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The papers that are presented to our magazine for publication are submitted anonymously to a double level of peer review.

The first level is a review of eligibility, implemented on the paper by the members of the Editorial Board, who assess the adequacy of the paper to the typical topics of the magazine.

The second level is a review of suitability for publication, implemented on the paper by two referees, selected within the Editorial Board, the Scientific Committee or externally among academics, scholars, experts on the subject who assess the content and the form.

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"Risk Management Magazine" is the AIFIRM (Italian Association of Financial Industry Risk Managers) magazine, fully dedicated to risk management topics.

The organization includes the managing editor, a joint manager and an Editorial Board and a Scientific Committee composed by academics.

The magazine promotes the diffusion of all content related to risk management topics, from regulatory aspects, to organizational and technical issues and all articles will be examined with interest through the Scientific Council.

The papers shall be presented in Microsoft Word format, font Times New Roman 10 and shall have between 5.000 and 12.000 words; tables and graphs are welcome.

The bibliography shall be written in APA format and shall accuratel specify the sources.

An Abstract in English is required (less than 200 words) highlighting the Key words.

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La sua struttura organizzativa prevede, oltre al direttore responsabile, un condirettore, un Editorial Board e un Consiglio Scientifico formato da accademici.

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Does the banks' performance improve after share buybacks?

Marina Brogi (Università di Roma La Sapienza), Michelangelo Bruno (EBA, Università di Roma La Sapienza), Valentina Lagasio (Università di Roma La Sapienza)

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Abstract

Share buybacks have become a popular way for companies to return capital to shareholders. However, there is an ongoing debate regarding the impact of share buybacks on the performance and shareholder value. This paper starts by examining the literature on share buybacks and aims at testing the signalling hypothesis (ie share buybacks are carried out to signal undervaluation of the stock) on share repurchases performed by banks. More specifically, the analysis conducted measured the impact of share buybacks on banks' performance as measured by the return on equity (ROE). The results show that there is low significant positive linear relationship between banks' share buybacks and their ROE.

Keywords

Share buybacks, banks' performance, return on equity, shareholders' value, pay-out policy, banking.

JEL code: G21-G32

1. Introduction

The pay-out policy has long been one major research topic in corporate finance starting from the renowned pay-out irrelevance proposition formulated by Modigliani & Miller (1958). According to this proposition the pay-out choices available to firms, i.e. dividends versus share buybacks (also share repurchases), are equivalent in an idealised world without taxes, frictions, and information asymmetries. However, in a world with taxes, frictions, and information asymmetries there could be reasons for firms to prefer share buybacks to dividends to distribute the profits to their shareholders. More specifically, in addition to the potential tax advantages that could lead a firm to prefer one pay-out method over another, the economic literature has shown that share buybacks may be the option favoured by firms as they signal to the market stock undervaluation and therefore may also be a means to deter takeover attempts on the firm.

Share buybacks is essentially a mechanism by which companies repurchase their own shares from the market, thereby reducing the number of outstanding shares. Share buybacks have become increasingly popular among firms as a way to return capital to shareholders. The decision to buy back shares is typically based on a variety of factors, including the company's financial health, cash position, and growth prospects. However, there is ongoing debate regarding the impact of share buybacks on a company's financial health, shareholder value, and long-term growth prospects.

The purpose of this paper is to examine the literature on share buybacks to assess their impact on a firm's financial health, share price, and long-term growth prospects. Specifically, we will review the existing research to determine whether share buybacks are an effective way to enhance shareholder value.

The BIS Quarterly Review discusses the impact of buybacks on corporate resilience and the need for public support. Buybacks are a means to distribute cash to shareholders, but they are of concern for two reasons: first, they could artificially increase stock prices in order to boost performance pay, and second, they could be a tool to raise leverage to excessive levels. Overall corporate pay-outs rose substantially in recent years, with US firms distributing $4 trillion in dividends and $6 trillion in buybacks, or $4 trillion net of equity issuance. Stock buybacks can be a double-edged sword from investors' perspective, as they can support a firm's market price by signalling undervaluation, achieving tax efficiency gains relative to dividends or helping avoid wasteful expenditures by managers, but they could be detrimental to long-term firm value if executives use them simply to increase their performance pay.

Corporate stock buybacks have tripled in the last decade, often to attain desired leverage, or debt as a share of assets. This can be excessive if companies do not account for all financial distress costs, including those potentially shifted to the public purse as a result of bailouts. Buybacks are a powerful tool for leverage management, as they complement and reinforce the effect of debt issuance on firms' capital structure. Equity decreases and leverage rises, more rapidly so when funds are obtained by issuing debt. For example, a firm with $100 in assets, $30 in debt and $70 in equity starts with leverage equal to 0.3.

More recently, share buybacks have also come under attack because of the public perception that the excess funds used to finance these operations have come from tax cuts and other sources (such as government bailouts) that were originally intended to foster investments by the firms or sustain wage increases for their workers. Thus, supporters of this claim have argued for amending tax laws across the different jurisdictions to discourage buybacks on the theory that the benefits of these operations favour mostly top executives and wealthy shareholders. In some jurisdictions, like in the US with the bill signed by Baldwin, Warren and Schatz, the regulators went as far as banning the open market stock buybacks claiming that "it's just wrong for big corporations to pocket massive, permanent tax breaks and reward the wealth of top executives with more stock buybacks, while closing facilities and laying off workers".[1] Stock buybacks have also found widespread support as they give companies the flexibility to return cash to shareholders who can then reinvest this cash in other more profitable projects. In this regard, Warren Buffet stated: "as the subject of repurchases has come to a boil, some people have come close to calling them un-American characterizing them as corporate misdeeds that divert funds needed for productive endeavours. That simply isn't the case. . . I'm not aware of any enticing project that in recent years has died for lack of capital (Call us if you have a candidate)"[2]. In August of 2022, President Biden signed the Inflation Reduction Act (IRA) into law. It is a climate and tax bill that advances administration economic priorities.

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[1] See press release at www.baldwin.senate.gov/press-releases/reward-work-act-2019.

The Act contains provisions intended to discourage the largest firms from exploiting tax loopholes that allow them to pay minimal or no federal income tax. In addition, it provides new and expanded tax incentives to encourage businesses and people to increase their usage of renewable energy.

While additional guidelines and regulations are anticipated in the coming months and years, here is an overview of the Inflation Reduction Act's principal business tax provisions. Unless explicitly specified, all modifications become effective after December 31, 2022. The IRA imposes a 1% tax on the fair market value of stock repurchased during the tax year by a publicly traded U.S. firm. The amount liable to this 1% tax is typically the amount paid by the issuing corporation to shareholders during the year in exchange for their issuing corporation stock, less the value of any stock issuances during the taxable year. The excise tax applies to IRC 317(b) redemptions, economically similar transactions, and stock acquired from a third party by a specified affiliate of a corporation. It also applies to some acquisitions and repurchases of publicly traded foreign corporate stock.

In the case of banks, this subject is even more significant and is gaining the attention of the international authorities. A number of financial sector rules that helped maintain financial stability during the pandemic have expired or been revised in the past couple of years. In September 2021, the limitations on dividend pay-outs and share buybacks that had been imposed on euro area banks were relaxed. Almost all lending moratoriums and government guarantee programs that aided in bolstering banks' asset quality have now officially ended (ECB, 2021). Indeed, following prior announcements of temporary capital and operational relief measures, ECB Financial Supervision recommended on March 27 that banks refrain from distributing dividends and repurchasing shares until October 1, 2020. All national authorities in the eurozone had made identical requests to the banks directly under their jurisdictions.

During the pandemic, ECB advised banks not to pay dividends or transfer capital to shareholders through share buybacks. That was an exceptional scenario as there was no visibility at all. We were unable to distinguish between the potential impact on a bank with a good capital position and a bank with a considerably more constrained capital position since the amount of the impact was difficult to predict. Currently, there is still a great level of uncertainty, but we can do much more granular work on exposures to vulnerable sectors and banks with specific exposures to Russia or Ukraine; banks with large exposures to customers who are highly sensitive to interest rates; and banks highly exposed to leverage finance or counterparty credit risk (Enria, 2022).

As for the US context, the Federal Reserve Board declared in March 2021 that the temporary and extra limits on bank holding company dividends and share repurchases presently in effect would have been lifted for the majority of enterprises in June 2021, following the conclusion of the last round of stress testing. As of that date, firms having capital levels exceeding the stress test requirements were no longer subject to the additional restrictions. The limits will continue to apply to firms with capital levels below those necessary by the stress test. The Securities and Exchange Commission proposed revisions to the regulations addressing disclosure of an issuer's repurchases of its equity shares to require an issuer to submit a new Form SR (including information related to the class of securities purchased, the total amount purchased, the average price paid, and the aggregate total amount purchased on the open market) by the end of the first business day after the date on which it repurchases shares.

The economic literature pointed out that, in addition to the opportunistic use of buybacks by top executives to boost performance pay, these operations could suitably be used by managers as a tool to increase leverage to excessive levels (Aramonte, 2020). Therefore, considering the potential for increasing leverage, risk managers and supervisors alike should pay particular attention to the potential negative effects that this tool may have on the capital position of banks. Given the importance of share buybacks the economic literature has been focusing on this topic studying different aspects.

However, the link between stock buybacks by banks and their future performance is not entirely clear (the results shown by the different studies available is rather inconclusive or conflicting). Bridging this gap, this paper aims at studying the link between stock buybacks by banks and their future economic performance to test the signalling hypothesis that argues that these operations are undertaken by the managers of the company (in our case bank) to signal to the market the undervaluation of the stock given its future potential. The analysis will be carried out by studying a sample of 1336 worldwide banks in the period between 2015 to 2021. The paper is organised as follows: section two will focus on the literature review on the topic; section three will present the relevant details on the dataset used for the analysis; section four will introduce the model used to test the link between stock buybacks by banks and their future performance while section five will outline the conclusions of the analysis.

2. Literature review

According to the existing literature on the topic up until 1980 companies worldwide mainly used dividends as a means of payment of surplus to the shareholders despite the relative tax advantage of share buybacks (Barclay and Smith, 1988). The number of share buybacks started growing in US after 1980. As a matter of fact, the spending of companies in US for share buybacks increased from 4.8% in 1980 to 41.8% in 2000 and in the period from 1990 to 2000, for the first time in history, companies spent more on share buybacks than in dividends (Grullon and Michaely, 2000). After the US experience, the share buybacks acquired popularity also in other developed countries such as UK, Canada, Australia, Japan, and France.

