment. Banks showing excessive exposure to long-term debt

¹⁰⁶ See Capitalisn't, SVB: The End of Banking as We Know It?, 16 March 2023, available at <https://www.capitalisnt.com/episodes/svb-the-end-of-banking-as-we-know-it/transcript>.

¹⁰⁷ See Van Vo – Thi Thu Le, From Hero to Zero – The Case of Silicon Valley Bank, The CLS Blue Sky Blog, Columbia Law School's Blog on Corporations and the Capital Markets, 14 April 2023.

¹⁰⁸ See Capitalisn't, SVB: The End of Banking as We Know It?, 16 March 2023, available at <https://www.capitalisnt.com/episodes/svb-the-end-of-banking-as-we-know-it/transcript>.

¹⁰⁹ Id.

could have been urged to hedge interest rate risk, but this did not happen.¹¹⁰

The other side of the coin is that in several states around the world, banks hold a substantial amount of public debt issued by their government.¹¹¹ Governments clearly need domestic banks to buy such debt to fund their expenditures and central banks in turn must keep this into careful account when implementing restrictive monetary policy measures. On these grounds, immediately after the collapse of Signature and SVB, the FED activated an emergency credit line available to banks facing liquidity tension, on the assumption that the increase of interest rates has led several banks suffer (realised or unrealised) losses on their portfolio of sovereign exposures.¹¹² Should (uninsured) depositors panic and withdraw their deposits (as happened with Signature and SVB), the banks concerned would end up exactly in the same liquidity crisis quickly leading to insolvency.¹¹³ Hence, assuming that monetary policy tightening is still needed to effectively face inflation, central banks should stand ready to provide banks with the liquidity they need in return for their sovereign bonds as collateral that should be valued at par.

The opposite reading could be that the failure of poorly financed institutions is exactly what the FED wants when it raises interest rates. Institutions and investors that have taken on too much risk are meant to fail when interest rates are raised. This is an uncomfortable, yet necessary part of slowing down the economy. But if that is the case, then, it would be difficult to explain why the FED decided to create an emergency lending facility for banks facing difficulties due to (unrealised) losses on their assets. If the emergency facility was created to stop risk of widespread bank

¹¹⁰ Id.

¹¹¹ See Bodellini, The long ‘journey’ of banks from Basel I to Basel IV: has the banking system become more sound and resilient than it used to be?, ERA Forum, 2019, 20.

¹¹² See Federal Deposit Insurance Corporation, Joint Statement by the Department of the Treasury, Federal Reserve, and FDIC, Press Release, 12 March 2023.

¹¹³ See Bodellini, The financing of problem banks: critical issues and challenges ahead, in Bodellini – Gimigliano – Singh (eds.), Commercial Banking in Transition: a Cross-Country Analysis, New York, forthcoming.

runs, then it has been regarded as the right move by the FED.¹¹⁴

9. Still, in Diamond's view, SVB was already bankrupt, even if the run had not happened. Thus, it was a failure of risk management at the bank, and it was a failure of the regulators for not preventing this situation from occurring in the first place.¹¹⁵ In other words, in the Nobel laureate's opinion, the run took place because SVB was insolvent. The increased interest rates caused a substantial funding-cost surge for lenders. If, theoretically, the interest rates they borrowed at stayed at zero for long, then they would have been solvent and viable.

Two different narratives have been told to explain the run on SVB. One explanation could be that start-ups with deposits with SVB needed their money, while the other one is that start-ups are sophisticated players and if they can obtain 5% interest on treasury bills or on money-market funds, they would not leave their deposits with their bank. In such a scenario, if SVB (and banks in similar situations) were to finance their 1% fixed-interest-rate treasuries with deposits carrying 5% interest, they would rather quickly become insolvent.¹¹⁶ And this is what happened to SVB.

SVB had enormous (still unrealised) losses on their HTM assets, as they invested in long-term bonds when the interest rate was at the minimum, which led to 16 billion USD in (unrealised) losses with 16 billion USD of equity. On paper, SVB was already insolvent. Yet, accounting rules applicable to the HTM portfolio are different from the ones applicable to the AFS portfolio, in that marking assets to market is only mandatory for AFS securities. To meet depositor withdrawals, SVB sold the AFS portfolio at a market price, forcing the lender to record a 2 billion USD loss. They had enough capital to absorb that loss. While there are currently several banks that have an (unrealised) loss on their HTM portfolio, this loss is not to be recorded

¹¹⁴ See Capitalisn't, SVB: The End of Banking as We Know It?, 16 March 2023, available at <https://www.capitalisnt.com/episodes/svb-the-end-of-banking-as-we-know-it/transcript>.

¹¹⁵ Id.

¹¹⁶ Id.

as the accounting rules do not request that. The rationale for this is that HTM securities will be most likely held all the way until they mature and therefore no real loss will be suffered. By contrast, if the bank sells anything out of the HTM portfolio, the latter has to be marked to market, thereby forcing the lender to book the loss. On these grounds, if SVB had not been forced to mark to market their government exposures, for example because they were given access to a discount window with the FED providing loans on par, (which is what is available now to banks), thereby avoiding any sale, they would not have had an insolvency problem.¹¹⁷

Nevertheless, this reading of the legal framework might appear somehow troubling. According to Luigi Zingales, in fact this means that SVB was insolvent, but as the framework allows banks to take advantage of depositors by not paying interest on deposits for a little while, banks can avoid recording losses until they are forced to sell their securities to meet withdrawals. And this is what several lenders currently seem to do. This means that if depositors are unsophisticated enough to keep their savings with banks without looking for higher interest, then banks can be considered solvent. By contrast, SVB's depositors were sophisticated and they moved their money out, thereby making their lender fail.¹¹⁸

From a macro perspective, the issue would then be that there might be several banks in this situation whereby they just rely upon their depositors being complacent. According to Zingales, there could be about 600 billion USD in hidden losses in the US banking sector.¹¹⁹ In other words, the solvency of such banks depends on their depositors not searching for the higher interest rates that currently the market can offer. Obviously, there could be several reasons why depositors might prefer to keep their money with a bank despite higher interest rates being offered on the market. For example, a business holding deposits mostly to make payroll might find it convenient to bank only with one institution. The same might hold true for

¹¹⁷ Id.

¹¹⁸ Id.

¹¹⁹ Id.

individuals preferring to buy all their banking services from the same bank. In other words, there are other intangibles that are part of a banking relationship and that might go beyond the interest rate offered by other financial institutions.¹²⁰ Yet, if this argument is correct, the solvency of several lenders is dependent on their depositors' inclination, and this might be difficult to predict and hence to manage.

It could also be argued that accounting rules allowing banks to avoid marking to market HTM securities are legitimizing a *fictio iuris*, whereby we pretend that insolvent banks are solvent. But irrespective of such a *fictio iuris*, those banks can survive only insofar as depositors (*rectius* uncovered depositors) do not start running. But even if that were to be the case, we keep alive a broke banking system on the hope that depositors are not interested in looking for higher remuneration. The *fictio* is thus still there.

Yet, it has also been argued that the actions of US institutions with regard to SVB and Signature have been successful in the short term, since the sense of panic has largely receded, there is no indication of an accelerating deposit run and market prices rebounded.¹²¹ Nonetheless, the long-term effects of these interventions might turn out to be negative, as the message is that all deposits are now protected irrespective of their size and the coverage limit. This is very likely to become perceived by American corporate treasurers, savers and the banks themselves as permanently applying to every situation. Guaranteeing all deposits without limit, even in relation to unsound banks, removes an element of market discipline which by contrast should feature the deposit insurance system. There have been several debates among economists about the design and impact of deposit insurance, with some seeing perverse incentives (so-called moral hazard)¹²² as inherent to any

¹²⁰ Id.

¹²¹ See Veron, Opinion: Fully reimbursing SVB depositors may prove to be a bad move, CNN Opinion, 16 March 2023, available at <https://edition.cnn.com/2023/03/16/opinions/silicon-valley-bank-deposit-insurance-vron/index.html>.

¹²² See Krugman, *The Return of Depression Economics and the Crisis of 2008*, WW Norton, New York, 2009, 63, defining moral hazard as 'any situation in which one person makes the decision about how much risk to take, while someone else bears the cost if things go badly'.

deposit insurance scheme, and others arguing that unlimited deposit insurance is a reality that should be explicitly acknowledged.¹²³ All in all, the unlimited guarantee, resulting from the application of the systemic risk exception in the crises of SVB and Signature Bank, makes the system different from what it was before, since uninsured depositors have incurred losses multiple times in the past.¹²⁴ Hence, the new system is less based on market discipline and risk assessment than was the case in the past. While the structural consequences of the US authorities' decision are not immediately clear, the detrimental effects of this shift can be already envisaged; for example poorly managed banks could find it easier to attract large depositors in the future on the assumption that a full guarantee is available to anyone.¹²⁵

10. Looking at the recent bank crises in the US and Switzerland, we argue that what most jurisdictions have in common is, on one side, that by implementing the FSB Key Attributes, their framework is based on the assumption that losses should be internalised through bail-in and bail-in like tools, but, on the other side, authorities will often do everything they can to deviate from the application of such tools. Of course, this could be understood on the grounds that bail-in can trigger instability; but even deviating from this operating model comes with negative consequences, such as moral hazard, negative impacts on market discipline and potentially on public finance. This also raises more philosophical questions as to whether it makes sense to have bail-in in force and then every time search for grounds to rely on exceptions (if not emergency legislation) allowing for its dis-application.

With regard to deposit insurance, importantly, in the US, the FDIC, in its dual capacity as deposit insurance agency and resolution authority, is the key player in

¹²³ See Veron, Opinion: Fully reimbursing SVB depositors may prove to be a bad move, CNN Opinion, 16 March 2023, available at <https://edition.cnn.com/2023/03/16/opinions/silicon-valley-bank-deposit-insurance-vron/index.html>.

¹²⁴ See Federal Deposit Insurance Corporation, Joint Statement by the Department of the Treasury, Federal Reserve, and FDIC, Press Release, 12 March 2023.

¹²⁵ See Veron, Opinion: Fully reimbursing SVB depositors may prove to be a bad move, CNN Opinion, 16 March 2023, available at <https://edition.cnn.com/2023/03/16/opinions/silicon-valley-bank-deposit-insurance-vron/index.html>.

charge to handle bank crises. It is this dual role that in the view of many has made the US system the international model for bank crisis management.¹²⁶ The recent failures of Signature, SVB and First Republic have shown once again that the availability of the DIF resources and the reliance on transfer strategies are two key elements to manage crises in that jurisdiction.

In the EU, this is not always the case. There are several member states where DGSs cannot and do not go beyond depositor pay-out. Irrespective of pay-out being the existential function of DGSs which needs to be part of the framework, limiting the DGSs role to it might be counterproductive in several situations.¹²⁷ On these grounds, the recent proposal of the European Commission has as its point of reference the FDIC-driven type of intervention.¹²⁸ But without considering the US, where the institutional set-up is different and currently impossible to replicate in the EU, the Italian framework and way of intervening might be a useful point of reference.¹²⁹ The bank supervisor, the resolution authority and the DGSs over time have developed effective forms of cooperation aimed at implementing transfer strategies on the assumption that in most cases they could be more effective from a system-wide perspective than depositor pay-out.¹³⁰ The main obstacle currently in place relates to the interplay between covered deposits and DGSs super-preference in insolvency and the least cost test. The Commission proposal aims at fixing that issue, by aligning every deposit in the creditor ranking and removing the extension of

¹²⁶ See Bodellini, *International Bank Crisis Management – A Transatlantic Perspective*, Oxford, 2022.

¹²⁷ See Bodellini, *The optional measures of deposit guarantee schemes: towards a new bank crisis management paradigm?*, *European Journal of Legal Studies*, 2021, 1.

¹²⁸ See Avgouleas – Ayadi – Bodellini – Ferri – Lastra, *Reform of the CMDI framework that supports completion of the Banking Union*, Policy Paper for the European Parliament, 17 May 2023.

¹²⁹ See Bodellini, *The Banking Union in the Aftermath of the COVID-19 Pandemic: An Incentive to Finalise the Project?*, in Gimigliano – Catellan (eds.), *Money Law, Capital, and the Changing Identity of the European Union*, Oxford, 2022.

¹³⁰ See Bodellini, *The key role that deposit guarantee schemes could and should play in bank crises: a proposal to amend the European Union framework*, in De Aldisio (ed.) *The crisis management framework for banks in the EU. How can we deal with the crisis of small and medium-sized banks?*, Bank of Italy, Rome, 2021.

the super-preference to DGSs.¹³¹ This could pave the way for a more proactive role of DGSs. The issue with the proposal is that such a role of DGSs should be played in resolution as opposed to winding up. If resolution is managed at EU level national DGSs will simply end up having to provide resources for the implementation of strategies defined by others at European level. And this might not be the ideal outcome in terms of effective governance arrangements.¹³²

As to the dichotomy between systemic institutions and non-systemic institutions, it is worth emphasising that every bank crisis could potentially have some systemic repercussions.¹³³ The issue is that it is very difficult for the authorities to foresee in advance if that is the case or not.¹³⁴ The policy discussion in the EU is interesting as the idea would now be to revert the original system upside down, that is, from the consideration that public interest resolution was needed only for few large and complex banks to the consideration that most banks should now be resolved in the event of failure. This change of paradigm could be explained with the fact that harmonising bank insolvency regimes is not feasible at this juncture and therefore the only way to achieve harmonisation is through expanding the scope of the (already) harmonised resolution regime. If that were to be the case, then such a change of paradigm would look like a *fictio iuris* where we pretend that there is almost always a public interest to protect through resolution. While the outcome might be somehow acceptable, the practical issue would still relate to the 8% bail-in rule in resolution that has to be complied with to have access to external funding.

¹³¹ Proposal for a Directive of the European Parliament and of the Council amending Directive 2014/59/EU as regards early intervention measures, conditions for resolution and financing of resolution action.

¹³² See Avgouleas – Ayadi – Bodellini – Ferri – Lastra, Reform of the CMDI framework that supports completion of the Banking Union, Policy Paper for the European Parliament, 17 May 2023.

¹³³ See Bodellini, Impediments to resolvability: critical issues and challenges ahead, Open Review of Management, Banking and Finance, 2019, 5; see also Bodellini – De Groen, Impediments to resolvability – what is the status quo?, Policy Paper Drafted for the European Parliament, 15 October 2021.

¹³⁴ See Goodhart, Multiple Regulators and Resolutions, Paper presented at the Federal Reserve Bank of Chicago Conference on Systemic Financial Crises: Resolving Large Bank Insolvencies, 30 September – 1 October 2004, *passim*, pointing that ‘the window of opportunity between closing a bank so early that the owners may sue and so late that the depositors may sue may have become vanishingly small’.