Share buybacks have been a popular way for companies to return capital to shareholders. Several studies have shown that share buybacks can lead to an increase in shareholder value. For example, a study by Ikenberry, Lakonishok, and Vermaelen (1995) found that firms that announced share buybacks experienced significant positive abnormal returns. Similarly, a study by Brav, Graham, Harvey, and Michaely (2005) found that firms that repurchased shares outperformed their peers in the three years following the buyback.

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[2] See 2016 Berkshire Hathaway shareholders letter at www.berkshirehathaway.com/letters/2016ltr.pdf

However, not all studies have found a positive relationship between share buybacks and shareholder value. A study by Fenn and Liang (2001) found that share repurchases did not significantly increase shareholder value in the long term. Similarly, a study by Yook (2008) found that while share buybacks led to an increase in share prices in the short term, they did not lead to sustained long-term growth.

There are several reasons why share buybacks may not lead to sustainable long-term growth. First, share buybacks are typically funded by cash reserves, which could be used for investment in research and development or capital expenditures. Second, share buybacks can reduce the number of outstanding shares, which can make the company appear more profitable on a per-share basis but does not necessarily increase overall profitability. Finally, share buybacks can lead to a decline in the company's financial flexibility, as it reduces the company's cash reserves.

Based on the existing literature, it appears that share buybacks can lead to an increase in shareholder value in the short term. However, there is no consensus on whether share buybacks lead to sustained long-term growth. While some studies have found a positive relationship between share buybacks and long-term growth, others have found no relationship or even a negative relationship.

One potential explanation for the mixed results is that the impact of share buybacks may depend on the company's financial health, growth prospects, and investment opportunities. For example, a financially healthy company with limited investment opportunities may be better served by returning capital to shareholders through share buybacks. On the other hand, a company with significant growth opportunities may be better served by investing in research and development or capital expenditures.

To sum up, different and diverse are the hypotheses identified by the economic literature that could justify share repurchases by companies. The list below provides an overview of these hypotheses:

1) Signalling hypothesis: according to the signalling hypothesis supported by Ross (1977), Bhattacharya (1979) and Spence (1973) the management of a company mainly uses the dividend policy as a signalling tool for the market. These studies, underscore the fact that share buybacks give two signals to the market such as undervaluation of the shares or enhanced potential growth prospects of the company. When a company announces that it will buy back shares at a huge premium it essentially signals to the market that the stock is undervalued. In this respect, Vermelen (1981) found that signalling is the most plausible explanation of the abnormal returns in the stock market after the share buyback. Bartov (1991) found that open market buybacks convey information on both earnings prospects and risk changes. Other studies such as the one of Stephens and Weisbach (1998) found a negative relationship between share buybacks and prior price performance of the stock. The studies of Comment & Jarrell (1991), Louis and White (2007) and Haw et al. (2013) examined the signalling effect of different methods of three types of share buybacks in the US such as Dutch auction self-tender offer, fixed price self-tender, and open market buybacks and concluded that fixed price self-tender method conveys a stronger signal of undervaluation than others.

2) Substitution hypothesis under the substitution hypothesis it is assumed that the share buyback programmes are implemented by companies as a pay-out method for shareholders over dividends. This hypothesis lies its foundations in the different fiscal treatment of the capital gains as compared to the dividends. As Grullon and Michaely (2000) point out capital gain tax is much lower in most jurisdictions than the tax on dividends hence shares repurchase is more tax efficient and valuable to shareholders. Another important characteristic of the share buyback programmes is their flexibility as unlike dividends they do not “promise” cash flows at regular intervals (Dittmar, 2000).

3) Optimum leverage hypothesis: Bagwell and Shoven (1988), Dittmar (2000), Mitchell and Dharmawan (2007) and Hovakimian et al. (2001), supporters of the optimum leverage hypothesis, argue that companies having a debt-to-equity ratio that is lower than the target ratio are more likely to undertake share buybacks. These studies therefore highlighted the importance played by the comparison between the actual and the target leverage ratio when the management of the company decides to implement a share buyback programme. The highest the difference between the actual and optimal leverage ratio, the highest the probability that the company will undertake a share buyback programme. Thus, by executing a share buyback programme the management increases the leverage in the capital structure of the firm and by benefitting of the tax shield provided by the additional debt they also increase the total value of the firm (Modigliani, Miller).

4) Takeover deterrence hypothesis: according to the takeover deterrence hypothesis companies would implement a share buyback programme when feeling under threat from a competitor. Bagwell (1991) demonstrated that when shareholders believe the value of their shares is more than repurchased price do not tender their shares for sale. In another research piece, Bagwell (1992) demonstrated that the cost of the acquisition for a potential acquirer will be higher in cases in which the company buys back shares as compared to cases in which it distributes dividends. Sinha (1991) went further documenting that this effect is even more pronounced when the repurchase is financed through debt. In such cases the value of the firm is increased making it also a less attractive target.

5) Stock option hypothesis: the stock option hypothesis that has been formulated by Kahle (2002) and Bens et al. (2003) found a positive correlation with the number of share buybacks done by the companies and the stock options outstanding given to employees. In particular, the authors claim that a large number of stock options outstanding has a dilutive effect on the EPS. In order to neutralise this effect, companies’ buyback shares.

6) Excess capital or cash flow hypothesis: the excess capital or cash flow hypothesis supported by Jensen (1986) and Vafeas and Joy (1995) found that the decision to buy back shares to distribute surplus cash to shareholders seeks to reduce the agency cost. According to this strand of studies, in fact, if firms hoard cash or capital in excess there is a higher probability that their management will undertake negative net value projects. Thus, a higher dividend pay-out or share buybacks will reduce the free cash flow available for the managers. Boudry (2013) found a positive relationship between the availability of cash and share buybacks holding investment opportunities constant.

7) Corporate governance hypothesis: the corporate governance hypothesis supported by Lee et al. (2007) claims that managers may use buybacks to exploit favourable price conditions. The underlying rationale underpinning this hypothesis is that managers can fruitfully exploit their insider information to get the advantage of undervalued shares.

8) Liquidity hypothesis: the relationship between liquidity and share buybacks has been studied first by Barclay and Smith (1988) however, it was Brockman et al. (2008) that found a positive relationship between liquidity and share repurchase. According to the evidence provided by this research, the companies that are more liquid (i.e. have more liquidity available) are also those that are more likely to undertake a share repurchase instead of distributing dividends.

None of the hypotheses reported above has been identified unanimously by the literature as the sole determinant of share repurchase by companies. Dittmar (2000) found that out of all the hypotheses mentioned above, stock undervaluation is the prime determinant that leads US companies to repurchase shares followed by excess capital hypotheses. Jagannathan and Stephens (2003) found that the justification for implementing a share repurchase might vary depending on whether the companies are frequent repurchasers or not. The study found that frequent repurchasers are large companies with less variation in operating income that implement share buybacks mainly as an alternative way of distributing excess cash to their shareholders. On the contrary, the primary motivation for infrequent repurchasers (mainly small and less structured companies) to implement buybacks is stock undervaluation. Backer et al. (2003) tested five hypotheses i.e. signalling, agency cost of free cash flow, capital market allocations, tax-motivated substitutions for dividend and capital structure adjustments, and found that undervaluation is the most important motive behind repurchase followed by lack of investment opportunities.

Li and McNally (2007) tested the hypotheses on some Canadian companies and found that firms with greater free cash flow, lower market to book ratio, negative return prior announcement and more insider holdings are more likely to repurchase their stocks. Thus, in Canada, firms are motivated to do share buybacks mainly by the agency hypotheses followed by undervaluation hypotheses.

Benhamouda and Watson (2010) examined the determinants influencing open market repurchase decisions in the UK. The study found that excess capital and substitution hypotheses are the motivating factors for share repurchase. This study doesn't support stock option hypothesis.

Farrugia et al. (2011) studying a sample of Australian companies, examined the relationship between the region where the companies where headquartered and the number share repurchases. They found that share buyback programs are positive and statistically significant in high rich areas compared to poorer areas. They also reported that firms going for frequent repurchase enjoyed of stronger returns across the business cycle compared with firms doing infrequent buybacks.

Andriosopoulos and Hoque (2013) reported that the firm’s size, the cash dividend, and concentration of the ownership structure are important factors in explaining the decision to repurchase shares for firms that are headquartered in countries like UK, Germany, and France. The results of this study show that large and widely held firms are more likely to make share buyback announcement and also found a complementary relationship between dividend payment and share repurchase in UK and Germany.

Yarram (2014) studied various factors that influence open market repurchases in Australia. The results of the study show support for the agency, signalling, and leverage hypotheses whereas they do not support the excess cash flow and the substitution hypotheses.

Chung et al. (2013) tested the signalling, free cash flow, management incentives, leverage, substitution and moral hazard hypotheses for determining factors influencing repurchase decision in Taiwan. The study found that out of all the above-mentioned hypotheses only signalling and free cash flow play a significant role in influencing share buyback decisions.

Bonaime et al. (2014) studied the relationship between share buybacks and the companies target capital structure. The authors found that the study found that out of the four combinations of target capital structure and mispricing (Under levered/Undervalued, Under levered/Overvalued, Over-levered/undervalued, Over-levered/overvalued) the firms add more value by doing share buybacks when they are under levered and undervalued both.

Another separate strand of research (Singh k. et al., 1994; Wiggins B., 1994; Miller and McConnell, 1995; Franz et al., 1995; Brockman & Chung, 2001; Ahn et al., 2001; Cook et al., 2004; Ginglinger and Hamon, 2007; Ridder and Råsbrant, 2009; McNally and Smith, 2011; De Cesari et al., 2011) focused specifically on the effects of share buybacks on liquidity. The discussion of the findings of these studies goes beyond the scope of this paper.