In the US, the systemic risk exception was applied to allow the FDIC to provide coverage to every deposit. Considering the nervousness of the market and the number of regional banks potentially being affected, it is not surprising that a decision of this sort was made. One could wonder though if there were no other alternatives to consider, such as a clear and explicit full guarantee provided at the very beginning by the government for a limited period of time to every depositor. This perhaps would have prevented the failure of those three banks and therefore saved resources of the DIF. It would also have avoided some banks to get even bigger through the acquisition of assets and liabilities from the three failed institutions. This going forward will be an issue that should not be underestimated, as handling too-big-to-fail institutions might prove impossible. Of course, it would have created also moral hazard, but the strategy eventually implemented through the systemic risk exception has created moral hazard too, and now every depositor in the US has the legitimate expectation to be fully protected anyway.

Concerning Credit Suisse, the way the Swiss lender was handled was somehow surprising. What is interesting is that even when bail-in should be the very first option, authorities are reluctant to apply it, and luckily this happened in Switzerland and not in Italy that was criticised in the past for deviating from the application of bail-in for banks which were way smaller than Credit Suisse.¹³⁵

The second aspect which was very interesting in the Credit Suisse crisis was the decision to write down AT1 instruments without writing down shares first. There might be several strategic reasons why the authorities have come to that decision, including the existence of some legal basis for doing that in the contractual provisions. Yet, AT1 holders might have grounds to bring claims against that decision. Assumingly, Swiss authorities were well aware of that risk too and it could also be the case that they decided to take that action because this could be somehow presented to Swiss citizens as a way to avoid a bail-out strategy. Still, if a court decision will be

¹³⁵ See Bodellini, *L'intervento pubblico nella crisi delle banche e la contraddittoria inefficienza delle istituzioni europee: appunti da Veneto e Toscana*, *Rivista di diritto dell'impresa*, 2019, 1.

made that the government (or FINMA) will have to compensate AT1 holders, then that will be a postponed bail-out. Nonetheless, from the political perspective, politicians will have the argument to use that this was not their decision, but rather a law-court decision.

As to the rapidity at which deposits can nowadays move through online banking, this circumstance could certainly accelerate a crisis, making it very difficult for the authorities to intervene. Still, it seems that the situation of SVB, and to a certain extent of Signature Bank, was quite peculiar with an extremely large number of uncovered deposits that would obviously have big incentives to flee as the first symptoms of a crisis materialise. Yet, if such a situation should occur again, perhaps a rule limiting the amount of uncovered deposits banks can take up could be considered. Of course, the other way around would be to increase the deposit coverage and to provide a special treatment to business accounts, that is what is actually under consideration in the US.¹³⁶

As to supervision, many people claim that the US crises were due not only to regulatory failures but also to the supervisory failures. That could certainly be the case, but what might appear somehow surprising is to explicitly read in the Barr report a clear recognition of their failure as supervisors.¹³⁷

¹³⁶ See Federal Deposit Insurance Corporation, Options for deposit insurance reform, 1 May 2023.

¹³⁷ See Board of Governors of the Federal reserve System, Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank, 28 April 2023.

ORGANISATION OF CORPORATE RIGHTS PROTECTION IN THE WORLD AND IN UKRAINE

Anatoliy V. Kostruba *

ABSTRACT: *The transition to a market economy caused the emergence of a considerable number of corporate enterprises, which in the absence of a remedy for their rights and interests led to their massive violation and to the need to develop an effective system for their protection. This issue remains relevant at the present time, since an effective means of protecting corporate rights has not yet been developed and a rather insignificant period of their development has not made it possible to generalize the achievements and eliminate the problems of law enforcement and judicial practice.*

The main goal of the scientific work was to carry out a legal characterization of the system of protection of corporate rights and to conduct a comparative analysis of Ukrainian and foreign experience in this field. The leading approach in this study was comparative analysis. The work expressed the content of the category of corporate rights and the essence of corporate legal relations as an object of research. It has been established that law enforcement practice has developed a thesis on ensuring the corporate legal capabilities of a person in the context of the general provisions of civil legislation. In this regard, the study presented comparative data regarding their list of such provisions in different countries. Based on the results of a literal interpretation, it was determined that the legally established list of remedies is not exhaustive. It has been proven that the current system of legal norms, which regulates corporate law and protects the rights of its subjects, is largely focused on ensuring the quality of shareholders' rights in the EU countries. This was illustrated by comparing the two main approaches to classifying remedies for corporate rights. The classification of means of protection of rights violated under corporate contracts is

* Department of Civil Law, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine.

presented, with the selection of three groups of means of protection, and the existing means of protection are supplemented with those that can be implemented taking into account the research data. The study analysed the judicial practice in different countries concerning dispute resolution in corporate relations.

SUMMARY: 1. Introduction. – 2. Materials and Methods. – 3. Results and Discussion. – 4. Conclusions.

1. Corporate agreements have been used as a legal instrument in Ukraine since the early 1990s, with the creation of the first business entities. However, at the time, the Ukrainian legislation lacked provisions for their regulation, and failed to keep up with the rapid development of corporate relations over time. Because of this, most of the relations between the participants of the established corporate companies were unregulated, especially the system of protection of their rights. The lack of a well-developed legislative framework and practice of regulating these relations during the Soviet period also played a significant role. At this time, as one of the researchers noted, corporate law, one of the fundamental sub-branches of civil law, was "forgotten as unnecessary"¹. An effective system of ensuring the legal capabilities of subjects of corporate relations is the most important tool for effective interaction in the economy at the current stage of development. Legislative ways to determine the most optimal and adequate remedies for participants in corporate relations in modern conditions of world entrepreneurship is one of the most difficult issues in both foreign and Ukrainian practice and finally unresolved in legal theory. The nature of corporate legal relations has been the object of researchers' study for quite a long time. All existing opinions regarding their definition can be grouped as follows: 1) the manifestation of relations of a real nature; 2) a specific type of obligations; 3) real relative law (while the boundaries of the existence of real and binding elements are not defined); 4) legal relations of a special kind. Over time, scientific research refuted theses on reducing corporate relations to real or binding,

¹ VASILIEVA, *Problems of corporate law development*, 2013, in *Private Law*, 1, 135-145.

as well as identifying real relative law in them. That is why the doctrine is dominated by recognition of the special nature of corporate rights²³⁴⁵⁶⁷⁸.

This issue is the most studied among foreign researchers, because in developed countries, the evolution of corporate law has a longer path compared to Ukraine, and therefore they have designed a more efficient and developed system for protecting these rights. Among foreign scientists, the following researchers deserve attention: D. Bilchitz⁵, B.R. Cheffins⁶. Corporate rights of the state and features of their protection were considered by O. V. Bignyak⁷, V.I. Zhabsky⁸, D. I. Pogribny⁹ and others. Direct attention to the various aspects of protection of corporate rights of business entities was paid by such researchers as O. V. Bignyak¹⁰, I. B. Sarakun¹¹, Yu. V. Wojciechowska and V. V. Wojciechowska¹², L. Gachak-Velychko and B. Kupchak¹³, T. I. Burdak¹⁴ and I. Spasybo-Fateeva¹⁵ and others.

The generalisation of the presented opinions showed that in general, Ukraine

² GALIAN, *The concept and legal nature of subjective corporate rights as an object of legal protection*, 2019, in *Entrepreneurship, Economy and Law*, 12, 27-31.

³ KRAVCHENKO, *Legal nature of corporate rights*, 2010, in *Journal of Kyiv University of Law*, 2, 176-179.

⁴ KOSTRUBA, MAYDANYK, and LUTS, in *Bonum requirements of the beneficiary in the corporate rights protection system in Ukraine: Implementing best practices*, 2020, in *Asia Life Sciences*, 1, 189–207.

⁵ BILCHITZ, *Corporations and the limits of state-based models for protecting fundamental rights in international law*, 2016, in *Indiana Journal of Global Legal Studies*, 23(1), 143-170.

⁶ CHEFFINS, *Company law: Theory. Structure and operation*, Oxford, Oxford University Press, 1997.

⁷ BIGNYAK, *Theoretical and applied aspects of protection and defense of corporate rights of the state*, 2018, in *Forum Prava*, 3, 13-21

⁸ ZHABSKY, *Corporate rights of the state as an object of corporate relations*, 2013, in *Our Law*, 10, 16-22.

⁹ ZHABSKY, *Corporate rights of the state as an object of corporate relations*, 2013, in *Our Law*, 10, 16-22.

¹⁰ BIGNYAK, *Civil law protection of corporate rights in Ukraine*, 2018. <http://dspace.onua.edu.ua/handle/11300/10739>.

¹¹ SARAKUN, *Exercise of corporate rights by participants (founders) of business associations (civil law aspect)*, Kyiv, The National Academy of Sciences of Ukraine, 2008.

¹² SARAKUN, *Exercise of corporate rights by participants (founders) of business associations (civil law aspect)*, Kyiv, The National Academy of Sciences of Ukraine, 2008.

¹³ GACHAK-VELYCHKO and KUPCHAK, *Corporate rights and their application in economic activity*, 2010, in *Scientific notes of Lviv University of Business and Law*, 5, 145-155.

¹⁴ BURDAK, *Legal nature of corporate rights and corporate relations in joint stock companies*, 2011, in *Journal of Kyiv University of Law*, 3, 169-173.

¹⁵ SPASYBO-FATEEVA, *Ways to solve problems of protection and defense of corporate rights*, 2009, in *Bulletin of the Academy of Legal Sciences of Ukraine*, 1(56), 150-155.

has created an institution and a holistic model of corporate remedies, the applicability of which depends on the nature and degree of the offence. A comparative analysis showed that the system of remedies under corporate contracts combined the remedies presented in Anglo-American and continental law. However, as revealed during the study, foreign practice still contains remedies that are not inherent in the Ukrainian system, and can be implemented in its national system of corporate law. Furthermore, practice has demonstrated the insufficiency of the already consolidated remedies in the legislation. These aspects determined the relevance of further research in this area and comparative analysis with other countries.

2. The article studied the principles and features of the legal system of corporate law regulation. On the basis of the chosen methodology, the work expressed and solved the main problems arising in the field of compliance with the rights of the subjects of corporate relations, both in the national and international doctrine. The methods chosen in the study provided for obtaining reliable conclusions. Based on the method of comparative analysis, the article studied Ukrainian and foreign experience in the context of ensuring corporate rights. This method was also used to study the retrospective dynamics of Ukrainian practice. The method of analysis in the article was necessary to describe the fundamental principles of corporate law in Ukraine, as well as the available tools for their implementation at various levels.

In addition, such methods as synthesis, analogy, system, classification and analysis were used in the scientific work. Since the topic of the article belongs to the legal sphere, a normative method was used for its thorough and in-depth study.

Using the assessment method, the research revealed the success of the process of implementing foreign legal acts into Ukrainian legislation. The analysis and use of primary sources was carried out using the synthesis method. An analytical method was used to identify qualitative and necessary provisions from the data of

primary sources. Also, on its basis, it was established that it is appropriate to use some international norms in the Ukrainian legal system. The study of the content and structure of normative legal acts was based on the methods of induction and deduction. Their role was especially important in the expression of specific legal concepts and categories that characterize the object of research. The main features and stages of the development of corporate law in Ukraine and abroad were outlined on the basis of the use of the historical method.

The scientific methods used in the work made it possible to describe the most common issues related to the field of corporate relations and their subjects in Ukrainian and foreign experience. On the basis of this methodology, the necessary conclusions for the formation of recommendations for Ukrainian legislation were obtained. The research used the method of comparative analysis, on the basis of which it was possible to express the common and distinctive features between the Ukrainian practice of directly protecting corporate rights and the legal basis of regulation of this sphere in other countries. In addition, the analysis was used to study Ukrainian practice in retrospective dynamics. In the theoretical context, this method made it possible to characterize the basic principles on the basis of which the legal system of corporate law regulation in Ukraine and at the international level is being built. In addition, the analysis was applied in the process of expressing approaches to protect the rights of the subjects of such a right.

The work also used a descriptive method, which consisted in expressing the obtained results in a logical sequence. As for the normative method, it formed the basis of the process of researching issues related to the legal sphere of regulation and protection of corporate rights in Ukraine and abroad.

Based on the assessment method, the degree of implementation of foreign legislative norms into the legal system of Ukraine was expressed in the study. The method of synthesis in the work was used to solve the problems formed in this study, due to the use of primary sources on the topic. The analytical method was necessary to identify and establish the most appropriate norms that can be properly

implemented into Ukrainian legislation. Based on the methods of induction and deduction, it was possible to study the system of regulatory legal acts, their features in the field of corporate law and regulation of relations between its subjects. Also, in addition to the method of analysis, the article used the historical method, which was responsible for studying the algorithm of the origin and spread of corporate law in Ukrainian scientific doctrine, as well as in practice.

The genetic method was used in the article to express the main stages of formation and consolidation of corporate law. This method was used to establish the sequence of the above-described process in time, as well as to identify the factors influencing it. Since the research object belongs to the legal sphere, it was necessary to use the concept of corporate rights in the article, which is enshrined in Art. 167 of the Economic Code of Ukraine¹⁶, and establishes their content.

This definition indicates that corporate rights include rights that vary in nature and content, both property rights and non-property rights. The rationale for assigning remedies for corporate rights to the group of special methods of protection is that they are used in a specific field (corporate legal relations). The special nature of remedies for corporate rights determines the ability of corporate companies' participants to perform actions aimed at terminating the violation of rights, as well as at restoring violated rights.

3. Property and non-property rights have a close interrelation, since they arise based on a single circumstance – a person's ownership of a share in the authorised capital of the company. In judicial practice, this leads to an increasing frequency of recognising these rights of participants as non-independent objects of legal relations, i.e., they are not recognised as property rights. Circumstances under which court decisions in similar legal disputes may differ significantly are common. Such cases concern the interpretation of legal norms, as well as various legal categories, for example, corporate law. The source of this problem is the lack of clear legislative

¹⁶ Economic Code of Ukraine, 2003. <https://zakon.rada.gov.ua/laws/show/436-15#Text>

regulation of concepts and mechanisms that form certain types of social relations. For example, often in court decisions two completely different categories are presented as the same, in particular, corporate law and a share in the authorized capital. As an example, one should examine the decision of the Commercial Court of Kyiv in case No. 910/17483/13¹⁷, according to which corporate rights are characterized by economic features, for example in the context of their use as an organizational and legal approach to financial transactions, their interpretation in the authorized capital. In an almost similar case No. 5005/1111/2011¹⁸, the Supreme Economic Court of Ukraine noted in its decision that the contribution to the authorized capital does not belong to the category of property rights, and therefore protects the non-property interests of the shareholder.