2.1 Share buybacks for banks

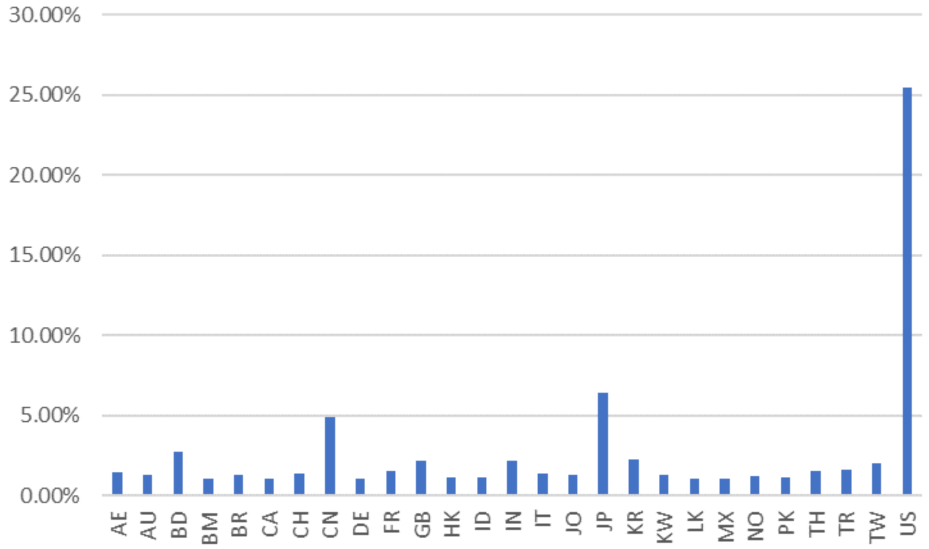
The literature on share buybacks in the banking industry is focused on some specific and technical aspects. One study found a positive relationship between stock repurchases and the financial performance of US bank holding companies (Federal Reserve Bank of New York, 2003). Another study (Federal Reserve Bank of New York, 2014) found that banks share repurchases programs tend to drop, as compared to the payment of dividends, during financial crisis. However, other studies found conflicting evidence with the results shown above. One study (Raghavan & Morris, 2005) focused on the US banking sector found no evidence of the signalling effect on banks. More specifically, the study shows that share repurchases do not coincide with superior future performances of the banks undertaking these programs. Along the same lines, Howe & Jain (2006), studying a sample of US bank holding companies during the period between 1994 to 1998, found a negative relationship between share repurchases and capital ratios (i.e. share repurchases in banks lead to a decrease of their capital ratios) while finding evidence of a positive relationship between share repurchases and industry-adjusted ROA in the following two years from the announcement.

To sum up, the economic literature on the share repurchases by firms is quite extensive. The studies analysed here focused on the factors that drive repurchases decisions by firms. These factors may differ from country to country depending on the institutional framework of share buyback in the specific country. For this reason, in a different country, different hypothesis is influencing share buyback decisions. However, the different studies did not identify a single most relevant factor that always supports the decision of repurchasing the shares. Another relevant finding of the existing literature is that the decision to repurchase share by a company may lead to a wealth distribution effect between non-selling shareholders or long-term shareholders at the expense of the short-term shareholders. The economic literature on share buybacks is also quite extensive and covers different areas. From the evidence collected in previous studies it is not entirely clear, however, what is the link between the share repurchases programs and the long-term performance of banks. This paper aims at bridging this gap by leveraging on the most recent data of a sample of worldwide banks or banking groups.

3. Dataset and descriptive statistics of the sample

The source of the dataset is BankScope and it includes relevant economic and financial metrics of 1,336 worldwide banks in the period from 2015 to 2021 (using annual data). It includes all the available institutions classified as banks by the provider during the selected period. The chart below shows the geographic distribution of the banks in the sample by country of origin.

Chart 1: Breakdown by country of origin of the banks in the sample



Source: internal elaboration on the data

The chart features the countries having a share of banks above one percent in the sample, all the countries not reaching this threshold have been excluded from the chart above. None of the banks included in the sample by default from the provider has been excluded from the analysis. Slightly more than a quarter of banks represented in the sample are headquartered in the US (25.45%) with the second country more represented being Japan and the third one Canada (having a share of banks in the sample respectively of 6.44% and 4.94%). The number of institutions remained stable across the years apart from the last year (2021) when the overall number of banks decreased to 1,335. The composition of the sample is also largely consistent with the BIS's official data on buybacks in terms of the amount repurchased, indicating that the sample is representative. Indeed, in 2019, US companies repurchased their own shares in the amount of $800 billion, net of equity issuance. Similar patterns were observed on a worldwide scale, with Japan, the United Kingdom, France, Canada, and China posting repurchases totalling a combined $130 billion in 2019. The nation level increases were most evident in China, where repurchases increased tenfold to $17 billion, and Japan, where they increased fivefold to $52 billion. Given the large magnitude and longer history of share repurchases in the United States, the remainder of this section focuses on US data on non-financial corporations' buybacks.

Details on the number of banks as well as descriptive statistics on the main metrics are provided in the table below.

Table 1: descriptive statistics of the sample

	2015			2016			2017			2018			2019			2020			2021		
	Obs.	Mean	MED	Obs.	Mean	MED	Obs.	Mean	MED	Obs.	Mean	MED	Obs.	Mean	MED	Obs.	Mean	MED	Obs.	Mean	MED
Op. Rev (USD mln)	1305	2,550	320	1329	2,511	331	1335	2,783	377	1332	2,807	380	1334	2,936	402	1335	2,996	419	1315	3,247	455
P&L before tax (USD mln)	1305	749	91	1329	743	94	1335	861	112	1332	892	105	1334	895	116	1335	711	90	1315	1,130	144
NI (USD mln)	1305	579	68	1329	554	71	1335	632	80	1332	707	83	1334	713	90	1335	572	68	1315	907	108
TA (USD mln)	1305	74,879	6,534	1329	76,578	6,892	1335	84,955	7,759	1332	86,001	7,814	1334	89,592	8,628	1335	102,364	9,751	1315	110,022	10,600
Equity (USD mln)	1305	5,950	819	1329	6,089	883	1335	6,845	989	1332	6,953	1,018	1334	7,390	1,098	1335	8,002	1,165	1315	8,698	1,241
Own shares (USD mln)	333	156	10	343	196	11	357	222	15	375	248	14	388	270	14	389	298	15	373	362	14
Number of Employess	1070	11,246	1,794	1080	11,647	1,790	1087	11,682	1,829	1075	11,670	1,963	1090	11,462	2,054	1107	11,445	2,114	1106	11,829	2,127
NPL ratio	1079	5.14	1.93	1110	5.37	1.90	1116	4.94	1.79	1132	4.90	1.85	1148	5.34	1.92	1142	5.50	2.02	1122	5.37	1.95
T1 Ratio (%)	824	14.27	12.89	843	14.52	13.10	875	14.64	13.44	886	14.81	13.43	892	15.28	13.86	861	15.73	14.26	835	15.97	14.37
TC lRatio (%)	978	18.84	15.03	997	18.56	15.12	1020	19.31	15.30	1019	18.64	15.35	1018	19.18	15.69	992	19.93	16.10	964	20.06	16.08
ROE (%)	1305	10.32	9.89	1329	9.08	9.58	1335	10.05	9.55	1332	8.70	9.96	1334	11.27	9.75	1335	7.84	7.83	1315	4.67	10.68
Cost/Income (%)	1293	60.59	59.45	1317	59.13	58.87	1323	58.94	58.82	1323	60.59	59.02	1324	54.43	58.56	1326	65.10	58.23	1306	58.79	56.67
RWA/TA	865	85	69	891	66	69	924	66	70	931	66	70	933	66	70	907	144	64	878	60	63

Source: internal elaboration on the data

As could be seen in the table, the operating revenues of the banks in the sample increased steadily over the period under analysis. Similar trends could be observed for the other profitability metrics shown. It is important to underscore that the average net income plunged in 2020 as a consequence of the COVID-19 pandemic. By the same token, the average NPL ratio increased over 2019 and

2020. The overall capital position of the banks improved steadily over the period observed as underlined by positive upward trends of all the main metrics (Equity in USD, T1 capital ratio and total capital ratio). This is in line with the findings of the BIS showing improved resilience, as measured by an increased amount of capital of a better quality, of the worldwide banking sector.[3] The overall profitability as measured by the ROE mean value in the sample showed a high variability over the period bottoming at 4.67% in 2021. The data however is heavily biased by the presence of outliers in the sample. Thus, the ROE median value seems to be a better value to assess the evolution of the profitability for the banks in the sample over the period between 2015 to 2021. The median ROE for the banks in the sample remained stable at approximately 10% from 2015 to 2020. The median ROE for this year was substantially lower and equal to 7.83%. The decline in profitability in 2020 is in line with the overall negative trend underscoring the effects of the pandemics on the banking sector as well as on the overall economy. The average total assets of the banks in the sample increased over the period under analysis from approximately 74 bn to 110 bn USD.

The own shares variable shows the value of shares owned by the bank and held in its portfolio. Increases of this variable entail the repurchases of stock by the bank.

The values of the main metrics (such as for instance operating revenues and P&L before tax) of the banks in the sample are denominated in USD.

4. Analysis

4.1 Empirical results

The main objective of this paper is to test the reliability of the signalling hypothesis for share buybacks in the banking sector. As see in section 2, this hypothesis is one of the main explanations supporting the decision of top executives to buyback shares.

To test this hypothesis, we assume that if the value of the stock is perceived as undervalued by the top executives, who have insider information on the future prospects of the bank, there should be a link between the share buybacks and future profitability of the bank. We therefore assess the relationship between the share buybacks ("Own shares" variable) and the increased profitability as measured by the ROE.

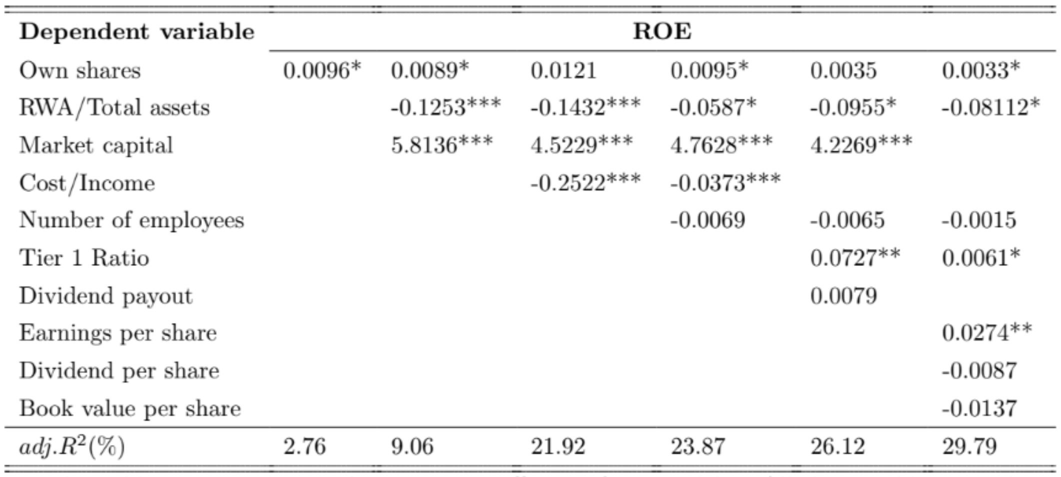
We conduct a panel regression analysis through model 1. The panel is unbalanced since not all the financial firms in each country have been trading continuously from 2015 to 2021.