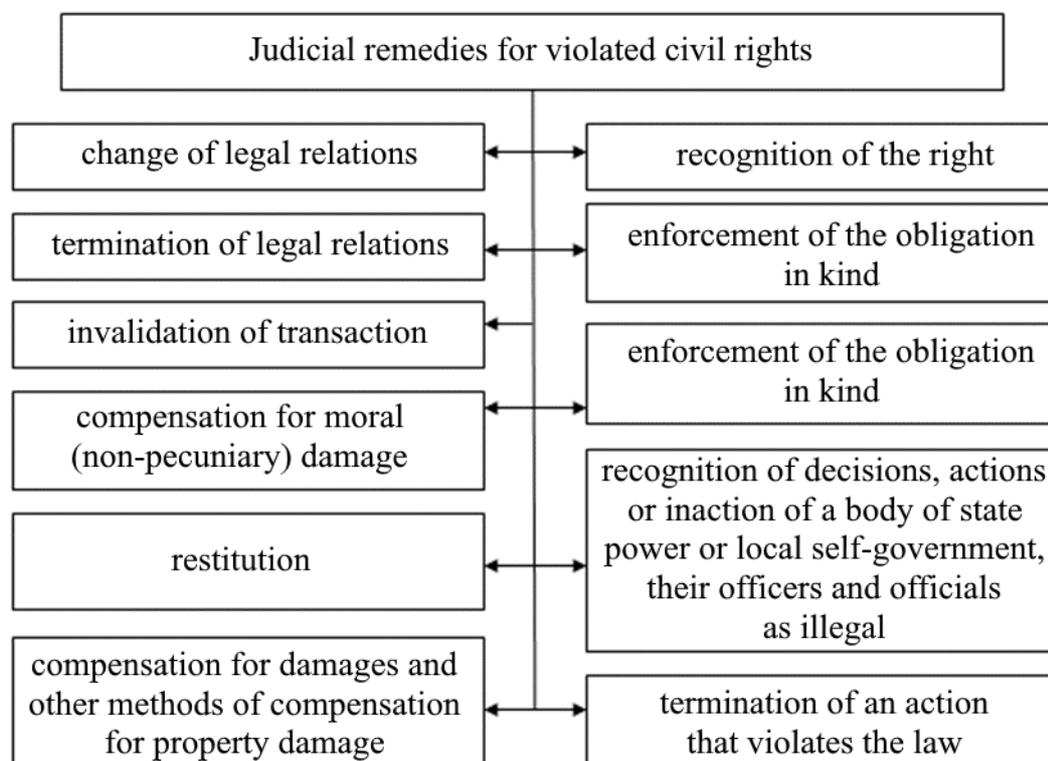
Law enforcement practice has developed a recognised thesis that corporate rights are protected within the framework of general provisions of civil legislation. In particular, Article 16 of the Civil Code of Ukraine¹⁹ provides a list of judicial remedies for violated civil rights (Chart 1).

¹⁷ Decision of the Supreme Commercial Court of Ukraine in the case of the Commercial Court No. 910/17483/13 of the city of Kyiv, 2014. <https://zakononline.com.ua/court-decisions/show/38746562>

¹⁸ Resolution of the Supreme Commercial Court of Ukraine in the case of the Commercial Court of Dnipropetrovsk region No. 5005/1111/2011, 2011. http://vgsu.arbitr.gov.ua/docs/28_3329895.html

¹⁹ The Civil Code of Ukraine, 2003. <https://zakon.rada.gov.ua/laws/show/435-15#Text>

Chart 1 – Judicial remedies for violated property and non-property civil rights



Source: systematised by the author

In the science of civil law, remedies are understood as "measures (means) not prohibited by law, due to which offences are suppressed and their consequences are eliminated, as well as the influence on the offender is carried out"²⁰. It should be noted that the current legislation on the regulation of corporate relations and the protection of the rights of their participants for objective reasons, which have a different legal nature, is largely focused on the legal regulation of ensuring the legal capabilities of subjects of corporate relations in the EU. countries. In particular, a common approach to the classification of means of protection of corporate rights in European and Ukrainian practice is one in which universal means of protection are distinguished, which can be applied in case of violation of the legal interests of subjects of corporate law, and separate means of protection, which are applied only

²⁰ Law of Ukraine No. 514-VI "On Joint-Stock Companies", 2008. <https://zakon.rada.gov.ua/laws/show/514-17#Text>

in case of violation a certain type of subjective civil rights that differ in specificity, in particular corporate rights. Notably, there is confusion in the legal literature regarding the distribution of remedies between these two groups. Thus, some researchers refer remedies for corporate rights to universal remedies, and not to the category of special remedies for civil rights.

In particular, the position of O.V. Bignyak⁷ is erroneous, who includes the right of shareholders to demand the redemption of shares owned by them in the list of universal remedies for subjective civil rights, as a kind of such a remedy as the cessation of actions that violate the law or create a threat of its violation. Furthermore, the author does not specify whose actions the share buyback is supposed to terminate in this case. In addition, it is clear that this action cannot stop the reformation of the company or its exercise of its rights, as well as make changes to the legal documents regarding the limitation of the rights of shareholders.

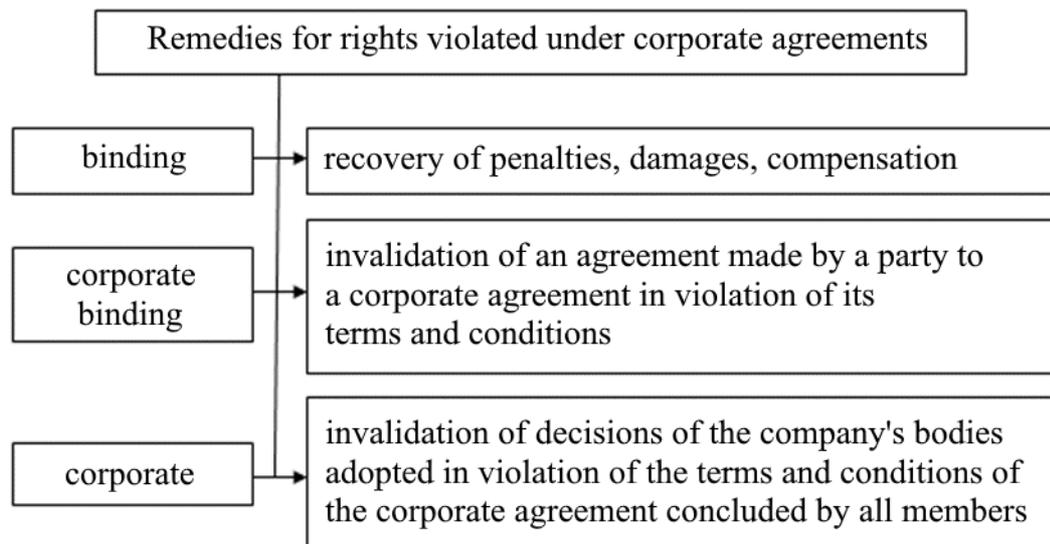
Undoubtedly, one of the universal remedies for violated right or interest is restitution. The use of this method makes provision for the possibility of specifying it in further legislative prescriptions that have the nature of special legal regulation. At the same time, this method can be applied without further specification. Therewith, in relation to ownership, remedies aimed at restoring the status, the right that existed prior to the violation can be divided into two groups: remedies aimed at restoring the lost opportunity for the right holder to use the object of the right; remedies aimed at removing obstacles for the right holder to use the object of the right that has not been lost.

Similar to the EU countries, the Latin American region and some post-Soviet countries, there is also an approach to the classification of means of protection of corporate rights depending on the organizational and legal forms of management: means of protection of corporate interests of founders of LLCs and organizations of other forms of ownership. Classification of remedies for rights violated under corporate agreements can be based on other criteria. In case of violation of the corporate contract, the following remedies are applied: compensation for damages,

collection of penalty and compensation, as well as invalidation of the transaction by the subject of corporate law, which violated the obligations stipulated by the contract or agreement. Instead, Ukrainian legislation does not contain a specific list of legal remedies but only defines the rights of the parties to the agreement between shareholders, in particular, the possibility of filing a lawsuit for the restoration of material interests caused by non-fulfillment of the terms of the agreement, collection of penalties (fines, interest), payment of compensation and other types of punishments for of this category of subjects²¹. The author believes that the most appropriate classification of remedies for rights violated under corporate agreements is to distinguish three groups of respective remedies (Chart 2). In addition to the existing means of protection, the following means of protection of rights under corporate agreements can be implemented in the Ukrainian system: coercion by a court decision to fulfill the terms of the corporate agreement and reconciliation of the received data after voting among shareholders. members of the company by court decision with the terms of the corporate agreement. In the aspect of comparative analysis of remedies for corporate rights, the consideration of the case against Notably, in Germany and other countries, the fundamental permissibility of shareholder agreements is a generally accepted norm, in contrast to Ukrainian practice. As a justification, German law refers, in particular, to the principle of freedom of agreement. The legal systems of England and the United States also do not question the right of shareholders to enter into contractual agreements with each other. The main problem with such agreements concerns the correct determination of the boundaries of possible content.

²¹ SHRAM, *Legal review of shareholder agreements*, 2008, in *Bulletin of Corporate Governance*, 7, 26-31.

Chart 2 – Classification of remedies for rights violated under corporate agreements



Source: systematised by the author.

Share agreements must comply with higher-ranking law, in particular the law on joint-stock companies. For example, shareholders have entered into an agreement according to which a company registered in one state must be governed by the laws of another state. The court rightfully recognized this clause in the contract as invalid, as it violated the general principle - the law applicable to the activity depends on the company's charter, and the charter depends on the location or place of registration. As for the right of higher rank, it is necessary to define what is meant by it. The most common point of view is to include laws, statutes and special administrative provisions that should not violate simple shareholder agreements. In this regard, it is inadmissible to include in the current shareholder agreement, which has an arbitrary form, a provision that, according to the legislation of the country, must be provided in the articles of association. In accordance with the established procedure, the question of the invalidity of the shareholder agreement, which contradicts the law in its content, arises. According to the German

interpretation, it is necessary to check each individual case and establish whether the provision of the law is mandatory and whether there is a possibility of derogating from it. Thus, in the given example, it was necessary to check whether shareholders are allowed to deviate from the requirements of the law regarding the convening and holding of general meetings, in particular, determining the quorum. Under German law, the decision would be identical because the provisions on general meetings serve to protect the rights of shareholders and therefore cannot be changed. And for a limited liability company, such a clause is acceptable subject to the consent of all shareholders.

Regarding the inadmissibility of a shareholder agreement in the absence of clear regulation of a higher rank, which is violated by the agreement. In this regard, in Germany, a shareholder agreement is considered invalid even if it violates general principles of civil law, for example, the prohibition of unauthorised exercise of a right or violation of generally accepted moral norms. The Federal Supreme Court of Germany was to rule on a case wherein shareholders granted each other the right of pre-emptive purchase in the event of alienation of shares. At the same time, the transaction defined the method by which the share price should be calculated upon making a pre-emptive sale. The problem was that the calculation method led to prices that were much lower than market prices. The Federal Supreme Court of Germany, referring to the general principles, made the following decision: the reservation is valid only regarding the pre-emptive sale, but cannot be applied relating to the method of determining the price²². German law attaches particular importance to the concept of "loyalty", which means the duty to serve the company in good faith or the duty of shareholders' loyalty to the joint-stock company, as far as shareholders are concerned. According to this concept, during their activities, shareholders should ensure not only their own interests, but also those of the company and, accordingly, its founders. In Germany, an agreement between shareholders that violates this concept will be void if it has the sole purpose of

²² Law of Ukraine No. 289-VIII "On Amendments to Certain Legislative Acts of Ukraine Concerning the Protection of Investors' Rights", 2014. <https://zakon.rada.gov.ua/laws/show/289-19#Text>

driving a minority shareholder out of the company.

The scope of the organization's legal capabilities is an important component of its activity, namely the management sector. This is explained by the fact that the results of direct entrepreneurial activity depend on this factor, as well as the satisfaction of the interests of the founders of such an organization. Attention should be paid to the fact that during the interaction of various authorized persons and bodies, disputes may arise, caused by different views of the participants of the legal entity regarding its future development. Such a situation is also possible as a result of choosing mutually exclusive goals by the founders of the corporation, which may be due to a polar desire to ensure their interests. Taking this into account, the factors described above can be identified as grounds for the formation of a corporate dispute. This situation is especially aggravated due to the shadowy activities of the majority of Ukrainian joint-stock companies. Accordingly, the basic principles on which the system of management and decision-making is based are opaque. As a result, it is possible to get negative consequences, which can be expressed in an underestimation of profit, not paying dividends to the company's participants.

Based on this, the institute for the protection of the rights of the shareholder, who has entered into corporate relations, but is deprived of the right to influence decision-making, has become particularly relevant. That is why this type of investment is quite risky.

Special attention should be paid to such an important feature of a legal entity as independent civil liability. It consists in the fact that the property of a company member is separate from other founders, and therefore they participate in civil turnover exclusively in their own name. This property allows the subject to avoid the possible influence of external factors on their decision-making or acts. As a result of this, conditions are formed that contribute to the protection of corporate relations from the pressure of the management bodies of the legal entity, as well as the

proper provision of the interests of the participant of the corporation²³²⁴.

The legal capabilities of the organization are usually reflected in its management functions, which are aimed at achieving high results specifically in the field of entrepreneurial activity, and are also combined with ensuring the wishes of the participants of the legal entity. Despite the existence of the principle of balance of interests, there are cases when, in the settlement of the company, several subjects determine different directions for its future development. Such mutually exclusive goals are due to the polar aspirations of the founders to develop corporate relations. Considering this, the researcher Yu. M. Zhornokuy²⁵ believes that the factors described above are the basis for a corporate dispute. He established that under conditions of non-transparency of the company's activities, not general, but specific problems were solved. Accordingly, Ukrainian joint-stock organizations focus attention on current management, as well as decision-making, which takes place on the basis of shadowy methods. As a result, the company may underestimate the profit, due to which the dividends cannot be paid in full. Based on this, the researcher indicated that investing with the inability to influence the management of the organization is a risky step. In this case, an important place is occupied by the independent civil liability of the legal entity. This factor is the main feature that makes it possible to distinguish the number of contributions of different members of the company. In addition, it is responsible for a person's participation in civil transactions on their own behalf and in their own interests, which allows for preventing undue external influence on the development of legal acts of a legal entity. At the same time, this approach involves the creation of opportunities for the management bodies of a legal entity to abuse their rights and, accordingly, encroach

²³ HARES, ELAMER, ALSHBILI and MOUSTAFA, *Board structure and corporate R&D intensity: evidence from Forbes global 2000, 2020*, in *International Journal of Accounting & Information Management*, 28(3), 445-463. <https://www.emerald.com/insight/content/doi/10.1108/IJAIM-11-2019-0127/full/html>

²⁴ LI, REN, YAO, QIAO, MIKALOUSKIENE, and STREIMIKIS, *Exploring the relationship between corporate social responsibility and firm competitiveness*, 2020, in *Economic Research-Ekonomska Istraživanja*, 33(1), 1621-1646. <https://hrcak.srce.hr/file/369821>

²⁵ ZHORNOKUY, *Corporate conflicts in joint-stock companies: civil law aspect*, Kharkiv, Pravo, 2015.

on its interests. As a result of such illegal actions, the level of provision and protection of the subjective civil rights of affiliated persons is deteriorating²⁶²⁷.

In order to eliminate such problems, it is possible to use one of the ways to protect the civil rights of the LLC, namely to file a lawsuit in court. The latter is directly responsible for ensuring the protection of the interests of the participant (founder) of the LLC. It is appropriate to call such a claim "derivative" or "indirect", which results from the analysis of the Anglo-Saxon legal doctrine. The development of such a legal instrument is related to the development of US case law, which later became a fundamental principle for the legal system of common law. In today's conditions, the described legal construction is widespread, as it is included in the legal systems of various countries of the world, for example: China, Singapore, Italy, Germany. The formation of such a derivative claim is due to the emergence of the joint-stock form of business organization, as well as the abuse of management bodies in relation to business companies. This legal construction is based on the practice of the English trust, namely the trust management of someone else's property. Based on this, the functions and tasks of directors of companies include the management of other people's property, as well as the financial resources of its owners, in particular, the founders. Such activity involves a person's responsibility for the preservation of other people's property, as well as the organization of the comrade's work as efficiently as possible in the interests of its participants. At the same time, this legal opportunity was not always available to shareholders, because until the beginning of the 19th century, they could not file a lawsuit in court for compensation for damage caused to the corporation.

However, the lack of an effective system of monitoring the adoption of corporate decisions by the management body made it impossible to develop this

²⁶ ULLAH, ADAMS, ADAMS and ATTAH-BOAKYE, *Multinational corporations and human rights violations in emerging economies: Does commitment to social and environmental responsibility matter?* 2021, in *Journal of Environmental Management*, 280, 111-119. <https://www.sciencedirect.com/science/article/pii/S0301479720316145>

²⁷ SHEEHY and FARNETI, *Corporate social responsibility, sustainability, sustainable development and corporate sustainability: What is the difference, and does it matter?*, 2021, in *Sustainability*, 13(11), 59-65. <https://www.mdpi.com/1124080>

area in the future. In this regard, shareholders, in the context of capital owners, were given the opportunity to sue the directors in the procedural form of a derivative action. Comparing the experience of the USA and Ukraine, it should be pointed out that in the first case, the development of a derivative claim is due to real necessity and, accordingly, is a consequence of judicial law-making in the field of corporate law. At that time, in Ukraine, this legal construction developed from the identification of the problem of derivative claims in the scientific doctorate to its consolidation at the legislative level. In these two countries, the effectiveness of the derivative claim is excellent, as in Ukraine, unfortunately, it has not found much use in applied legal science. Taking this into account, it can be stated that, provided the mechanism of responsibility of the joint-stock company is properly developed and launched, it is an extremely important element of corporate relations. This is explained by the need to ensure the protection of shareholders and third parties from unlawful encroachments that may arise from the control authorities. For this, the legislative demarcation of the competence and powers of each body in this area is important.

With this in mind, the formation of a legal system for the regulation of corporate relations was started in Ukraine. This process should be associated with the adoption of the Law "On Amendments to Certain Legislative Acts of Ukraine Regarding the Protection of Investors' Rights", which provided for the possibility of filing a derivative lawsuit. Taking this into account, amendments were made to the provisions of Art. 89 of the Civil Code¹⁹ and set out in the new edition. The latter provides that the authorized subjects are responsible for the damages caused by them to the economic subjects.

It is essential to underscore the pivotal elements of banking and financial regulation within the legislative framework of Ukraine. Thus, the National Bank of Ukraine (NBU) is the main regulatory body responsible for banking and financial regulation in Ukraine. Its main purpose is to ensure the stability and efficiency of Ukraine's banking and financial systems. The NBU operates under the Law of Ukraine

"On the National Bank of Ukraine"²⁸, which stipulates its functions, responsibilities, and powers. As a regulatory body, the NBU has the authority to issue banking licenses, permitting the operation of banking activities. Besides issuing licenses, it also takes responsibility for monitoring adherence to the licensing requirements. In situations of severe or chronic non-compliance, the NBU can rescind licenses²⁸. The NBU also supervises banks to ensure they comply with applicable laws, regulations, and prudential norms. This supervisory role involves both on-site inspections and off-site monitoring. In addition to that, the NBU establishes prudential norms, setting the regulatory requirements for banks in areas such as capital adequacy, liquidity, and risk management²⁸. The NBU is not only a regulatory body but also responsible for Ukraine's monetary policy implementation. Its monetary responsibilities range from managing the country's foreign exchange reserves and setting the discount rate, to controlling the circulation of the national currency²⁸. Apart from the NBU, the National Securities and Stock Market Commission (NSSMC) is also a significant player in the financial sector regulation. The NSSMC takes charge of the regulation and development of the securities market in Ukraine. Its main goal is to ensure market transparency, efficiency, and the protection of investors' rights²⁹.

The legal framework for banking and financial regulation in Ukraine encompasses several laws and regulations such as the "On Banks and Banking"³⁰, "On Financial Services and State Regulation of Financial Markets"³¹, and "On Securities and Stock Market"³². In a bid to combat money laundering and terrorist financing, Ukraine has instituted a law known as the "On Prevention and Counteraction to Legalization (Laundering) of the Proceeds of Crime, Terrorist Financing, and Financing

²⁸Law of Ukraine No. 679-XIV "On the National Bank of Ukraine", 1999. <https://zakon.rada.gov.ua/laws/show/679-14#Text>

²⁹National Securities and Stock Market Commission. <https://www.nssmc.gov.ua/en/>

³⁰Law of Ukraine No. 2121-III "On Banks and Banking", 2001. <https://zakon.rada.gov.ua/laws/show/2121-14#Text>

³¹ Law of Ukraine No. 2664-III "On Financial Services and State Regulation of Financial Markets", 2002. <https://zakon.rada.gov.ua/laws/show/2664-14#Text>

³²Law of Ukraine No. 3480-IV "On Securities and Stock Market", 2006. <https://www.president.gov.ua/documents/3480iv-4050>

of Proliferation of Weapons of Mass Destruction"³³. This law mandates banks and other financial institutions to enforce Anti-Money Laundering & Counter-Terrorism Financing Policy procedures like Know Your Customer (KYC) and transaction monitoring. Another significant component of the Ukrainian financial system is the Deposit Guarantee Fund (DGF)³⁴, which provides a safety net for depositors. Should a bank become insolvent, the DGF compensates the depositors up to a certain limit. In circumstances where a bank becomes insolvent or fails, the DGF and the NBU collaborate to ensure a seamless resolution process. The DGF can offer financial assistance, sell assets, or even partake in the liquidation of the insolvent bank.

In terms of consumer protection, the NBU and other regulatory authorities are committed to protecting consumers of financial services. Laws like the "On Consumer Lending"³⁵ and the "On Payment Systems and Money Transfer in Ukraine"³⁶ help ensure this protection by mandating transparent information disclosure, fair treatment of customers, and the availability of redress mechanisms for consumer complaints. The NBU also has oversight over payment systems and financial market infrastructures, ensuring their safe and efficient operation. The legal basis for the operation and oversight of payment systems are found in the "On Payment Systems and Money Transfer in Ukraine"³⁶ law and NBU regulations. In the fight against corruption, the National Agency on Corruption Prevention (NACP)³⁷ leads the charge in developing and implementing national anti-corruption policy. Banks and other financial institutions are required to adhere to anti-corruption laws, including the "On Corruption Prevention" law³⁸.

³³Law of Ukraine No. 361-IX "On Prevention and Counteraction to Legalization (Laundering) of the Proceeds of Crime, Terrorist Financing, and Financing of Proliferation of Weapons of Mass Destruction", 2020. <https://zakon.rada.gov.ua/laws/show/361-20#Text>

³⁴ Deposit Guarantee Fund. <https://www.fg.gov.ua/>

³⁵Law of Ukraine No. 1734-VIII "On Consumer Lending", 2017. <https://zakon.rada.gov.ua/laws/show/1734-19#Text>

³⁶ Law of Ukraine No. 2346-III "On Payment Systems and Money Transfer in Ukraine", 2001. <https://zakon.rada.gov.ua/laws/show/2346-14#Text>

³⁷ National Agency on Corruption Prevention. <https://nazk.gov.ua/uk/>

³⁸Law of Ukraine No. 1700-VII "On Corruption Prevention", 2014. <https://zakon.rada.gov.ua/laws/show/1700-18#Text>

3. Based on the conducted research, it should be established that law-enforcement and doctrinal practice developed theses on the protection of corporate rights within the general provisions of civil legislation. The analysis of objects of modern science is based on the fact that legal means are divided into universal (general) and special. Their list is open and usually fixed in the provisions of the civil legislation of different countries and has significant differences.

The study proved that not all means of legal protection should be endowed with universal properties, since some of them could act as special ones for proper regulation of corporate relations. In addition, the study conducted an analysis of judicial practice, based on which it was established that there are differences in the interpretation of the same situations and the court's rendering of different decisions. During the comparative analysis of the national experience with foreign practice, additional means of legal protection were discovered, which are currently not used in the Ukrainian legal environment and may be implemented in it in the future. The conducted study of law enforcement practice made it possible to reach a conclusion about the low efficiency of the existing means of protecting corporate rights and this legal field as a whole.

Therefore, legal doctrine, as well as law enforcement practice, should be aimed at finding a new legal entity that will correspond to the modern environment. For the development of this scientific research in the future, attention should be paid to the following three directions: clarifying the essence of corporate relations, establishing the limits of the use of special means of protection and identifying new effective special means of protecting corporate rights.

HIGHER ORDER MOMENTS PORTFOLIO OPTIMIZATION VIA DEEP LEARNING

Cosimo Izzo* - Francesca Medda**

ABSTRACT: *We analyse the problem of asset allocation with Deep Learning techniques via direct deterministic policy gradient methods applied to different reward formulations that depend on the desired degree of approximation of an investor's utility function, and therefore accounting for higher order moments. We compare against other deep learning and standard financial approaches. As we take an utilitarian view of the portfolio optimization problem, a contribution of this work is to compare the performances of Deep Learning Portfolio Optimization methods when using different objective functions depending on the desired degree of approximation of a given utility function. We test the different approaches via a recursive out-of-sample exercise on daily data from the 1st of January 2011 up until the 15th of March 2021. The investment set contains the sectoral decomposition of the SP500 plus the Bloomberg Barclays US Aggregate index. We find that including higher moments into the objective function helps improving performances, albeit the minimum-variance strategy combined with the Deep Dynamic Factor Model of Andreini et al. (2020) outperforms all the other methods over the sample analysed and in terms of the risk-adjusted metrics considered. We conclude this chapter by carrying out an analysis of the relation between the excess returns generated by selected strategies, and standard financial factors. We do so both by using linear regression methods and deep learning techniques together with Shapley values.*

* Independent Researcher

** UCL Institute of Finance and Technology

This work reflects the analysis and views of the authors, Cosimo Izzo and Francesca Medda. No reader should interpret this work to present the views of any third party. Assumptions, opinions, views and estimates constitute the authors' judgment as of the date given and are subject to change without notice and without duty to update.

SUMMARY: 1. Introduction and literature review. - 2. Methodological background. – 2.1. *Portfolio optimisation and utility function*. – 2.2. Other approaches to portfolio optimisation. – 2.3. Deep portfolio optimisation. – 2.4. Dynamic framework. - 3. *Dynamic portfolio optimisation with deep learning and higher order moments*. – 4. An application to the us stock market. – 4.1. Data and training details. – 4.2. Results and discussion. – 4.3. Factor based shapley attributions. – 5. Conclusion.

1. The application of machine learning to economics and finance has often encountered the problem of its *black box* nature. We can define a *black box* either as a function, such in the case of deep learning models, too complex to be comprehended or a function that is proprietary. Nonetheless, some economic and financial problems which are mainly focus on prediction, can very effectively be structured by using machine learning approaches. These approaches are indeed able to outperform conventional econometrics approaches, particularly due to their ability to capture nonlinearities of data. The objective of this paper is to examine the problem of portfolio optimization by applying a deep learning approach.

A formulation of the portfolio optimisation problem consists in finding the series of vectors representing asset allocation weights $\{w_t\}_{t \geq 0}$ that maximise an expected lifetime utility subject to some constraints¹. This problem involves the estimation of future wealth distribution, which in turns is a function of asset allocation weights and future returns' joint distribution; thus, the task, implicitly or explicitly, involves also a prediction problem. Therefore, one can think of it as a combination of two problems: a forecasting problem and an optimisation problem given these forecasts. However, the problem can also be considered from the viewpoint of a unique reward optimisation problem under the lens of Reinforcement Learning. In particular, one can see the portfolio optimisation problem under the lens of stochastic control and therefore interpret the problem as a Markov Decision

¹ Within this work we focus on self-financing portfolios, thus assuming income and consumption are zeros across all periods (see Back, 2017, for example).

Process (MDP). Namely, one can collect in a stochastic vector x_t the states relevant for a given transition probability function that conditioned on those and the actions taken at time t will provide the next state x_{t+1} and the reward achieved in transitioning from the current state to the new state, given the action taken. Within the portfolio optimisation context the action space could be interpreted as the feasible allocation weights set. Those actions can be expressed as the output of a function of the current states which is called the policy function. On the other side, the state vector x_t should contain all features necessarily to specify the state transition probabilities and rewards.

Although this stochastic control problem could be approached with standard tools from Dynamic Programming, the dimensionality of the portfolio allocation problem makes the computational cost of these methods impossible to sustain. Therefore, approximate methods are more appropriate and the representation of the portfolio optimisation task as a stochastic control problem unleashes the power of approximate methods from the Reinforcement Learning (RL) literature (see Szepesvári, 2010; Sutton and Barto, 2018; Sewak, 2019, for example). In practice these approaches are sensible to algorithmic design, the features representing the states, the action sets definition and the design of the reward function that aims to represent and/or approximate some or all aspects of the true (lifetime) utility function of the investor. Within the field of RL, when deep neural networks are used to parametrise some or all parts of the process the overall approach takes the name of Deep Reinforcement Learning (DRL).

Hu and Lin (2019) outline and address some of these issues in the context of DRL for portfolio management. Additionally, financial data are not identically and independently distributed, and this could prohibit the use of randomised cross validation methods for hyper-parameter tuning ². Moreover, in its original form the problem is not first order Markov, and it needs to be converted from an M^{th} order

² These models have a number of hyperparameters whose values are generally selected on so called validation set(s) produced via a method called cross-validation. The problem of cross-validation in time series is discussed also in Bergmeir et al. (2018).

Markov³. Also, in financial applications a full state space representation is seldom if ever possible to obtain, given the unknown high dimensional features of the economic and financial world. Therefore, more than (convertible to) fully observable MDP we will be faced with a problem that can be at most converted to a partially observable MDP (POMDP). This makes standard RL tools prone to possible failures. The authors consider also the problem of the reward design and discuss the use of different metrics to approximate a general utility function including the Sharpe ratio. They consider different DRL approaches including policy gradient methods and actor-critic methods. The former optimises directly a parametrised policy function with respect to the designed reward. In the latter the policy function is used by the actor to output an action which is then evaluated by a critic network.