We run the following model:

$$ROE_{i,t} = \alpha_i + \sum_{i=1}^{n} \beta_{i,t} X_{i,t} + \beta_{i,t} Own\ shares_{i,t} + \sum_{i=1}^{n-1} Firm_i + \sum_{j=1}^{m-1} Time_j + \varepsilon_{i,t}$$

where ROE is the return on equity, X is a (n x 1) vector of firm-specific variables, which are selected by estimating model returning the highest Akaike information criterion, Own shares is the annualized share buyback. Finally, Firm and Time are firm and time dummies to control for the individual fixed firm and time effects, respectively.

Table 2: Panel regression results.



Dependent variable	ROE					
Own shares	0.0096*	0.0089*	0.0121	0.0095*	0.0035	0.0033*
RWA/Total assets		-0.1253***	-0.1432***	-0.0587*	-0.0955*	-0.08112*
Market capital		5.8136***	4.5229***	4.7628***	4.2269***	
Cost/Income			-0.2522***	-0.0373***		
Number of employees				-0.0069	-0.0065	-0.0015
Tier 1 Ratio					0.0727**	0.0061*
Dividend payout					0.0079	
Earnings per share						0.0274**
Dividend per share						-0.0087
Book value per share						-0.0137
adj.R^2(%)	2.76	9.06	21.92	23.87	26.12	29.79

Notes: This table presents the panel regression coefficients from model 1. All the variables are taken at a annual frequency. All equations are estimated with firm and time fixed effects. Intercept results are not reported for the sake of space.

The panel regression estimates are reported in Table 2. Interestingly the table shows that the variable "own shares" has a positive albeit low impact on ROE in three cases. In all the cases the variable is significant considering a 10% level of confidence, suggesting not a strong statistical relationship. Starting from left, the first regression, a simple linear regression having as dependent variable the ROE and as independent variable "own shares", shows that for each additional unit of "own shares" the ROE (measured in percentage points) increases of 0.0096. The adjusted R-squared shown at the bottom of the table, however, suggests that the explanatory power of the model is rather limited as it is equal to 2.76%. At the other end of the table we see that the "own shares", even if considered with all the other variables of the model, has a positive impact on the ROE. More specifically, keeping all the other variable constant, each unit increase of “own shares” determines an increase of the ROE equal to 0.0033. The adjusted R-squared substantially improved considering also the other control variables in the model and is now equal to 29.79%.

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[3] https://www.bis.org/statistics/consstats.htm

Since a buyback performed in t − 1 could also affect the ROE, we run also model 2:

$$ROE_{i,t} = \alpha_i + \sum_{i=1}^{n} \beta_{i,t} X_{i,t} + \beta_{i,t} Own\ shares_{i,t-1} + \sum_{i=1}^{n-1} Firm_i + \sum_{j=1}^{m-1} Time_j + \varepsilon_{i,t}$$

The panel regression estimates are reported in Table 3

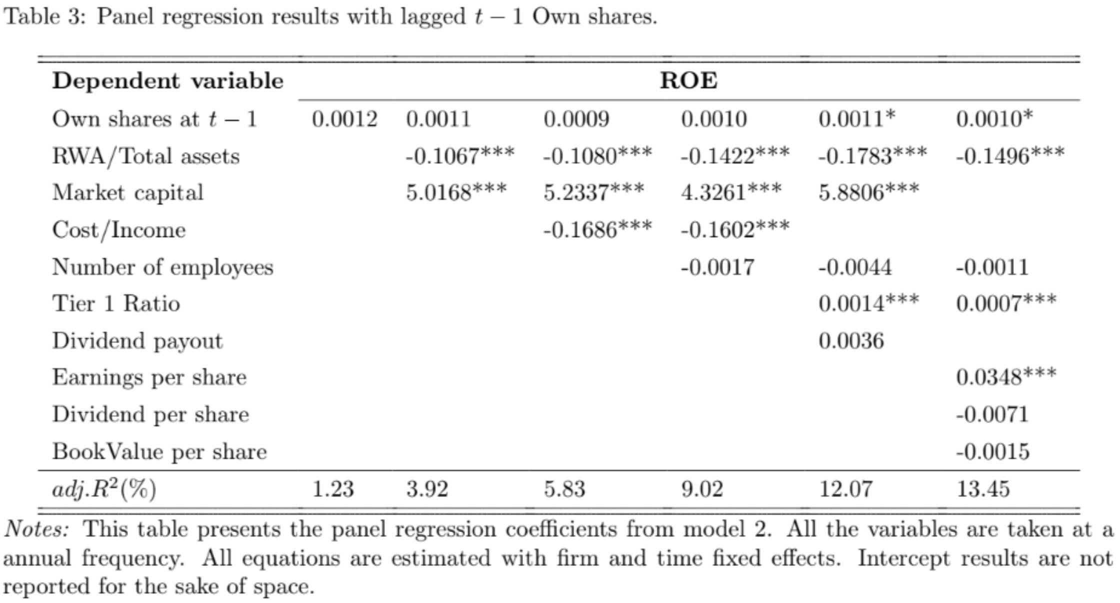

Table 3: Panel regression results with lagged $t-1$ Own shares.

Dependent variable	ROE					
Own shares at $t-1$	0.0012	0.0011	0.0009	0.0010	0.0011*	0.0010*
RWA/Total assets		-0.1067***	-0.1080***	-0.1422***	-0.1783***	-0.1496***
Market capital		5.0168***	5.2337***	4.3261***	5.8806***	
Cost/Income			-0.1686***	-0.1602***		
Number of employees				-0.0017	-0.0044	-0.0011
Tier 1 Ratio					0.0014***	0.0007***
Dividend payout					0.0036	
Earnings per share						0.0348***
Dividend per share						-0.0071
BookValue per share						-0.0015
adj.R^2(%)	1.23	3.92	5.83	9.02	12.07	13.45

Notes: This table presents the panel regression coefficients from model 2. All the variables are taken at a annual frequency. All equations are estimated with firm and time fixed effects. Intercept results are not reported for the sake of space.

As shown in the table above, the “own shares at t-1” variable is significant only in two cases, the last two columns of the table and considering a 10% level of confidence. More specifically, in both cases the variable in the model considering also other control variables such as RWA/total assets, market capital and cost/income. In both cases the impact of a unit change of “own shares at t-1” on the ROE is limited and equal to 0.0011 and 0.0010 respectively, holding all the other variables constant. The low values of the adjusted R-squared, shown at the bottom of the table, however, suggest that the explanatory power of these models, as compared to the ones shown in the table above is rather limited. Moreover, the results shown in the model are perfectly consistent with the reality. As an example, the variable “RWA/total assets” is strongly significant (using a 1% level of confidence) in all regressions ran and has a negative impact on the ROE. This is consistent with the economic literature as an increase of the RWA/total assets (ie the riskier assets), the bank will have an increase in the capital requirement, a probable deterioration of the quality held in its books and, consequently, a decrease of the ROE.

5. Conclusion

Buybacks, or repurchases of a company's own stock, have become a popular tool for capital management in the banking sector. However, concerns have been raised about the potential risks associated with the use of buybacks, particularly in relation to leverage management and systemic risk. This paper provides an overview of buyback practices in banking, analyses the implications of buybacks for profitability and shareholder value, and discusses the regulatory framework governing buybacks in banking. While buybacks can provide benefits to shareholders, their use has also raised concerns about potential risks to financial stability. One concern is that buybacks can be used as a tool for leverage management, as they can increase the debt-to-equity ratio of a bank. This can make the bank more vulnerable to financial distress in the event of an economic downturn or other adverse event. In addition, buybacks can reduce the amount of capital available for other purposes, such as investments or acquisitions, which can limit a bank's ability to respond to changing market conditions.

Buybacks can provide benefits to shareholders by increasing earnings per share (EPS) and signalling confidence to the market. By reducing the number of outstanding shares, buybacks can increase the value of each remaining share, which can enhance shareholder value. In addition, buybacks can signal to the market that the bank believes its shares are undervalued, which can result in an increase in the stock price.

The regulatory framework governing buybacks in banking varies by country and region. In the United States, the Federal Reserve has established guidelines for buybacks, including stress-testing requirements and limitations on the amount of capital that can be returned to shareholders. In addition, the Basel III regulatory framework includes provisions related to the use of buybacks in capital management. The guidelines require banks to maintain a minimum level of capital and to consider the impact of buybacks on their capital position.

There are several reasons why a bank may choose to engage in a buyback. One primary reason is to increase shareholder value by reducing the number of shares outstanding. By doing so, the bank can increase its earnings per share and return on equity. Additionally, by reducing the number of shares, the bank can also increase the market demand for its shares, leading to an increase in the share price.

Another reason why a bank may engage in a buyback is to return excess capital to shareholders. When a bank generates more capital than it requires for its operations, it may choose to distribute the excess capital to its shareholders in the form of dividends or buybacks. This is a common practice used by banks to manage their capital structure and optimize their return on equity.

In addition to shareholder value and capital management, buybacks can also be used to fend off hostile takeovers. In the event of a hostile takeover attempt, a bank may engage in a buyback to increase the price of its shares and deter potential acquirers. By increasing the share price, the bank can make it more expensive for the acquirer to purchase a controlling stake in the bank.

It is important to note that buybacks are not without risks. One potential risk is that the bank may overpay for its own shares, leading to a decrease in shareholder value. Additionally, the bank may reduce its cash reserves by engaging in a buyback, which could leave it vulnerable to unexpected market shocks or economic downturns.

In conclusion, buybacks are a common practice used by banks to manage their capital structure, increase shareholder value, and fend off hostile takeovers. While there are risks associated with buybacks, when executed properly, they can be an effective tool for optimizing a bank's return on equity and capital structure.

This paper aimed at testing the signalling hypothesis presented in the economic literature by analysing the potential impact of shares buyback on banks' performance as measured by the return on equity. In our analysis we found a limited significant linear relationship between share buybacks and the banks' return on equity. Further studies could leverage on this analysis and measure the impact of share buybacks on the performance of firms other than banks. The results of this analysis could also be further tested by enlarging the sample of banks considered or by lengthening the observation period.

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Analysis of numerical integration schemes for the Heston model: a case study based on the pricing of investment certificates

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Abstract

The Heston model is one of the most used techniques for estimating the fair value and the risk measures associated with investment certificates. Typically, the pricing engine implements a significant number of projections of the underlying until maturity, it calculates the pay-off for all the paths thus simulated considering the characteristics of the structured product and, in accordance with the Monte Carlo methodology, it determines its theoretical value by calculating its mean and discounting it at valuation time. In order to generate the future paths, the two stochastic differential equations governing the dynamics of the Heston model should be integrated simultaneously over time: both the one directly associated with the underlying and the one associated with variance. Consequently, it is essential to implement a numerical integration scheme that allows such prospective simulations to be implemented. The present study aims to consider alternatives to the traditional Euler method with the aim of reducing or in some cases eliminating the probability of incurring unfeasible simulated values for the variance. In fact, one of the main drawbacks of the Euler basic integration scheme applied to the Heston bivariate stochastic model is that of potentially generating negative variances in the simulation that should be programmatically corrected each time such undesired effect occurs. The methods which do not intrinsically admit the generation of negative values of the variance proved to be very interesting, in particular the Transformed Volatility scheme.

Key Words:
Certificate pricing, Stochastic Differential Equation, Heston model, Numerical integration schemes.

JEL code: G12-G17-C53-C63

1) Introduction

The financial industry has paid particular attention to the issue of structured products and investment certificates in order to meet the needs of investors, as shown in the analysis of the primary market made by ACEPI (Italian Association of Investment Certificates and Products). The first quarter of 2023 showed that the total volumes, equal to 5,572 million euros issued by ACEPI members, increased by 37% compared to the previous quarter and compared to the average of the quarterly issues in 2022. The increase in amounts issued in Q1 2023 strengthens the growth trend recorded in the second half of 2022 (the year ended overall at a figure of 16,236 million euros), up 71% compared to 2021. In a context of uncertainty regarding monetary policies, market trends and the stability of the financial system, the search for protection was one of the factors explaining the growing trend. The number of products offered, 376, exceeded the record of 343 already achieved in Q4 last year, confirming a further 10% increase. In terms of breakdown into ACEPI macro-classes, in Q1 protected-capital products accounted for 63% of issues on the primary market compared to 30% of conditionally protected capital products. The remaining 7% refers to Credit Linked Notes, a type of product which had shown considerable growth in 2022, with peaks of 11% and 10% of the total issues in Q3 and Q4.

The figures presented briefly in this context suggest the importance for financial institutions to estimate the fair value and the sensitivity measures of these products as precisely and reliably as possible. To this end, after focusing on variance reduction techniques (Bottasso *et al.*, 2023a) and on low discrepancy sequences (Bottasso *et al.*, 2023b), the present study centers on the numerical integration schemes associated with one of the most widespread quantitative analysis models for investment certificates: the Heston model (1993). In particular, the goal is to look for valid alternatives to the most widespread method of numerical integration, i.e., the Euler method which, due to the type of stochastic process, could unfortunately present the drawback of making the variance assume negative and, consequently, not eligible values (Rouah, 2013). Such variance values, unacceptable from a theoretical point of view, are artificially set to zero or considered for their absolute value. Thus, the importance of studying more robust integration schemes that minimize (or, in some cases, eliminate) the probability that this undesired effect occurs. The problem is well known in the scientific literature, in fact several studies applied to different types of options have been dedicated to this research, including: Vanilla options (Mrázek and Pospíšil, 2017), Asian options (Begin, Bedard and Gaillardetz, 2015), Forward-Start options (Broadie and Kaya, 2006), Double-no-touch options (Lord, Koekkoek and van Dijk, 2008). On the other hand, the implementation of other schemes, different from the traditional Euler scheme, in the pricing of hybrid instruments, i.e., characterized by a Fixed Income component and one or more option strategies, such as certificates, is innovative.

In the next section of the paper we will describe the integration schemes that allow to reduce the numerical approximation error of the dynamics. They will then be implemented in the third section of the paper applied to the pricing of a plain vanilla option written on the FTSE MIB index using market parameters. For such pricing problem, an analytical valuation formula is known, i.e. the price of a European call option can be expressed in a closed form involving integrals in the complex numbers that can be numerically valuated with the Gauss-Laguerre quadrature. Having a reasonably exact expression to which the Monte Carlo method should converge makes it possible to test the stability (absence of convergence bias to the fair value) and measure the performance across numerical integration schemes. The schemes that proved to be most stable and efficient have been taken into consideration to be implemented in a valuation context for which an analytical pricing formula is not available. The last section of the study, therefore, implements the schemes that resulted most suitable in the previous tests and values, again using market parameters, the most widespread types of investment certificates, in accordance with the ACEPI statistics previously presented: i.e. products characterized by digital coupons with or without memory, autocallability and conditionally protected capital.

2) An overview of the numerical integration schemes for the Heston model

The Monte Carlo method within the Heston pricing framework is understood as a set of techniques which allow the generation of an artificial historical series of prices of an underlying (typically equity or index) and of variance over time, from which option prices can be calculated. In the literature, several numerical schemes allow to achieve this goal. The first approach is to implement standard methods valid for any kind of stochastic differential equation that is supposed to be integrated over time: among these, the most popular are the Euler and the Milstein methods. The advantage of employing these multi-purpose techniques is that they are easy to understand, and their convergence properties are well known. As a result, these two schemes can be adopted for pricing a large number of financial derivatives typologies which fair values have to be estimated using a Monte Carlo technique. A second approach is to use methods designed ad-hoc for the specific Heston dynamics. As regards the Heston model, we can mention the IJK scheme of Kahl and Jäckel (2006), the transformed volatility scheme of Zhu (2010) or the moment-matching scheme of Andersen and Brotherton-Ratcliffe (2005). Such approaches, specifically applicable for the most widely used valuation model for pricing investment certificates with an equity or index underlying, are potentially able to reach a theoretically higher speed of convergence and in certain cases to avoid the unwelcome effect of generating negative variances, which might occur using a multi-purpose scheme. For a comprehensive review of methods for numerical integration, the contribution of Van Haastrecht and Pelsser (2010) should be considered.
The starting point for the study and the consequent implementation of any numerical integration technique is to consider the object of integration in a continuous form. Bearing in mind that the stock (or index) price and its variance in the Heston model are driven by the following bivariate system of stochastic differential equations (SDE):

$$\begin{aligned} dS_t &= (r-q)S_t dt + \sqrt{v_t} S_t dW_{1,t} \\ dv_t &= \kappa(\theta - v_t)dt + \sigma\sqrt{v_t} dW_{2,t} \end{aligned} \quad (1)$$

Where $E\left[dW_{1,t}, dW_{2,t}\right] = \rho dt$

The parameters of the model are:

$(r-q)$ the drift of the process for the share or index. In particular, r is the risk-free rate and q is the dividend yield associated with the underlying. Depending on the available market data, both quantities should be time varying.

$\kappa > 0$ the mean reversion speed for the variance.

$\theta > 0$ the mean reversion level for the variance.

$\sigma > 0$ the volatility of the variance.

$v_0 > 0$ the initial level of the variance (at time zero).

Furthermore $W_{1,t}$ and $W_{2,t}$ are Wiener processes with correlation $\rho \in [-1,1]$ and S_t is the value of the price of the share/index assumed at time t. Thus, S_0 is the initial spot value.

The processes described in Equation (1) are defined in continuous time. The numerical simulation, however, must necessarily be programmed using discrete time steps. Therefore, the first step to be taken in a numerical simulation scheme is generally that of approximating the continuous-time process with a discrete-time process: in other words, discretizing the stochastic differential equations. Both the dynamics associated with the stock price and that associated with its volatility can be rewritten in the following general form, considering a generic random variable X_t:

$$dX_t = \mu(X_t, t)dt + \sigma(X_t, t)dW_t \quad (2)$$

With $\mu(X_t, t)$ being the drift and $\sigma(X_t, t)$ being the volatility of the stochastic process to be represented. X_t is simulated, along the time interval $[0, T]$, which is supposed to be divided into N points thus creating a time grid of the type $0 = t_1 < t_2 < \cdots < t_N = T$ where the time increments are characterized by the same amplitude dt. This choice also allows the use of a more convenient notation since it allows to write $t_i - t_{i-1}$ merely with dt for any $i = 2, \ldots, N$. It being understood that all results derived with equally spaced time increments can easily be extended by ranges of non-uniform amplitude. Integrating dX_t from t to $t + dt$, we have:

$$X_{t+dt} = X_t + \int_t^{t+dt} \mu(X_u, u)du + \int_t^{t+dt} \sigma(X_u, u)dW_u \quad (3)$$

Equation (3) is the starting point for the discretization. The concept is that at time t the value of X_t is known and we want to obtain the next value of the time series X_{t+dt} at time $t + dt$. Clearly, to obtain the value of an option by means of numerical simulation, which we supposed in the first part of our discussion to be a plain vanilla European option, we have to simulate the Heston bivariate process (S_t, v_t) and generate N paths from $t = 0$ to $t = T$. We then retain the last stock price from each stock price path and obtain the payoff of the European option at expiry, take the average over all stock price paths and discount back to time zero. So, in the case considered we would have respectively for a call option, $C(K)$ and a put option $P(K)$:

$$C(K) = e^{-rT} \frac{1}{N} \sum_{i=1}^{N} \max\left(0, S_T^{(i)} - K\right) \quad (4)$$

$$P(K) = e^{-rT}\frac{1}{N}\sum_{i=1}^{N}\max\left(0, K - S_T^{(i)}\right) \quad (5)$$

Where $S_T^{(i)}$ is the final price of the stock or index generated by the i -th path for $i = 1, \dots, N$. Such valuation requires the estimation of the characteristic parameters of the Heston dynamics: κ, θ, σ, v_0 and ρ (refer to paragraph 3).