According to Almahdi and Yang (2017), the first applications of dynamic programming methods to the asset allocation problem are discussed in Bertsekas and Shreve (1996), while early applications of RL can be found in Moody et al. (1998); Moody and Saffell (2001). More recently, Huang (2018) proposes to solve the problem with a state of the art DRL algorithm: Deep Recurrent Q-Network (DRQN). In an application to the exchange rate market with data at the 15 minutes frequency, they define the state space as a 198 dimensional vector which includes time features, market features including past closing and tick volumes of each currency, and position features representing the current allocation of the investor. The action space allows for changes in these allocations. Rewards are defined as portfolio log-returns net of transaction costs, which are the product of a constant spread and the absolute change in allocations between two consecutive periods. The DRQN is parametrised with LSTM layers and the authors show the potential of this framework.

Chen et al. (2018) propose agent-based reinforcement learning for trading via

³ A stochastic process is said to satisfy the first order Markov condition (from Andrey Andreyevich Markov) if at any time t the conditional probability of an arbitrary future event given the entire past of the process is equal to the conditional probability given only the present state values (see Murphy, 2022, for example).

cloning trading strategies from professionals. Chakraborty (2019) evaluates the profitability of various Reinforcement Learning (RL) algorithms, including Q-learning and SARSA. They show that such approaches can beat the buy and hold strategy. Jeong and Kim (2019) propose a framework that combines deep neural networks, RL and Transfer Learning (TL) to build a financial trading system for profit maximisation. The authors identify in TL a way to address the small data problem in Finance. Ritter (2017) shows in a simulated market the potential of reinforcement learning solutions and Q-learning in particular.

Song et al. (2017) analyse portfolio allocation from the perspective of a ranking problem to be then converted to a long-short strategy. They adopt two ranking algorithms: ListNet and RankNet. They apply the two algorithms using 10 years of market and news sentiment data. In a backtesting assessment from 2006 to 2014, they show that their strategies produce risk-adjusted returns superior to the S&P500 index and a measure of the hedge fund industry average performance.

Almahdi and Yang (2017) extend the existing work in RL to build a portfolio optimisation framework that accounts for transaction costs and features adaptive stop-loss to consistently outperform the hedge fund index benchmark. Moreover, they suggest a reassessment of the previously proposed RL objective functions, including those based on the Sharpe ratio. They propose to use the Calmar ratio, which differs from the Sharpe ratio with respect to the denominator adopted to adjust returns by risk. In particular, the Sharpe ratio adjust returns by taking a ratio of the expected returns to the standard deviation; while, the Calmar ratio uses the expected maximum drawdown as denominator. They show this latter specification to deliver superior return performances.

Within the context of Deep Reinforcement Learning, Jiang et al. (2017) introduce a framework that aims to address the portfolio allocation issue using three types of neural networks: CNN, a basic RNN, and LSTM. Liang et al. (2018) analyse different deep reinforcement learning algorithms, including Deep Deterministic Policy Gradient (DDPG), Proximal Policy Optimization (PPO) and Policy Gradient (PG).

In an empirical evaluation on the Chinese stock market, they found that the standard approaches that are useful in game playing and robot control contests do not apply in this financial problem. In particular, they show that PG is more desirable in financial market than DDPG and PPO, although the latter being more advanced. Finally, they propose adversarial training methods and a PG algorithm to outperform the uniform constant rebalanced portfolio. Heaton et al. (2017) support the idea that deep learning tools can detect and possibly exploit interactions in the data that do not seem to be captured by existing financial economic theory. They show that a portfolio weighted using deep learning outperformed the IBB index. Deng et al. (2016) use a DRL approach by combining recurrent networks with direct policy learning and show successful applications on the S&P 500 and on commodity future contracts.

Wang et al. (2020) propose a combination of LSTM and mean-variance in an application to the components of the UK Stock Exchange 100 Index with data from 1994 to 2019. The LSTM selects the assets with higher expected returns. They compare against other ML tools, such as support vector machine, random forest, deep neural networks, and autoregressive integrated moving average models. They show LSTM can outperform all the others. On the selected assets a mean-variance optimisation is carried out, and the authors find this LSTM mean-variance strategy to outperform five baselines across all the performance measures used, including cumulative returns and Sharpe ratio.

Recently, Huynh and Lenhard (2022) used asymmetric autoencoders to estimate an exact static factor model on asset returns and combine it with minimum variance. They tested the proposed method against other dimension reduction techniques and observable financial factors based approaches, finding the asymmetric autoencoder to significantly outperform. This finding is consistent with the results of the experiments presented in this work, where we find that combining minimum variance with the asymmetric autoencoder based approach of Andreini et al. (2020) delivers the best performance.

Alternative approaches are adopted in De Prado (2016) and Raffinot (2017). Here the authors employ hierarchical clustering algorithms to construct diversified portfolios. Namely, a variation of risk parity (De Prado, 2016) and a variation of the equal risk contribution (Raffinot, 2017), both aiming to take advantage of the possible hierarchical correlation structure among assets, are introduced. Finally, other Machine Learning approaches to the problem include also the application of evolutionary algorithms (see Moral-Escudero et al., 2006; Hassan and Clack, 2008; Rosenberg et al., 2016, for example) and quantum annealing techniques (Rosenberg et al., 2016) in order to take into consideration additional constraints that are faced in the practical implementation process, and that complicate the optimization problem.

2. In this section we discuss the portfolio optimisation problem. We start by formulating it as a single period utility maximisation problem following Scherer and Winston (2011). We then discuss other common approaches which are not utility based. Finally, we consider recent Deep Learning approaches for portfolio optimisation. We conclude with a dynamic formulation of the problem that allows to use Reinforcement Learning techniques.

2.1. Portfolio optimisation is the process of finding the optimal allocation of wealth to different investments, given some objective and constraints. We are going to call $U(W_t)$ the utility function of a representative investor with wealth W_t at the end of period t , with $W_t = w_t'(1+r_t)$ where $\{r_t\}_{t \geq 0}$ is assumed to be a vector of stationary stochastic processes representing asset returns, while w_t represents the vector of allocation weights over n assets chosen by the agent at the beginning of the period. The optimal single period asset allocation problem can be formulated as

$$\max_{w_t \in \Omega} E[U(W_t)] = \max_{w_t \in \Omega} \int \dots \int U(w_t'(1+r_t)) dF(r_t) \quad (1)$$

where Ω is the set of permissible portfolios, while $F(r_t)$ represents the joint cumulative distribution function of asset returns. The expected utility can be

approximated via a Taylor Series around a root point, \bar{W} . The approximation converges to the true expected utility function for all levels of wealth when we are faced with an exponential or polynomial utility, while for power utility it converges only if the wealth is within a given range (Loistl, 1976; Lhabitant, 1998; Jondeau and Rockinger, 2006). Hence, and assuming conditions for equality holds, we get

$$E[U(W_t)] = \sum_{k=0}^{\infty} \frac{U^{(k)}(\bar{W})}{k!} E[(W_t - \bar{W})^k] \quad (2)$$

where $U^{(k)}(\bar{W})$ represents the k -th derivative of the utility function evaluated at the root point \bar{W} , and can be interpreted as the investor's preference (or aversion) towards the k -th moment of the distribution. Notably, as observed by Jondeau and Rockinger (2006) and shown by Scott and Horvath (1980), under the assumptions of strict consistency for moment preferences, decreasing absolute risk aversion at all levels of wealth, and positive marginal utility, $U^{(k)}(\bar{W})$ is strictly negative for even k and strictly positive for odd k . In case the root point \bar{W} coincides with the expected wealth, we have the following fourth order Taylor approximation:

$$E[U(W_t)] \approx U(\mu_t^p) + \frac{1}{2}U^{(2)}(\mu_t^p)var_t^p + \frac{1}{6}U^{(3)}(\mu_t^p)sk_t^p + \frac{1}{24}U^{(4)}(\mu_t^p)\kappa_t^p. \quad (3)$$

where we define expected returns, variance, (un-standardised) skewness and kurtosis in the following ways:

$$\mu_t^p = E[\mathbf{w}_t' \mathbf{r}_t], \quad var_t^p = E[(\mathbf{w}_t' \mathbf{r}_t - \mu_t^p)^2] = E[(W_t - \bar{W})^2], \quad sk_t^p = E[(\mathbf{w}_t' \mathbf{r}_t - \mu_t^p)^3] = E[(W_t - \bar{W})^3], \quad \kappa_t^p = E[(\mathbf{w}_t' \mathbf{r}_t - \mu_t^p)^4] = E[(W_t - \bar{W})^4].$$

Alternatively, one can take the Taylor expansion of expected utility around $W = 0$, yielding to the fourth order Maclaurin expansion:

$$E[U(W_t)] \approx U(0) + U^{(1)}(0)M_1(W_t) + \frac{1}{2}U^{(2)}(0)M_2(W_t) + \frac{1}{6}U^{(3)}(0)M_3(W_t) + \frac{1}{24}U^{(4)}(0)M_4(W_t) \quad (4)$$

where $M_i(W_t)$ is the moment generating function. Conditions for sign identification of the relations between the different moments and the utility function can be found in Scott and Horvath (1980).

Mean Variance Optimisation as a special case. Markowitz's theory suggests that two dimensions matter when picking up a portfolio that maximises the utility of an investor: expected return and variance of the portfolio. Thus, the problem of portfolio selection boils down to a trade-off between the mean return of a portfolio μ_t^p and its variance var_t^p . Therefore, yielding the following optimisation problem:

$$\max_{w_t \in \Omega} E[U(W_t)] = \mu_t^p - \frac{\lambda}{2} var_t^p = E[w_t' r_t] - \frac{\lambda}{2} E[(w_t' r_t - \mu_t^p)^2] \quad (5)$$

where λ is a positive parameter representing investor aversion towards risk, in this framework related to the second moment only of the return distribution.

It now emerges that equation (5) relates to equations (3) and (4) when we drop dependence of the utility function to the third and fourth moment of the distribution. This is legitimate in two circumstances: when the utility function is quadratic, and/or when returns follow a multivariate elliptical distribution. A critique raised against the quadratic utility assumption is that it provides unintuitive implications when returns rise above a critical value. In particular, investors maximising a quadratic utility function after a critical value prefer less return to more. On the statistical properties of asset returns, Chamberlain (1983) showed that when these follow a multivariate elliptical distribution (e.g.: Normal, Student-t and Levy distributions), the mean-variance approximation is exact for all possible utility functions. Empirically, Kroll et al. (1984) and Jondeau and Rockinger (2006) found that the mean-variance provides a good approximation only under moderate non-normality.

Approaches to Higher Moments. When an investor is faced with two investment options exhibiting the same first and second moments, it comes naturally for the investor to consider higher order moments. A rational investor would certainly prefer higher skewness and lower kurtosis. Therefore, the mean-variance approximation is no longer appropriate when higher moments matter and cannot be spanned by lower ones (Scherer and Winston, 2011). This is indeed the approach taken, for example, by Harvey et al. (2010), where skewness and co-skewness are accounted for when considering different portfolios. In Fabozzi et al. (2007), portfolio

selection in the presence of higher moments is discussed, and they show that a fourth order Taylor expansion of a logarithmic utility function delivers an objective that penalises variance and kurtosis, while rewarding expected returns and skewness. Finally, Jondeau and Rockinger (2006) analyse the case for the first four central moments of the expected utility function in general and of the CARA (Constant Absolute Risk Aversion) in particular; in Lai et al. (2006), a polynomial goal programming framework is developed to solve the mean-variance-skewness-kurtosis problem.

Transaction Costs. Transaction costs can be modelled in different ways. Following Sun et al. (2006) we can model linear transaction costs such that when taking allocation weights w_{t-1}^+ the cost incurred is

$$C_t = C(w_t, w_{t-1}^+) = c' |w_t - w_{t-1}^+| \quad (6)$$

Where w_{t-1}^+ is the pre-rebalance (end of period) asset position $w_{t-1}^+ = \frac{w_{t-1} \circ (1+r_t)}{w_{t-1}'(1+r_t)}$, $|\cdot|$ is the element-wise absolute value and c is the vector of transaction costs; thus, equation (6) induces a penalisation term on rebalancing.

Estimating statistics. In order to maximise the approximated utility function in equations (3), (4) or (5), it is first necessary to compute an estimate for the statistics of interest, or more generally of the joint distribution function of asset returns $F(r_t)$. Different approaches are available in the literature, starting from the simple use of historical sample moments, using moving average or exponential moving averages, or adopting time series models for the purpose. For example, autoregressive models can be estimated to provide next period estimates of the first and second moment of asset returns. The estimation of these statistics is tantamount to the performance, as errors propagate into the optimisation problem with the consequence of injecting noise in the asset allocation step. In this work we provide estimates of the relevant statistics for the asset allocation strategies with two approaches, the first of which applies simple sample estimates using expanding windows. In the second approach we use the output of the Deep Dynamic Factor Model (D2FM) introduced in Andreini et al. (2020).

2.2. We now present other approaches to the problem of optimal asset allocations that we will use and empirically evaluate in this work. All of them require an estimate for the relevant statistics characterising some aspects of the distribution of next period asset returns.

Minimum Variance. Minimum variance is similar in spirit to the mean variance optimisation framework, but assumes that investors care only about risk. Hence, the objective function is:

$$\min_{\mathbf{w}_t \in \Omega} E[(\mathbf{w}'_t \mathbf{r}_t - \mu_t^p)^2]. \quad (7)$$

A comparison between mean variance and minimum variance signals that a minimum variance investor has a lower expected return profile. Nevertheless, empirically high volatility and high beta stocks have performed worst than low volatility and low beta stocks in the U.S. market (Baker et al., 2011). Additionally, one can think about the minimum variance as special case of the mean-variance where prices's stochastic processes are martingales, hence making expected returns zero.