There are two kinds of problems that arise when simulating the bivariate stochastic process (S_t, v_t). The first aspect is the slow convergence speed. The second, to be considered as a more serious problem, is given by the CIR (Cox-Ingersoll-Ross) type of process which describes the variance v_t over time. Considering how it was modeled, this dynamic leads a large number of numerical simulation schemes (including the most popular in the financial industry, namely Euler and Milstein) to generate negative values for v_t, even though the Feller condition, such that $2\kappa\theta > \sigma^2$, is respected. This occurs because such condition is valid for continuous-time CIR stochastic processes, while simulations, by nature, work in discrete time, approximating the dynamics defined on the continuum. The simplest and most direct way to manage the problem of having a negative variance even though Feller's condition is satisfied is to correct it instantaneously by systematically introducing an override every time this unwanted effect occurs. There are at least two ways to implement this:

- in the full truncation scheme, a negative value for v_t is set equal to zero. So v_t is replaced with $v_t^+ = \max(0, v_t)$ anywhere during the discretization process.

- in the reflection scheme, a negative value for v_t is reflected with $-v_t$. So v_t is replaced with $|v_t|$ anywhere during the discretization process.

The disadvantage of the full truncation scheme is that it creates a zero variance, which is an inaccurate representation of the real dynamics of an asset, which never shows a zero variance.

The disadvantage of the reflection schemes is that they make a large negative value assume a largely positive one. So, in other words, it would produce the bias of turning a low volatility into a high volatility.

The first problem related to the Heston model can be mitigated by taking into consideration variance reduction methodologies (Giribone and Ligato, 2013) or by implementing a Randomized Quasi Monte Carlo (Giribone and Ligato, 2014), since there are no distorting effects of convergence.

For the second aspect, certainly more crucial, it is necessary to resort to an adjustment of the integration scheme itself in the hope of improving the approximation of the continuous dynamics. So, another way to deal with negative simulated values of v_t is to design simulation schemes for variance that do not inherently produce negative values or so that the probability of running into such cases is very low. Most of the research focuses precisely on this aspect, namely that of simulating the variance process in the Heston model in the most accurate and stable way possible.

All simulation schemes for the Heston model contain the same basic steps. First, two independent random draws are made from a standard normal distribution. These variables are made dependent by applying the Cholesky decomposition. They are then multiplied by $\sqrt{dt}$ to make them a proxy for Brownian motion increments. The second step provides the updated value of the variance v_{t+dt} and the last step the updated value for the share or index, S_{t+dt}. This procedure, common to all the schemes that will be presented below, can therefore be summarized as follows:

Initialization: Assign the spot value to S_0 and the initial variance value to v_0.

Step 1. Generate two independent random variables Z_1 and Z_2 and define $Z_V = Z_1$ and $Z_S = \rho Z_V + \sqrt{1-\rho^2}Z_2$. Approximate the Brownian motion with $dW_{1,t} = Z_S\sqrt{dt}$ and $dW_{2,t} = Z_V\sqrt{dt}$.

Step 2. Get the updated value for v_{t+dt}

Step 3. Given v_{t+dt} calculate the updated value of S_{t+dt} and return to Step 1.

Let us note that, in accordance with the traditional use of the Cholesky decomposition for the simulation of correlated variables, the following statistical properties hold: $E[Z_V] = E[Z_S] = 0$ and $E[Z_V Z_S] = \rho E[Z_1^2] + \sqrt{1-\rho^2}E[Z_1 Z_2] = \rho$.

In the following subparagraphs, the most common integration schemes for (S_t, v_t) will be described assuming that the time grid is discretized using equally spaced time increments with a size equal to dt.

2.1) The Euler scheme

The easiest way to discretize the process represented in Eq. (3) is to adopt the traditional Euler scheme. This is equivalent to approximating integrals using the left-point rule (Rouah, 2013). The first integral is approximated as the product of the integrand at time t and the integration domain dt:

$$\int_t^{t+dt}\mu(X_u, u)du \approx \mu(X_t, t)\int_t^{t+dt}du = \mu(X_t, t)dt \quad (6)$$

The left-point rule is used since the value $\mu(X_t, t)$ is known at time t. The second integral is approximated as follows:

$$\int_t^{t+dt}\sigma(X_u, u)du \approx \sigma(X_t, t)\int_t^{t+dt}dW_u = \sigma(X_t, t)(W_{t+dt} - W_t) = \sigma(X_t, t)\sqrt{dt}Z, \quad (7)$$

since $W_{t+dt} - W_t$ and $\sqrt{dt}Z$ are identical in distribution, where Z is a standard normal variable. Thus, the discretization of Equation (3) according to the Euler method is:

$$X_{t+dt} = X_t + \mu(X_t, t)dt + \sigma(X_t, t)\sqrt{dt}Z \quad (8)$$

Considering the specific Heston model, the next step is to particularize Eq. (8) for the dynamics that regulate the variance and for the one that regulates the price.

The SDE for v_t in Eq. (1) rewritten in the form of Eq. (3) is:

$$v_{t+dt} = v_t + \int_t^{t+dt} \kappa(\theta - v_u)du + \int_t^{t+dt} \sigma\sqrt{v_u}dW_u \quad (9)$$

In accordance with Eq. (8), the Euler discretization approximates the integrals in (9) as:

$$\int_t^{t+dt} \kappa(\theta - v_u)du \approx \kappa(\theta - v_t)dt \quad (10)$$

$$\int_t^{t+dt} \sigma\sqrt{v_u}dW_{2,u} \approx \sigma\sqrt{v_t}(W_{t+dt} - W_t) = \sigma\sqrt{v_t}\sqrt{dt}Z_V \quad (11)$$

This implies that the Euler discretization for the variance is:

$$v_{t+dt} = v_t + \kappa(\theta - v_t)dt + \sigma\sqrt{v_t}\sqrt{dt}Z_V \quad (12)$$

From the theory related to stochastic processes of the CIR type, the probability of generating negative values for v_{t+dt} can be calculated, as follows:

$$\Pr(v_{t+dt} < 0) = \Phi\left(\frac{-(1-\kappa dt)v_t - \kappa\theta dt}{\sigma\sqrt{v_t}\sqrt{dt}}\right) \quad (13)$$

Where $\Phi(x)$ denotes the standard normal cumulative distribution function, evaluated at x. Therefore, since there is a non-zero probability of having a negative variance, the full truncation scheme or a reflection scheme should be applied to override any negative value generated during the simulation.

Regarding the simulation of the stock price or the index price, there are two common approaches: we can either directly simulate S_t or we can simulate $\ln S_t$ then calculate the exponential on the result obtained. The SDE for S_t in Eq. (3) can be expressed in integral form as:

$$S_{t+dt} = S_t + (r - q)\int_t^{t+dt} S_u du + \int_t^{t+dt} \sqrt{v_u}S_u dW_u \quad (14)$$

Applying Eq. (8), the Euler discretization approximates the integrals as follows:

$$\int_t^{t+dt} S_u du \approx S_t dt \quad (15)$$

$$\int_t^{t+dt} \sqrt{v_u}S_u dW_{1,u} \approx \sqrt{v_t}S_t(W_{t+dt} - W_t) = \sqrt{v_t}S_t\sqrt{dt}Z_S \quad (16)$$

Consequently, the discretization of the share price or index price is:

$$S_{t+dt} = S_t + (r - q)S_t dt + \sqrt{v_t}S_t\sqrt{dt}Z_S \quad (17)$$

To simulate the log stock price, we apply Itô's lemma to the first dynamic in Eq. (1). Then, $\ln S_t$ follows the SDE:

$$d\ln S_t = \left(r - q - \frac{1}{2}v_t\right)dt + \sqrt{v_t}dW_{1,t} \quad (18)$$

Or expressing it as integral:

$$\ln S_{t+dt} = \ln S_t + \int_t^{t+dt}\left(r - q - \frac{1}{2}v_u\right)du + \int_t^{t+dt}\sqrt{v_u}dW_{1,u} \quad (19)$$

The Euler discretization for the process $\ln S_t$ is:

$$\ln S_{t+dt} \approx \ln S_t + \left(r - q - \frac{1}{2}v_t\right)dt + \sqrt{v_t}\left(W_{1,t+dt} - W_{1,t}\right) = \ln S_t + \left(r - q - \frac{1}{2}v_t\right)dt + \sqrt{v_t}\sqrt{dt}Z_S \quad (20)$$

The Euler discretization for S_t is obtained applying the exponential to the various terms of the previous equation:

$$S_{t+dt} = S_t \exp\left[\left(r - q - \frac{1}{2}v_t\right)dt + \sqrt{v_t}\sqrt{dt}Z_S\right] \quad (21)$$

Again, in order to avoid the undesirable effect of obtaining negative variances, the introduction of the full truncation or reflection scheme is necessary, replacing v_t respectively with v_t^+ or $|v_t|$.

To implement the Euler simulation, initialization is performed setting S with the initial values of S_0 (or in the case of adoption of the logarithmic evolution process $x_0 = \ln S_0$) for the stock price and v_0 for the variance (in all cases). Given the values (S_t, v_t), v_{t+dt} is obtained from Eq. (12) and S_{t+dt} is obtained both from Eq. (17) and from Eq. (21) (for the case of logarithmic evolution of the asset price over time).