Risk Parity. The risk parity portfolio consists in allocating wealth to the assets so that they contribute equally to the variance of the portfolio; while mean-variance generally leads to concentrated positions in a few assets, the risk parity approach favours diversification (Bai et al., 2016). The objective function in this setting is

$$\min_{\mathbf{w}_t \in \Omega} \sum_{i=1}^n [w_{t,i} - \frac{(\sum_{i=1}^n \sigma_i(\mathbf{w}_t))^2}{(\sum_t \mathbf{w}_t)_i N}]^2, \quad (8)$$

where Σ_t is the variance covariance matrix of asset returns r_t , while $(\Sigma_t \mathbf{w}_t)_i$ is the i -th element of the vector of the product of this matrix with the asset weights. Finally

$$\sigma_i(\mathbf{w}_t) = \frac{w_{t,i} (\Sigma_t \mathbf{w}_t)_i}{\sqrt{\mathbf{w}'_t \Sigma_t \mathbf{w}_t}}.$$

Hierarchical Risk Parity. Hierarchical risk parity, as introduced by De Prado (2016, 2020), deals with three major concerns of quadratic optimisers in general and the Markowitz framework in particular: instability, concentration and under-performance. The authors argues that in any optimisation framework that involves

the inversion of the variance-covariance matrix, the higher is the correlation among asset returns, the more unstable the solution, notwithstanding the higher the need for diversification in such a situation. This is what De Prado (2016) calls the Markowitz' curse, and to deal with the problem he introduces an algorithm with three steps: Hierarchical Tree Clustering, Quasi-Diagonalisation and Recursive Bisection. The Hierarchical Tree Clustering step at first converts a correlation matrix ρ_t into a correlation distance matrix D_t , such that element $D_{t,i,j} = \sqrt{0.5(1 - \rho_{t,i,j})}$. Then another distance matrix is constructed to measure the closeness in similarity of two assets with respect to all other assets in Euclidean metric. This measure takes the form $\bar{D}_{t,i,j} = \sqrt{\sum_{k=1}^d (D_{t,k,i} - D_{t,k,j})^2}$. Finally, clusters are defined by taking the two elements at the minimum of this distance matrix. The procedure is repeated by recursively dropping the clustered elements so as to construct a dendrogram. The Quasi-Diagonalisation step consists in a rearrangement of the covariance matrix such that similar assets are placed together, and dissimilar ones are placed far apart. Finally, allocations are provided by the Recursive Bisection step. Namely, all weights are initialised to 1. Then, starting from the topmost cluster, we compute the variance of the sub-clusters as $\tilde{V}_{t,i} = \mathbf{w}_t' V_{t,i} \mathbf{w}_t$, where $V_{t,i}$ with $i = 1, 2$ is the variance of child cluster i , while $\mathbf{w}_t = \frac{\text{diag}(V_t)^{-1}}{\text{trace}(\text{diag}(V_t)^{-1})}$. Successively, a split factor is computed as $\alpha_t = 1 - \frac{\tilde{V}_{t,1}}{\tilde{V}_{t,1} + \tilde{V}_{t,2}}$. Finally, weights in child cluster 1 are scaled by α_t , while those in child cluster 2 by $1 - \alpha_t$. The process is repeated until leaf nodes. A detailed implementation of the algorithm can be found in the original source (De Prado, 2016, 2020).

2.3. Recently, a number of papers have proposed the use of deep learning techniques to solve the asset allocation problem (see Zhang et al., 2020; Noguera Alonso and Srivastava, 2020; Lucarelli and Borrotti, 2020; Koker and Koutmos, 2020; Yashaswi, 2021, for example). In such a framework, asset allocation weights are given by a parametrised deep learning model of the following form:

$$\mathbf{w}_t = DNN(\mathbf{x}_t; \theta) \tag{9}$$

where $DNN(\mathbf{x}_t; \theta)$ stands for a generic deep neural network with parameters θ and inputs \mathbf{x}_t . One difference in this approach compared to the aforementioned is the combination of the prediction and optimisation step in a unique one. Indeed, the method does not require the user to plug in any estimate of key statistics for future returns distribution, but rather only the history of returns together with any other feature that the user deems relevant, and which we collect in \mathbf{x}_t (on top of the objective function to optimise). Another important difference with respect to the static myopic approaches discussed thus far is the dynamic aspect of this methodology, and its relation to Dynamic Programming and Reinforcement Learning. The DNN in equation (9) can be seen as a parametrised policy function solving the dynamic asset allocation problem that we will discuss in next section. Nevertheless, the link is clear only when cumulative rewards in terms of profits are specified as objective function, or the average returns as in Nogueira Alonso and Srivastava (2020), but when other types of loss are designed, like the Sharpe ratio, such connection is no longer sharp (Zhang et al., 2020).

In order to optimise the parameters θ , we need to define an objective function (or loss function). In Zhang et al. (2020) the Sharpe ratio is used, i.e., $-L(\theta) = \frac{\hat{\mu}_t^p(\theta)}{\hat{\sigma}_t^p(\theta)}$, while Nogueira Alonso and Srivastava (2020) use $-L(\theta) = \hat{\mu}_t^p(\theta)$. Here, we set the minus in front of the loss function $L(\theta)$, as this one is generally minimised. Estimates of the statistics are computed over a given trading period; thus, we have $\hat{\mu}_t^p(\theta) = \frac{1}{T} \sum_{t=1}^T (\pi_\theta(\mathbf{x}_t)' \mathbf{r}_t)$ and $\hat{\sigma}_t^p(\theta) = \sqrt{\frac{1}{T} \sum_{t=1}^T (\pi_\theta(\mathbf{x}_t)' \mathbf{r}_t - \hat{\mu}_t^p(\theta))^2}$, where $\pi_\theta(\mathbf{x}_t)$ are the asset allocation decisions taken for period t , which are function of the neural network input features summarised in the vector of relevant states \mathbf{x}_t , and its parameters θ (i.e., $\pi_\theta(\mathbf{x}_t) := DNN(\mathbf{x}_t; \theta)$). In both methods, the output layer is a softmax function so that weights are larger than zero and sum up to 1, thus, imposing a long-only fully invested constraint. Generalised gradient methods on the loss function $L(\theta)$

allow us to ameliorate the parameters θ and the conditional allocation weights $\mathbf{w}_t = \pi_\theta(\mathbf{x}_t)$, with respect to the specified loss function.

2.4. Up to now, and with the exception of the previous subsection, we have discussed the static version of the portfolio optimisation problem. Namely, we have assumed a single period framework. We now proceed by formulating the dynamic version of the problem within a self-financing framework, thus without accounting for consumption and income effects. Before doing this, let's define the MDP faced by the investor. We assume at any given point in time t the investor observes a vector of states \mathbf{x}_t , conditioned on which he takes action $\mathbf{w}_t = \pi(\mathbf{x}_t)$. Upon taking this action, the investor incurs into an instantaneous cost C_t defined in equation (6) which cumulates with the expected reward. The latter is a function of the allocation strategy \mathbf{w}_t and the next period returns' distribution \mathbf{r}_{t+1} which we assume to be both fully characterised by the current states \mathbf{x}_t . The system then evolves according to a given transition probability kernel P from state \mathbf{x}_t to the new state \mathbf{x}_{t+1} , and so on. Thus, similarly to Sun et al. (2006) we can write the following Bellman equation⁴

$$J_t(\mathbf{x}, \pi) = \max_{\pi} \{E[G(\mathbf{x}_t, \pi) + J_{t+1}(\mathbf{x}_{t+1}, \pi) | \mathbf{x}_t = \mathbf{x}]\}, \quad (10)$$

with the instantaneous reward defined as

$E[G(\mathbf{x}_t, \pi) | \mathbf{x}_t = \mathbf{x}] = E[C(\pi(\mathbf{x}_t), \mathbf{w}_{t-1}^+) + U(\pi(\mathbf{x}_t)'(1 + \mathbf{r}_{t+1})) | \mathbf{x}_t = \mathbf{x}]$, where we have collected the previous period weights in the state vector \mathbf{x}_t together with all other relevant information to ensure Markovianity. This dynamic formulation of the problem allows us to apply the techniques Stochastic Control and Approximate Stochastic Control (e.g., Reinforcement Learning) techniques to the problem.

⁴ Sun et al. (2006) use this formulation in the context of optimal portfolio rebalancing, we borrow their formulation and adapt it to our context.

3. In this section we introduce our formulation of dynamic portfolio optimisation, which is adapted from the portfolio rebalancing framework presented in Sun et al. (2006). We assume there is no consumption and income, and thus the wealth process in this circumstance is called self-financing (Back, 2017). Let's start by casting the dynamic portfolio optimisation problem into a Markov Decision Process (MDP). Namely, we assume that at time t the investor observes the realisation of a stochastic vector \mathbf{x}_t which includes the period t asset returns r_t , the previous period portfolio allocation weights w_{t-1} , and any other relevant information to correctly specify the state transition kernel from the current state to the next state. Conditioned on the realisation of the current state \mathbf{x}_t , the investor chooses the new allocation weights $w_t = \pi_\theta(\mathbf{x}_t)$ via the policy function π_θ in order to maximise the value function. To this purpose, we can express the value function of the investor as follows

$$J_t(\mathbf{x}_t, \pi_\theta) = E_t[G(\mathbf{x}_t, \pi_\theta) + J_{t+1}(\mathbf{x}_{t+1}, \pi_\theta)] \quad (11)$$

where E_t is the expectation operator conditioned on information up to time t which is summarised into \mathbf{x}_t . The first term on the right hand side of equation (11) is the instantaneous reward and it is defined here as

$$E_t[G(\mathbf{x}_t, \pi_\theta)] = C(\pi_\theta(\mathbf{x}_t), w_{t-1}^+) + E_t[U(\pi_\theta(\mathbf{x}_t)'(1 + r_{t+1}))], \quad (12)$$

Where $C(\pi_\theta(\mathbf{x}_t), w_{t-1}^+)$ represents transaction costs incurred when taking action $\pi_\theta(\mathbf{x}_t)$ from state \mathbf{x}_t . The latter includes the previous allocation weights w_{t-1} and the current realised returns r_t through which it is possible to compute the end of period allocation weights $w_{t-1}^+ = \frac{w_{t-1}(1+r_t)}{w_{t-1}(1+r_t)}$. Thus, equation (12) imposes a separability condition between transaction costs and instantaneous utility similarly to Sun et al. (2006).

The second term of equation (12), that is $E_t[U(\pi_\theta(\mathbf{x}_t)'(1 + r_{t+1}))] = E_t[U(W_{t+1})]$ is the expected single period utility from wealth. If we then take a fourth order Taylor expansion of $E_t[U(W_{t+1})]$ around some root point $\bar{W} = 0$, and to make this

approximation implementable we assume a CARA utility function of the form $U(W_{t+1}) = -e^{-\lambda \widetilde{W}_{t+1}}$, we obtain

$$\begin{aligned} E_t[U(W_{t+1})] &\propto \lambda M_{1|t}(W_{t+1}) - \frac{\lambda^2}{2} M_{2|t}(W_{t+1}) + \frac{\lambda^3}{6} M_{3|t}(W_{t+1}) - \frac{\lambda^4}{24} M_{4|t}(W_{t+1}) \\ &= E_t[\widetilde{U}(W_{t+1})] = E_t[U(\pi_\theta(\mathbf{x}_t)'(1 + \mathbf{r}_{t+1}))] \end{aligned} \quad (13)$$

where λ is the risk aversion parameter that we set to 1 in the empirical section, while $M_{i|t}$ is the i -th conditional moment to time t information, here again summarised in \mathbf{x}_t . This formulation allows us to have an intuitive statistical interpretation of investors' preferences with respect to relevant statistics of the portfolio return's distribution, and it encompasses the mean-variance preferences as a special case.

We can now replace $E_t[U(W_{t+1})]$ with its approximation $E_t[\widetilde{U}(W_{t+1})]$ and express the new value function from equation (11) as follows

$$J_t(\mathbf{x}_t, \pi_\theta) = E_t[\widetilde{G}(\mathbf{x}_t, \pi_\theta)] + E_t[J_{t+1}(\mathbf{x}_{t+1}, \pi_\theta)], \quad (14)$$

Where

$$E_t[\widetilde{G}(\mathbf{x}_t, \pi_\theta)] = C(\pi_\theta(\mathbf{x}_t), \mathbf{w}_{t-1}^+) + E_t[U(\pi_\theta(\mathbf{x}_t)'(1 + \mathbf{r}_{t+1}))], \quad (15)$$

noting that both terms depend just on the policy π_θ and the properly constructed state \mathbf{x}_t . We can then express the Q -function of this problem when following the policy π_θ for all subsequent actions and conditioned on the state \mathbf{x} and action \mathbf{w} at time $t = 0$ as

$$Q_{\pi_\theta}(\mathbf{x}, \mathbf{w}) = E\left[\sum_{t \geq 0} \widetilde{G}(\mathbf{x}_t, \pi_\theta) \mid \mathbf{x}_0 = \mathbf{x}, \mathbf{w}_0 = \mathbf{w}\right]. \quad (16)$$

It is now possible to apply Reinforcement Learning and Deep Reinforcement Learning techniques to solve this formulation of the dynamic portfolio optimisation problem. In particular, and assuming both the policy and the Q function are differentiable, one can apply direct deterministic policy gradient methods to optimise the parametric policy function π_θ with respect to its parameters θ via gradient ascent computed as follows

$$\Delta_\theta J_\theta = E[\Delta_\theta \pi_\theta(\mathbf{x}) \Delta_{\mathbf{w}} Q_{\pi_\theta}(\mathbf{x}, \mathbf{w}) \mid \mathbf{w} = \pi_\theta(\mathbf{x})], \quad (17)$$

where the actual value $\Delta_{\theta}J_{\theta}$ is replaced by its sample estimates $\widehat{\Delta_{\theta}J_{\theta}}$ which involve the computation of the derivatives of the sample estimates for the moments introduced in equation (13) and entering here via equation (16).

4. In this section we compare different approaches on a dataset of daily returns from the U.S. stock market. In particular, we restrict the investment set to the Standard & Poor's 500 sectoral indices, plus the Bloomberg Barclay U.S. Aggregate Bond index.

We do a horse race in the form of a recursive out-of-sample comparison among different investment strategies, including: buy and hold starting from equally weighted, equally weighted, mean-variance, minimum variance, risk-parity and hierarchical risk-parity. For these approaches estimates of the parameters (mean, covariance or correlation matrix) are carried out both with expanding window sample estimates and through the D^2FM of Andreini et al. (2020).

We compare these methods to other Deep Learning Portfolio Optimization (DLPO) approaches. In particular, we specify different approximations of equation (13) before applying the direct policy gradient approach via equation (17). Following Nogueira Alonso and Srivastava (2020), in one of our specifications we use the first moment only. However, we also use up to the second, third and fourth moments. Finally, we also compare against the Sharpe ratio objective proposed in Zhang et al. (2020). All of these deep learning approaches share the same set of possible deep learning architectures, however we select for each of them separately the best architecture within this shared set based on the performance achieved on the last 10% of the in-sample data. We provide as input either the raw historical returns or the state vectors estimated by the D^2FM . Overall, we compare a total of 20 strategies in a recursive out-of-sample exercise. Namely, starting from the beginning of the out-of-sample portion of the data, each of the models is provided with past data to then output asset allocation weights for the next period. This procedure is repeated until

the end of the out-of-sample. We next provide additional details on the data, training and evaluation methodologies adopted.

4.1. The dataset comprises 3830 daily observations starting from the 3rd of January 2006 and ending the 15th of March 2021. The investment set together with the summary statistics are described in Table 1.