2.2) The Milstein scheme

The general case for the discretization of an SDE according to such a numerical integration scheme is described in Glasserman (2003) and Kloeden and Platen (1992). For the specific case observed, i.e., the Heston bivariate process, the coefficients of Eq. (2) do not depend directly on time t, but exclusively on X_t. For the sake of simplicity, we can thus assume that the stock price and the variance are driven by the SDE:

$$dX_t = \mu(X_t)dt + \sigma(X_t)dW_t = \mu_t dt + \sigma_t dW_t \quad (22)$$

In integral form:

$$X_{t+dt} = X_t + \int_t^{t+dt} \mu_s ds + \int_t^{t+dt} \sigma_s dW_s \quad (23)$$

The idea behind the Milstein scheme is that the accuracy of the discretization can be increased by expanding the coefficients $\mu_t = \mu(X_t)$ and $\sigma_t = \sigma(X_t)$ through Itô's lemma. The coefficients will follow the following SDEs:

$$d\mu_t = \left(\mu'_t\mu_t + \frac{1}{2}\mu''_t\sigma_t^2\right)dt + (\mu'_t\sigma_t)dW_t \quad (24)$$

$$d\sigma_t = \left(\sigma'_t\mu_t + \frac{1}{2}\sigma''_t\sigma_t^2\right)dt + (\sigma'_t\sigma_t)dW_t \quad (25)$$

Where the single $'$and double quotes $''$ refer to the differentiation in X and where the derivatives in t are zero since μ_t and σ_t do not have a direct time dependence in the Heston model. The integral form of the coefficients at time s (with $t < s < t + dt$) is:

$$\mu_s = \mu_t + \int_t^s \left(\mu'_u\mu_u + \frac{1}{2}\mu''_u\sigma_u^2\right)du + \int_t^s(\mu'_u\sigma_u)dW_u \quad (26)$$

$$\sigma_s = \sigma_t + \int_t^s \left(\sigma'_u\mu_u + \frac{1}{2}\sigma''_u\sigma_u^2\right)du + \int_t^s(\sigma'_u\sigma_u)dW_u \quad (27)$$

Substituting μ_s and σ_s into the integrals in Eq. (23) we obtain:

$$X_{t+dt} = X_t + \int_t^{t+dt}\left[\mu_t + \int_t^s \left(\mu'_u\mu_u + \frac{1}{2}\mu''_u\sigma_u^2\right)du + \int_t^s(\mu'_u\sigma_u)dW_u\right]ds +$$

$$+ \int_t^{t+dt}\left[\sigma_t + \int_t^s \left(\sigma'_u\mu_u + \frac{1}{2}\sigma''_u\sigma_u^2\right)du + \int_t^s(\sigma'_u\sigma_u)dW_u\right]dW_s \quad (28)$$

The first order major differentials $dsdu = \mathcal{O}(dt^2)$ and $dsdW_u = \mathcal{O}(dt^{3/2})$ are here neglected. The term dW_udW_s is retained since it is of the first order, $\mathcal{O}(dt)$. Considering such assumptions, Eq. (28) simplifies to:

$$X_{t+dt} = X_t + \mu_t\int_t^{t+dt} ds + +\sigma_t\int_t^{t+dt} dW_s + \int_t^{t+dt}\int_t^s(\sigma'_u\sigma_u)\, dW_udW_s \quad (29)$$

We apply the Euler discretization to the last term of Eq. (29) and we obtain:

$$\int_t^{t+dt}\int_t^s(\sigma'_u\sigma_u)\, dW_udW_s \approx \sigma'_t\sigma_t\int_t^{t+dt}\int_t^s dW_udW_s = \sigma'_t\sigma_t\int_t^{t+dt}(W_s - W_t)dW_s = \sigma'_t\sigma_t\left[\int_t^{t+dt} W_sdW_s - W_tW_{t+dt} + W_t^2\right] \quad (30)$$

To solve the remaining integral in Eq. (30), we define $dY_t = W_tdW_t$. Using Itô's Lemma, it is easy to prove that Y_t has the following solution: $Y_t = \frac{1}{2}W_t^2 - \frac{1}{2}t$. Therefore: $\frac{\partial Y}{\partial t} = -\frac{1}{2}, \frac{\partial Y}{\partial W} = W$ and $\frac{\partial^2 Y}{\partial W^2} = 1$:

$$dY_t = \left(-\frac{1}{2} + 0 + \frac{1}{2} \times 1 \times 1\right)dt + (W_t \times 1)dW_t = W_tdW_t \quad (31)$$

Using this result, we can write:

$$\int_t^{t+dt} W_sdW_s = Y_{t+dt} - Y_t = \frac{1}{2}W_{t+dt}^2 - \frac{1}{2}W_t^2 - \frac{1}{2}dt \quad (32)$$

Substituting this last equation into Eq. (30) we obtain:

$$\int_t^{t+dt}\int_t^s(\sigma'_u\sigma_u)\, dW_udW_s \approx \frac{1}{2}\sigma'_t\sigma_t[(W_{t+dt} - W_t)^2 - dt] = \frac{1}{2}\sigma'_t\sigma_t[(\Delta W_t)^2 - dt] \quad (33)$$

Where $\Delta W_t = W_{t+dt} - W_t$, which is equal in distribution to $\sqrt{dt}Z$ with Z distributed as a standard normal. Combining Eq. (29) and Eq. (33), the general form for the Milstein discretization is therefore:

$$X_{t+dt} = X_t + \mu_tdt + \sigma_t\sqrt{dt}Z + \frac{1}{2}\sigma'_t\sigma_tdt(Z^2 - 1) \quad (34)$$

Thus, the Milstein discretization for dX_t expressed in Eq. (34) is identical to the Euler one in Eq. (8), with the exception of the added term $\frac{1}{2}\sigma'_t\sigma_tdt(Z^2 - 1)$ which allows to improve the accuracy of the discretization scheme compared to the standard one.

Reconsidering the Heston model in Eq. (1), this last integration scheme can be applied both for the processes of S_t (or $\ln S_t$) and the processes of v_t.

The coefficients for the variance process are $\mu(v_t) = \kappa(\theta - v_t)$ and $\sigma(v_t) = \sigma\sqrt{v_t}$, substituting them in the general expression (34) we obtain:

$$v_{t+dt} = v_t + \kappa(\theta - v_t)dt + \sigma\sqrt{v_t}\sqrt{dt}Z_V + \frac{1}{4}\sigma^2dt(Z_V^2 - 1) \quad (35)$$

Which can be rewritten as:

$$v_{t+dt} = \left(\sqrt{v_t} + \frac{1}{2}\sigma\sqrt{dt}Z_V\right)^2 + \kappa(\theta - v_t)dt - \frac{1}{4}\sigma^2dt \quad (36)$$

Although the Milstein discretization scheme for the variance stochastic process produces far fewer negative values compared to the basic Euler scheme (Rouah, 2013), it is still necessary to implement the full truncation scheme or the reflection scheme to Eq. (35) and Eq. (36).

The coefficients for the stock price or the index price process are $\mu(v_t) = (r - q)S_t$ and $\sigma(S_t) = \sqrt{v_t}S_t$, substituting them into the general expression, Eq. (34) becomes:

$$S_{t+dt} = S_t + (r-q)S_t dt + \sqrt{v_t}\sqrt{dt}S_t Z_S + \frac{1}{2}v_t S_t dt(Z_S^2 - 1) \quad (37)$$

We can also discretize the log-stock process, which, according to Itô's lemma, will follow the following dynamics:

$$d\ln S_t = \left(r - q - \frac{1}{2}v_t\right)dt + \sqrt{v_t}dW_{1,t} \quad (38)$$

The coefficients are $\mu(S_t) = r - q - \frac{1}{2}v_t$ and $\sigma(S_t) = \sqrt{v_t}$ so that $\mu_t' = \sigma_t' = 0$. Since v_t is known at time t, we can treat it as a constant within the definition of the coefficients. Applying Eq. (34), we reach the following result:

$$\ln S_{t+dt} = \ln S_t + \left(r - q - \frac{1}{2}v_t\right)dt + \sqrt{v_t}\sqrt{dt}Z_s \quad (39)$$

which is identical to Eq. (20) obtained applying the simple Euler discretization. Thus, the Milstein discretization of $\ln S_t$ in the Heston model does not produce a more accurate approximation than the basic method.

Similarly to what has already been discussed, the price of the share or the index is directly obtained applying the exponential function to all the terms of Eq. (39). The adoption of the full truncation or the reflection scheme is also necessary for Eq. (37) or Eq. (39).

To implement the Milstein simulation, we initialize the value of the stock price and the value of the variance, respectively with S_0 and v_0. Given the simulated values (S_t, v_t), v_{t+dt} is obtained from Eq. (35) and S_{t+dt} is obtained from Eq. (37) or, alternatively, from Eq. (39).

In Eq. (34) for the discretization of dX_t, the coefficients $\mu_t = \mu(X_t)$ and $\sigma_t = \sigma(X_t)$ are respectively the drift and the volatility of the process for X_t and they are functions of X_t itself. In the implicit version of the Milstein scheme, the coefficient of the drift μ_t is expressed as a function of X_{t+dt}. Consequently, such value is known only implicitly and not explicitly, as in the previous case which depended on X_t and Eq. (34) becomes:

$$X_{t+dt} = X_t + \mu_{t+dt}dt + \sigma_t\sqrt{dt}Z + \frac{1}{2}\sigma_t'\sigma_t dt(Z^2 - 1) \quad (40)$$

Where $\mu_{t+dt} = \mu(X_{t+dt})$. It is also possible to interpolate between the Milstein implicit-explicit schemes, calculating a weighted average between μ_t and μ_{t+dt}. The weighted implicit-explicit Milstein scheme is therefore:

$$X_{t+dt} = X_t + [\alpha\mu_t + (1-\alpha)\mu_{t+dt}]dt + \sigma_t\sqrt{dt}Z + \frac{1}{2}\sigma_t'\sigma_t dt(Z^2 - 1) \quad (41)$$

Where $\alpha \in (0,1)$ represents the assigned weight. The explicit Milstein can be obtained as a degenerate case by setting $\alpha = 1$, just as the implicit Milstein can be obtained by setting $\alpha = 0$.