The out-of-sample starts the 1st of January 2011 and goes up to the end of the sample. We allow for daily rebalancing for all the approaches compared. Further, a daily reestimation is implemented for the parameters of mean-variance, minimum-variance, risk-parity and hierarchical risk parity. While, for the approaches involving Deep Learning techniques, we re-estimate the model at the beginning of every year and validate the hyperparameters on the last 10% of the sample. With respect to such hyperparameters, we tune: the number of lags on the input variables in {0,5,21,63}, the structure of the neural networks in {*lstm*(5),*relu*(6)-*lstm*(3),*relu*(6)-*relu*(3),*relu*(12)-*relu*(6)-*relu*(3)} and the batchsize in {63,126,252}. Training is carried out with ADAM with default parameters, we stop the training if the validation loss does not improve for 3 consecutive epochs. Finally, the same validation approach is used for the hyperparameters of the D²FM; this time the object of validation are the number of lags on the same grid as above, and the encoder structure with respect to the number of hidden units only, as we fix the type of link function to *relu* with batch normalization layers among hidden layers only into the encoder network. In particular, the number of hidden units is in {40-20-10,32-16-8,20-10-5,16-8-4,20-4}.

4.2. We use a number of evaluation metrics commonly adopted for the assessment of quantitative investment strategies. In particular, we evaluate the out-of-sample performance of the different approaches via the following metrics:

$$\text{Sharpe ratio} = \sqrt{252} \frac{E(r_p)}{\text{Std}(r_p)} \quad (18)$$

Asset	Standard Deviation	Mean	Skewness	Kurtosis
S&P 500 Information Technology Sector GICS Level 1 Index	1.45	0.06	-0.07*	9.92***
S&P 500 Energy Sector GICS Level 1 Index	1.90	0.02	-0.2***	14.68***
S&P 500 Financials Sector GICS Level 1 Index	2.09	0.03	0.32***	15.72***
S&P 500 Utilities Sector GICS Level 1 Index	1.24	0.02	0.41***	17.95***
S&P 500 Consumer Discretionary Sector GICS Level 1 Index	1.38	0.05	-0.14***	9.82***
S&P 500 Health Care Sector GICS Level 1 Index	1.12	0.04	-0.01	11.5***
S&P 500 Industrials Sector GICS Level 1 Index	1.41	0.04	-0.29***	9.08***
S&P 500 Consumer Staples Sector GICS Level 1 Index	0.94	0.03	0.06	14.77***
S&P 500 Materials Sector GICS Level 1 Index	1.60	0.04	-0.25***	8.45***
S&P 500 Communication Services Sector GICS Level 1 Index	1.32	0.03	0.23***	11.78***
S&P 500 Real Estate Sector GICS Level 1 Index	2.14	0.04	0.41***	17.03***
Bloomberg Barclays US Agg Total Return Value Unhedged USD	0.23	0.02	-0.36***	4.27***

Table 1. List of indexes used with sample statistics computed on daily returns. For Skewness and Kurtosis we do a statistical test of deviation from normality. Significance level are: * for 10%, ** for 5% and *** for 1%.

where $E(r_p)$ is computed using the out of sample average portfolio return, while $Std(r_p)$ is the out of sample standard deviation;

$$Sortino\ ratio = \sqrt{252} \frac{E(r_p)}{Std(r_p^-)} \quad (19)$$

where $Std(r_p^-)$ is the standard deviation computed only on negative returns;

$$maximum\ drawdown = \max_{0 \leq t_1 \leq t_2 \leq T} \left(\frac{P_{t_1}^p - P_{t_2}^p}{P_{t_1}^p} \right) \quad (20)$$

where P_t^p is the actual value of the portfolio at time t equal t_1 and t_2 ;

$$turnover = \frac{252}{T} \sum_{t=1}^T \sum_{i=1}^n \left| w_{i,t} - \frac{(1+r_{i,t-1})w_{i,t-1}}{1 + \sum_{i=1}^n r_{i,t-1}w_{i,t-1}} \right|. \quad (21)$$

We report the results of our exercise in Table 2.

By analysing Table 2, we note that all the strategies provide better risk adjusted returns in terms of Sharpe and Sortino ratios compared to an equally weighted allocation and the buy and hold strategy, the latter being constructed starting from an equally weighted portfolio and without rebalancing. The only exception is the mean-variance portfolio with the D²FM prediction. In particular, with the exception of the minimum variance strategy and the Deep Learning one with Sharpe ratio as objective function, all others show a reduction in their performance when inputs are provided from the D²FM. Thus, indicating they do not combine well with such model. This is not surprising for the Deep Learning Portfolio Optimisation (DLPO) approaches involving higher moments, as at the current stage the D²FM does not take into consideration such higher order moments.

However, the highest performance model is the minimum variance with the covariance matrix provided by the D²FM. This approach provides the best performance both in terms of Sharpe and Sortino ratios. Namely, it outperforms its counterpart using the sample estimate of the covariance matrix (i.e., the second best approach) by 11% in terms of Sharpe ratio and 7% in terms of Sortino ratio, albeit sacrificing 13% in terms of maximum drawdown. What's more, its turnover is also among the lowest.

The next top performing approach is the Deep Learning based portfolio optimisation with four moments (DLPO first four moments) and the raw returns as input. This is the best performing method among the Deep Learning ones in terms of risk adjusted returns. Among the DL approaches that use a moment based loss function, it is also the best in terms of maximum drawdown. Finally, with respect to the annual portfolio turnover we note that the DL based approaches make much more re-allocations compared to standard financial approaches.

Figure 1 shows the evolution over the out of sample period for the best performing strategies and the equally weighted portfolio. For comparison with respect to the previous Deep Learning approaches present in the literature for portfolio optimization, we also include the ones that use as objective function the

first moment and the Sharpe ratio. The strategy that displays the steadiest growth in the portfolio is the minimum variance, and this justifies its superior performance in terms of risk adjusted returns as reported in Table 2. Nevertheless, a closer look at the chart also shows that the Deep Learning based approach with four moments delivers to a value of the portfolio that is above all other four strategies for most of the out-of-sample, even though it shows much more volatility compared to the minimum variance approach. Finally, it is the one that benefits the most from the recovery experienced by the stock market starting at the end of March 2020, which has been particularly favourable for the technological (+58% from end of March to end of December), consumer discretionary (+61% from end of March to end of December) and materials sectors (+58% from end of March to end of December)⁵ first, and then successively also for the energy sector (from a +31% up to end of 2020, to +82% if computed up to end of March 2021).

⁵ +71% if computed up to end of March 2021.

Input Data	Method	Sharpe Ratio	Sortino Ratio	Maximum Drawdown	Turnover
	buy and hold	0.69	0.80	32.56	0.00
	equally weighted	0.66	0.77	33.71	1.28
	mean-variance	0.69	0.73	36.07	255.81
	minimum variance	1.43	1.75	8.02	0.59
D ² FM predictions	risk-parity	0.74	0.82	41.29	2.32
	hierarchical risk-parity	0.89	1.08	31.86	0.70
	mean-variance	0.74	0.88	31.21	10.57
	minimum variance	1.29	1.64	7.12	1.52
Sample average	risk-parity	0.77	0.91	33.40	1.09
	hierarchical risk-parity	0.89	1.10	32.09	0.34
	DLPO sharpe	0.94	1.05	16.33	89.91
	DLPO first moment	0.71	0.85	35.31	223.91
D ² FM states	DLPO first two moments	0.74	0.90	31.58	204.61
	DLPO first three moments	0.74	0.89	31.54	200.53
	DLPO first four moments	0.74	0.89	31.55	200.52
	DLPO sharpe	0.81	0.93	16.82	105.30
	DLPO first moment	0.77	0.85	28.48	150.52
	DLPO first two moments	0.79	0.90	28.35	142.24
Plain inputs	DLPO first three moments	1.04	1.41	21.47	114.00
	DLPO first four moments	1.06	1.44	20.84	118.77

Table 2. Recursive out-of-sample results of the different asset allocation strategies for the period 01/01/2011 to 15/03/2021. DLPO stands for Deep Learning Portfolio Optimisation methods. All the Deep Learning models are re-estimated yearly. The states and predictions of the D²FM are updated daily via the Kalman Filter. Colours go from best blue to worst red.

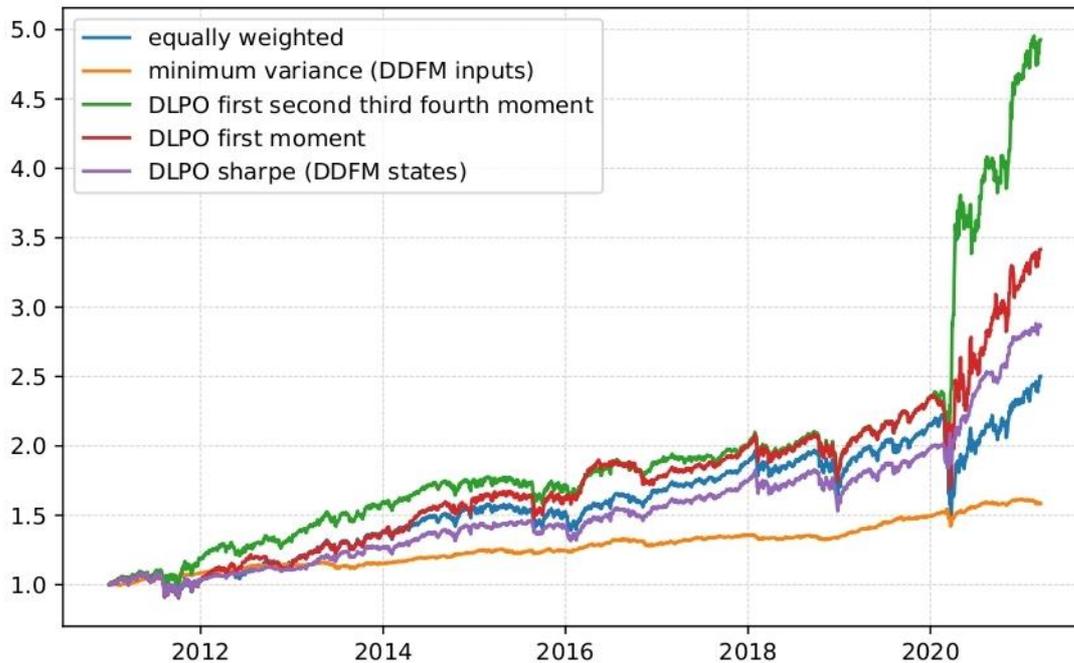


Figure 1. Evolution of the portfolio values over the out of sample for selected strategies.

We continue our analysis in Table 3 where we report the results of a linear regression of the selected strategies excess returns against five factors coming from the financial literature on factor investing⁶. Our aim here is to check whether these strategies can be linearly replicated by standard financial factors, and whether, once corrected for such factors, there is a significant alpha. Among the many factors present in the literature, we select the most important ones. In particular, the betting against beta (BAB) factor from Frazzini and Pedersen (2014); the market (MKT), small minus big or size (SMB), and high minus low or value (HML) factors from the Fama–French three-factor model (Eugene and French, 1992; Fama and French, 1993; Eugene et al., 1996); the up minus down or momentum (UMD) factor introduced by Carhart (1997).

The regression results in Table 3 show that the only two factors that are significant in linearly explaining excess returns consistently among all the selected strategies are BAB and MKT. Further, the only two strategies that generate a

⁶ We download data for the factors from AQR website: <https://www.aqr.com/Insights/Datasets/Betting-Against-Beta-Equity-Factors-Daily>.

significant alpha over the out of sample are the minimum variance and the Deep Learning one with four moments. Thus, confirming those are the best strategies. Additionally, only the alpha of the latter is significant at the 5% level. Overall, the variance explained by those factors is below 10%. Thus, meaning little can be linearly replicated by these factors for the strategies analysed.

4.3. Moehle et al. (2021) use Shapley Value to compute portfolio performance attribution with respect to given features. In this section we present a methodology to compute nonlinear factor exposure and portfolio performance attribution to financial factors. The methodology is based on Shapley values decomposition and the baseline proposed in Izzo et al. (2020).

Indeed, OLS regressions can only linearly attribute the performances of the strategies to each of the canonical financial factors. Hence, we go a step further and use multi-layer perceptrons to check whether the strategies can be better explained by the financial factors via the nonlinear formulations spanned by these models. To this purpose we validate different network structures on the data, including the linear model. However, we find that for most of the strategies the best model among all the ones tested on the data under analysis is the linear model. The only

	equally weighted	minimum variance	DLPO first third	second fourth moment	DLPO first moment	DLPO sharpe (DDFM states)
const	0.0001 (0.0002)	0.0001* (0.0001)	0.0005** (0.0003)		0.0002 (0.0003)	0.0003 (0.0002)
BAB	0.4232*** (0.0498)	0.0587*** (0.0101)	0.1662*** (0.0509)		0.4501*** (0.0567)	0.1254*** (0.0385)
MKT	0.1135*** (0.0235)	0.0148*** (0.0048)	0.0929*** (0.0240)		0.1585*** (0.0268)	0.0362** (0.0182)
SMB	0.2821*** (0.0536)	0.0013 (0.0109)	0.1004* (0.0547)		0.2091*** (0.0610)	0.0467 (0.0414)
HML	0.0951* (0.0560)	0.0165 (0.0114)	0.0885 (0.0571)		0.2219*** (0.0637)	0.0051 (0.0432)
UMD	-0.0942** (0.0434)	-0.0072 (0.0088)	-0.0414 (0.0443)		-0.0455 (0.0493)	-0.0465 (0.0335)
R-squared	0.0729	0.0307	0.0206		0.0718	0.0100

Table 3. OLS regression of selected strategies excess returns against financial factors. BAB stands for betting against beta factor, MKT for the market factor, SMB for small minus big, HML for high minus low, UMD for up minus down. All the factors are taken from AQR website. Significance level are: * for 10%, ** for 5% and *** for 1%.

exceptions are the four moments DLPO and the DLPO Sharpe with states estimated by $D2FM$ as inputs. However, also for these the variances explained by linear and nonlinear models are very close to each other. Nonetheless, for the sake of completeness and as an illustrative example we decide to use Shapley values and the baseline proposed in Izzo et al. (2020) to decompose excess returns in terms of each of the risk factors for these two strategies. Namely, we estimate models of the following form

$$r_{p,t}^{DPO} = G_{\theta}(\mathbf{f}_t) + \epsilon_t, \quad (22)$$

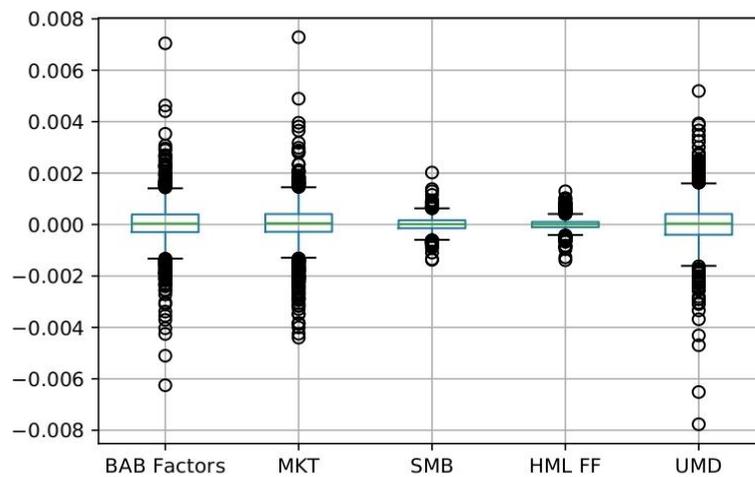
with $r_{p,t}^{DPO} = r_{p,t} - r_{f,t}$, that is the return of a selected portfolio (DLPO or the DLPO Sharpe) on top of the risk free rate; while \mathbf{f}_t is the vector collecting the financial risk factors. Finally, $G_{\theta}(\cdot)$ is the selected MLP and ϵ_t is the error term. All models are trained with a mean square error loss. Once the model has been estimated we compute its Shapley values. In particular, we set 0 as neutrality level for the output of the model to calculate the baseline, as we want to explain excess returns on top of the risk-free. Figures 2a and 2b display Shapley values computed on the strategies whose validation exercise selects neural networks as the best performing model instead of the linear one.

Figure 2a shows that the financial factors contribute half of the time positively and half of the time negatively to the excess returns generated by the 4 moments DLPO strategy. Whereas, Figure 2b indicates that for the DLPO with Sharpe loss and the D_2FM states the box-plots of HML and UMD are entirely below zero; therefore, they almost always contribute negatively to the excess returns generated by this strategy.

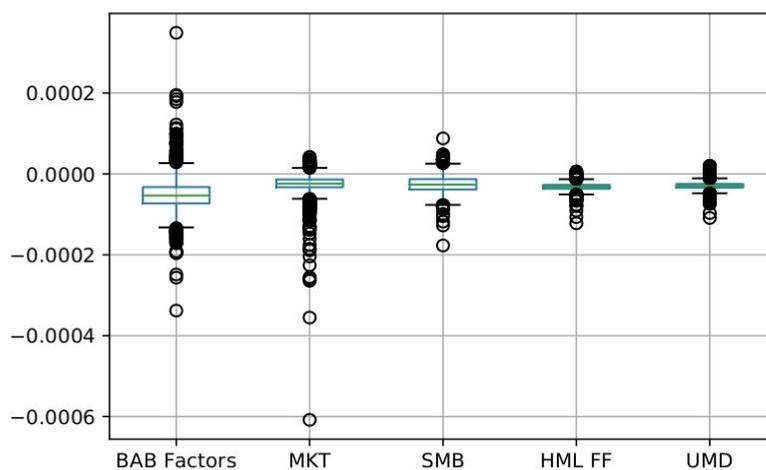
5. In this work we have discussed an approach to combine portfolio choice theory with Deep Learning and Deep Reinforcement Learning. We have provided a possible, albeit exploratory, framework for the dynamic portfolio optimisation problem that takes into account higher order moments, and allows to compute

nonlinear portfolio performance attribution and exposure to financial-economic factors. For the former, we used a gradient based deterministic policy only deep learning method. We then also combined all the different methods analysed with the D^2FM of Andreini et al. (2020). With respect to the portfolio performance attribution, we show a way to compute this via Shapley values and the baseline introduced in Izzo et al. (2020).

The empirical analysis on U.S. daily market data show that combining a classical minimum variance approach with the D^2FM introduced in Andreini et al. (2020) delivers the best riskadjusted performances. Overall, the findings of this work support the potential of hybrid strategies.



(a) Four moments DLPO.



(b) DLPO sharpe (D^2FM states)

Figure 2. Box-plot of Shapley values with neutral baseline and neutrality value set to 0.

merging financial theory with machine learning for investing. Nevertheless, further research and experiments are needed to effectively adopt the methods discussed. Indeed, more advanced and hybrid optimisation algorithms, and (Deep) Reinforcement Learning (e.g., Silver et al., 2014), could benefit the framework. Additional theoretical and empirical analysis would also be beneficial to the work. On the empirical aspect, performing multiple evaluations on different datasets and including additional strategies such as the ones discussed in the literature review section would only serve to enhance the assessment of the methodologies⁷. Also, evaluations in synthetic environments with known optimal allocation strategies could shed light on whether the approach is able to recover the otherwise known best investment actions⁸. With respect to the factor exposure, different model specifications including additional features could be considered and evaluated. Moreover, similarly to Nakagawa et al. (2018, 2019) interpretable versions of the models could be constructed and compared to ex-post explanation strategy. We leave these areas of enquiry to future research.

References:

Almahdi, S. and Yang, S. Y. (2017). An adaptive portfolio trading system: A risk-return portfolio optimization using recurrent reinforcement learning with expected maximum drawdown. *Expert Systems with Applications*, 87:267–279.

Andreini, P., Izzo, C., and Ricco, G. (2020). Deep dynamic factor models. *arXiv preprint arXiv:2007.11887*.

Back, K. (2017). *Asset pricing and portfolio choice theory*. Oxford University Press.

Bai, X., Scheinberg, K., and Tutuncu, R. (2016). Least-squares approach to risk parity in portfolio selection. *Quantitative Finance*, 16(3):357–376.

Baker, M., Bradley, B., and Wurgler, J. (2011). Benchmarks as limits to arbitrage: Understanding the low-volatility anomaly. *Financial Analysts Journal*, 67(1):40–54.

Bergmeir, C., Hyndman, R. J., and Koo, B. (2018). A note on the validity of cross-validation for evaluating autoregressive time series prediction. *Computational Statistics & Data Analysis*, 120:70–83.

⁷ See also Jansen (2020); Dixon et al. (2020); Jacquier et al. (2022); Capponi and Lehalle (2023).

⁸ See Chaouki et al. (2020), for example.

Bertsekas, D. P. and Shreve, S. E. (1996). *Stochastic optimal control: the discrete-time case*, volume 5. Athena Scientific.

Capponi, A. and Lehalle, C.-A. (2023). *Machine Learning and Data Sciences for Financial Markets: A Guide to Contemporary Practices*. Cambridge University Press.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance*, 52(1):57–82.

Chakraborty, S. (2019). Capturing financial markets to apply deep reinforcement learning. *arXiv preprint arXiv:1907.04373*.

Chamberlain, G. (1983). A characterization of the distributions that imply mean–variance utility functions. *Journal of Economic Theory*, 29(1):185–201.

Chaouki, A., Hardiman, S., Schmidt, C., Sérié, E., and De Lataillade, J. (2020). Deep deterministic portfolio optimization. *The Journal of Finance and Data Science*, 6:16–30.

Chen, C.-T., Chen, A.-P., and Huang, S.-H. (2018). Cloning strategies from trading records using agent-based reinforcement learning algorithm. In *2018 IEEE International Conference on Agents (ICA)*, pages 34–37. IEEE.

De Prado, M. L. (2016). Building diversified portfolios that outperform out of sample. *The Journal of Portfolio Management*, 42(4):59–69.

De Prado, M. L. (2020). *Machine learning for asset managers*. Cambridge University Press.

Deng, Y., Bao, F., Kong, Y., Ren, Z., and Dai, Q. (2016). Deep direct reinforcement learning for financial signal representation and trading. *IEEE Transactions on Neural Networks and Learning Systems*, 28(3):653–664.

Dixon, M. F., Halperin, I., and Bilokon, P. (2020). *Machine learning in finance*, volume 1170. Springer.

Eugene, F. and French, K. (1992). The cross-section of expected stock returns. *Journal of Finance*, 47(2):427–465.

Eugene, F., Kenneth, R. F., et al. (1996). Multifactor explanations of asset pricing anomalies. *Journal of Finance*, 51(1):55–84.

Fabozzi, F. J., Kolm, P. N., Pachamanova, D. A., and Focardi, S. M. (2007). *Robust portfolio optimization and management*. John Wiley & Sons.

Fama, E. F. and French, K. R. (1993). French, 1993, common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1):3–56.

Frazzini, A. and Pedersen, L. H. (2014). Betting against beta. *Journal of Financial Economics*, 111(1):1–25.

Harvey, C. R., Liechty, J. C., Liechty, M. W., and Müller, P. (2010). Portfolio selection with higher moments. *Quantitative Finance*, 10(5):469–485.

- Hassan, G. and Clack, C. D. (2008). Multiobjective robustness for portfolio optimization in volatile environments. In *Proceedings of the 10th annual conference on Genetic and Evolutionary Computation*, pages 1507–1514.
- Heaton, J. B., Polson, N. G., and Witte, J. H. (2017). Deep learning for finance: deep portfolios. *Applied Stochastic Models in Business and Industry*, 33(1):3–12.
- Hu, Y.-J. and Lin, S.-J. (2019). Deep reinforcement learning for optimizing finance portfolio management. In *2019 Amity International Conference on Artificial Intelligence (AICAI)*, pages 14–20. IEEE.
- Huang, C. Y. (2018). Financial trading as a game: A deep reinforcement learning approach. *arXiv preprint arXiv:1807.02787*.
- Huynh, K. and Lenhard, G. (2022). Asymmetric autoencoders for factor-based covariance matrix estimation. In *Proceedings of the Third ACM International Conference on AI in Finance*, pages 403–410.
- Izzo, C., Lipani, A., Okhrati, R., and Medda, F. (2020). A baseline for shapley values in mlps: From missingness to neutrality. *ESANN 2021 proceedings, European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*.
- Jacquier, A., Kondratyev, O., Lipton, A., and de Prado, M. L. (2022). *Quantum Machine Learning and Optimisation in Finance: On the Road to Quantum Advantage*. Packt Publishing Ltd.
- Jansen, S. (2020). *Machine Learning for Algorithmic Trading: Predictive models to extract signals from market and alternative data for systematic trading strategies with Python*. Packt Publishing Ltd.
- Jeong, G. and Kim, H. Y. (2019). Improving financial trading decisions using deep q-learning: Predicting the number of shares, action strategies, and transfer learning. *Expert Systems with Applications*, 117:125–138.
- Jiang, Z., Xu, D., and Liang, J. (2017). A deep reinforcement learning framework for the financial portfolio management problem. *ArXiv*, abs/1706.10059.
- Jondeau, E. and Rockinger, M. (2006). Optimal portfolio allocation under higher moments. *European Financial Management*, 12(1):29–55.
- Koker, T. E. and Koutmos, D. (2020). Cryptocurrency trading using machine learning. *Journal of Risk and Financial Management*, 13(8):178.
- Kroll, Y., Levy, H., and Markowitz, H. M. (1984). Mean-variance versus direct utility maximization. *The Journal of Finance*, 39(1):47–61.
- Lai, K. K., Yu, L., and Wang, S. (2006). Mean-variance-skewness-kurtosis-based portfolio optimization. In *First International Multi-Symposiums on Computer and Computational Sciences (IMSCCS'06)*, volume 2, pages 292–297. IEEE.
- Lhabitant, F.-S. (1998). On the (ab) use of taylor series approximations for portfolio selection, portfolio performance and risk management. *HEC, University of Lausanne*.

Liang, Z., Chen, H., Zhu, J., Jiang, K., and Li, Y. (2018). Adversarial deep reinforcement learning in portfolio management. *arXiv preprint arXiv:1808.09940*.

Loistl, O. (1976). The erroneous approximation of expected utility by means of a Taylor's series expansion: analytic and computational results. *The American Economic Review*, 66(5):904–910.

Lucarelli, G. and Borrotti, M. (2020). A deep q-learning portfolio management framework for the cryptocurrency market. *Neural Computing and Applications*, 32(23):17229–17244.

Moehle, N., Boyd, S., and Ang, A. (2021). Portfolio performance attribution via shapley value. *arXiv preprint arXiv:2102.05799*.

Moody, J. and Saffell, M. (2001). Learning to trade via direct reinforcement. *IEEE Transactions on Neural Networks*, 12(4):875–889.

Moody, J., Wu, L., Liao, Y., and Saffell, M. (1998). Performance functions and reinforcement learning for trading systems and portfolios. *Journal of Forecasting*, 17(5-6):441–470.

Moral-Escudero, R., Ruiz-Torrubiano, R., and Suárez, A. (2006). Selection of optimal investment portfolios with cardinality constraints. In *2006 IEEE International Conference on Evolutionary Computation*, pages 2382–2388. IEEE.

Murphy, K. P. (2022). *Probabilistic machine learning: an introduction*. MIT press. Nakagawa, K., Ito, T., Abe, M., and Izumi, K. (2019). Deep recurrent factor model: interpretable non-linear and time-varying multi-factor model. In *Proceedings of the Thirty-First AAAI Conference on Artificial Intelligence*.

Nakagawa, K., Uchida, T., and Aoshima, T. (2018). Deep factor model. In *ECML PKDD 2018 Workshops*, pages 37–50. Springer.

Noguer i Alonso, M. and Srivastava, S. (2020). Deep reinforcement learning for asset allocation in us equities. *arXiv preprint arXiv:2010.04404*.

Raffinot, T. (2017). Hierarchical clustering-based asset allocation. *The Journal of Portfolio Management*, 44(2):89–99.

Ritter, G. (2017). Machine learning for trading. *Available at SSRN 3015609*.

Rosenberg, G., Haghnegahdar, P., Goddard, P., Carr, P., Wu, K., and De Prado, M. L. (2016). Solving the optimal trading trajectory problem using a quantum annealer. *IEEE Journal of Selected Topics in Signal Processing*, 10(6):1053–1060.

Scherer, B. and Winston, K. (2011). *The Oxford handbook of quantitative asset management*. OUP Oxford.

Scott, R. C. and Horvath, P. A. (1980). On the direction of preference for moments of higher order than the variance. *The Journal of Finance*, 35(4):915–919.

Sewak, M. (2019). *Deep Reinforcement Learning*. Springer.

Silver, D., Lever, G., Heess, N., Degris, T., Wierstra, D., and Riedmiller, M. (2014). Deterministic policy gradient algorithms. *International Conference on Machine Learning*, pages 387–395.

Song, Q., Liu, A., and Yang, S. Y. (2017). Stock portfolio selection using learning-to-rank algorithms with news sentiment. *Neurocomputing*, 264:20–28.

Sun, W., Fan, A., Chen, L.-W., Schouwenaars, T., and Albot, M. A. (2006). Optimal rebalancing for institutional portfolios. *The Journal of Portfolio Management*, 32(2):33–43.

Sutton, R. S. and Barto, A. G. (2018). *Reinforcement learning: An introduction*. MIT press.

Szepesvári, C. (2010). *Algorithms for reinforcement learning*, volume 4. Morgan & Claypool Publishers.

Wang, W., Li, W., Zhang, N., and Liu, K. (2020). Portfolio formation with preselection using deep learning from long-term financial data. *Expert Systems with Applications*, 143:113042.

Yashaswi, K. (2021). Deep reinforcement learning for portfolio optimization using latent feature state space (lfss) module. *arXiv preprint arXiv:2102.06233*.

Zhang, Z., Zohren, S., and Roberts, S. (2020). Deep learning for portfolio optimization. *The Journal of Financial Data Science*, 2(4):8–20.