To apply the implicit Milstein scheme to the Heston model, in Eq. (35) we replace the term $\kappa(\theta - v_t)dt$ with $\kappa(\theta - v_{t+dt})dt$. We then bring $\kappa v_{t+dt}dt$ over to the left-hand side of the resulting equation, and we divide by $1 + \kappa dt$ to obtain:

$$v_{t+dt} = \frac{v_t + \kappa\theta dt + \sigma\sqrt{v_t}\sqrt{dt}Z_V + \frac{1}{4}\sigma^2 dt(Z_V^2 - 1)}{1 + \kappa dt} \quad (42)$$

The same steps can also be performed for the case of the weighted scheme (Eq. 41) to obtain:

$$v_{t+dt} = \frac{v_t + \kappa(\theta - \alpha v_t)dt + \sigma\sqrt{v_t}\sqrt{dt}Z_V + \frac{1}{4}\sigma^2 dt(Z_V^2 - 1)}{1 + (1-\alpha)\kappa dt} \quad (43)$$

2.3) The Transformed Volatility scheme

One way to avoid negative variances is to simulate volatility rather than variance, and then square the result. From Itô's lemma, the volatility $\omega_t = \sqrt{v_t}$ follows the following stochastic process (Rouah, 2013):

$$d\omega_t = \frac{\kappa}{2}\left[\left(\theta - \frac{\sigma^2}{4\kappa}\right)\frac{1}{\omega_t} - \omega_t\right]dt + \frac{1}{2}\sigma dW_{1,t} \quad (44)$$

The Euler discretization for Eq. (44) is:

$$\omega_{t+dt} = \omega_t + \frac{\kappa}{2}\left[\left(\theta - \frac{\sigma^2}{4\kappa}\right)\frac{1}{\omega_t} - \omega_t\right]dt + \frac{1}{2}\sigma\sqrt{dt}Z_V \quad (45)$$

While the Euler discretization of the log stock price produces:

$$S_{t+dt} = S_t \exp\left[\left(r - q - \frac{1}{2}\omega_t^2\right)dt + \omega_t\sqrt{dt}Z_S\right] \quad (46)$$

Zhu (2010) has shown that the Euler discretization of the volatility ω_t avoids the negative variances, but it has the disadvantage that the mean level $\theta_\omega = \frac{\theta - \frac{\sigma^2}{4\kappa}}{\omega_t}$ in Eq. (44) is stochastic due to the term $\frac{1}{\omega_t}$.

This could cause low simulation performance. The transformed volatility scheme proposed by Zhu (2010) applies a robust approximation for θ_ω which allows to rectify this problem. His transformed process for volatility is:

$$d\omega_t = \frac{\kappa}{2}[\theta^* - \omega_t]dt + \frac{\sigma}{2}dW_{2,t} \quad (47)$$

Which is characterized by having a mean reversion speed equal to $\kappa/2$ and a variance volatility equal to $\sigma/2$.

The mean reversion level θ_t^* is equal to:

$$\theta_t^* = \frac{\beta-\omega_t \exp(-\kappa dt/2)}{1-\exp(-\kappa dt/2)} \quad (48)$$

Where:

$$\beta = \sqrt{[E(v_{t+dt}) - \mathrm{Var}(\omega_{t+dt})]^+} = \sqrt{\left[\theta + (v_t - \theta)\exp(-\kappa dt) - \frac{\sigma^2}{4\kappa}(1-\exp(-\kappa dt))\right]^+} \quad (49)$$

Note that parameter β is equal to zero when $E(v_{t+dt}) < \mathrm{Var}(\omega_{t+dt})$, while the mean reversion level θ_t^* depends on the value of ω_t.

The Euler discretization for $d\omega_t$ in Eq. (47) generates:

$$\omega_{t+dt} = \omega_t + \frac{\kappa}{2}[\Theta^* - \omega_t]dt + \frac{\sigma}{2}\sqrt{dt}Z_V \quad (50)$$

The same procedure can be used for conducting the simulations as discussed in the previously presented discretization schemes, with the sole exception that the starting point for the initial volatility should be set to $\sqrt{v_0}$.

2.4) The Balanced Implicit scheme

This scheme is able to preserve positivity in the stochastic process associated with the variance. It is defined in Platen and Heath (2009) and in Kahl and Jäckel (2006) as:

$$v_{t+dt} = v_t + \mu_t dt + \sigma_t \Delta W_t + (v_t - v_{t+dt})C(v_t) \quad (51)$$

Where:

$$C(v_t) = c^0(v_t)dt + c^1(v_t)|\Delta W_t| \quad (52)$$

With $c^0(v_t) = \kappa$ and $c^1(v_t) = \sigma/\sqrt{v_t}$. The Balanced Implicit scheme for the Heston model is therefore:

$$v_{t+dt} = v_t + \kappa(\theta - v_t)dt + \sigma\sqrt{v_t}\sqrt{dt}Z_V + (v_t - v_{t+dt})C(v_t) = \frac{v_t[1+C(v_t)] + \kappa(\theta - v_t)dt + \sigma\sqrt{v_t}\sqrt{dt}Z_V}{1+C(v_t)} \quad (53)$$

With:

$$C(v_t) = \kappa dt + \frac{\sigma\sqrt{dt}|Z_V|}{\sqrt{v_t}} \quad (54)$$

Since the variance is always guaranteed to be positive, reflection and full truncation schemes are unnecessary. Unfortunately, as shown by Kahl and Jäckel (2006), the convergence of this scheme is not always optimal.

2.5) The Pathwise Adapted Linearization Quadratic

Another scheme for variance discretization is the Path Adapted Linearization Quadratic introduced by Kahl and Jäckel (2006). These authors demonstrated a faster convergence compared to the previous one, especially for small values of σ. The discretization scheme is given by:

$$v_{t+dt} = v_t + \left[\kappa(\tilde{\theta} - v_t) + \sigma\beta_n\sqrt{v_t}\right] + \left(1 + \frac{\sigma\beta_n - 2\kappa\sqrt{v_t}}{4\sqrt{v_t}}dt\right)dt \quad (55)$$

Where $\tilde{\theta} = \theta - \sigma^2/(4\kappa)$ and where $\beta_n = \frac{Z_V}{\sqrt{dt}}$. For high values of σ it could introduce potential instabilities (Rouah, 2013).

2.6) The Kahl-Jäckel IJK Scheme

This scheme was also proposed by Kahl and Jäckel (2006) and it consists in simulating v_t with the implicit Milstein scheme, according to Eq. (42) and simulating the $\ln S_t$ with the IJK discretization:

$$\ln S_{t+dt} = \ln S_t + \left(r - q - \frac{v_t + v_{t+dt}}{4}\right)dt + \rho\sqrt{v_t dt}Z_V + \frac{1}{2}\left(\sqrt{v_t} + \sqrt{v_{t+dt}}\right)(Z_S - \rho Z_V)\sqrt{dt} + \frac{\rho\sigma dt}{2}(Z_V^2 - 1) \quad (56)$$

Since this scheme can produce negative values for variance, it is necessary to implement it in conjunction with the full truncation or the reflection scheme. For details on the derivation of the scheme, please refer to the above cited paper.

2.7) The Moment Matching scheme

Andersen and Brotherton-Ratcliffe (2005) proposed a moment-matched discretization scheme which generates only positive variances. This technique produces a variance which is distributed according to a log-normal, so a reasonable choice of parameterization is to match the first two moments of a log-normal discretization process.

The numerical integration scheme can therefore be expressed in the following form:

$$v_{t+dt} = [\theta + (v_t - \theta)\exp(-\kappa dt)]\exp\left(-\frac{1}{2}\Gamma_t^2 + \Gamma_t Z_V\right) \quad (57)$$

Where:

$$\Gamma_t = \ln\left(1 + \frac{\sigma^2 v_t[1-\exp(-2\kappa dt)]}{2\kappa[\theta + (v_t - \theta)\exp(-\kappa dt)]^2}\right) \quad (58)$$

Following the part of the study dedicated to the theoretical description of the most popular numerical schemes associated with the Heston bivariate stochastic model, the ensuing sections of the paper focus on their algorithmic implementation and, consequently, on the scientific evidence found. In particular, the next paragraph examines the process of estimating the parameters of the dynamics which typically takes place using call and put options listed on the market and written on the same certificate underlying. This calibration occurs by comparing the market prices with the theoretical prices computed using the closed formula for vanilla options derived from Heston (1993) and successively improved by (Albrecher et al., 2007).

Once the five characteristic parameters have been estimated, we move on to the programming of the discussed numerical schemes: Euler [E], Explicit Milstein [M], Implicit Milstein [IM], Weighted Implicit-Explicit Milstein [WM], Transformed Volatility [TV], Balanced Implicit [B], Pathwise Adapted Linearization Quadratic [PW], Kahl-Jackel [IJK] and Moment Matching [MM]. Also in section 3, the code and the absence of bias are verified through the comparison between the output of the Monte Carlo simulator and the analytical formula provided by Heston (1993) for the case of standard optionality (European calls/puts). Once we are confident on the validity of the implemented model, we proceed to the last part of the paper and to the pricing of two investment certificates having a highly non-linear optionality and in line with the characteristics that are most requested by customers (Acepi associates' primary market 2023 Q1). In this case there are no analytical pricing formulas for certain types of features such as autocallability or the memory effect associated with the payment of additional amounts. The comparison therefore takes place exclusively between the various numerical schemes and we estimate how many times it was necessary to adjust the variance for each of the integration schemes.

3) Implementation of the numerical integration schemes for the Heston model

The Heston model implies that the price drift and volatility of a security follow certain laws according to 5 parameters: $V_0, \theta, k, \sigma, \rho$. These parameters cannot be directly observed on the market therefore they must be estimated in order to enter them into the Monte Carlo pricing engine. For the calibration, we start from the implied volatility surface of the FTSE MIB and take the volatilities of the options traded on the market, then all the parameters are estimated together using a least squares minimization (Mrázek & Pospíšil, 2017). It is also possible to assign weights, for example, giving importance to the volatilities deriving from the most traded options on the market (the most liquid ones). Such implied surface has strikes ranging from 80% to 120% in terms of moneyness while the maturities range from 1 month to 7 years. The calibration is presented as a five-dimension minimization problem where we try to minimize the least squares of the differences between the volatilities obtained from the model and those observed on the market. Therefore, defining the implied volatility of an option as $I(V_i)$, the problem is as follows:

$$\min \sum_{i=1}^{n} (I(V_i^{model}(S, t_i, K_i, \bar{\phi})) - I(V_i^{market}(S, t_i, K_i))^2 \quad (59)$$

With $\overline{\phi} = (V_0, \theta, \kappa, \sigma, \rho)$ under the following conditions: $V_t \geq 0,\ \theta \geq 0, k \geq 0, \sigma \geq 0$ and $-1 \leq \rho \leq +1$

The closed formula for pricing a European Call Option that pays a continuous dividend within the Heston model pricing framework is (Heston, 1993):

$$C(S_t V_t, t, T) = S_t P_1 - K e^{-r(T-t)} P_2 \quad (60)$$

Where:

$$P_j(x, V_t, T, K) = \frac{1}{2} + \frac{1}{\pi} \int_0^{\infty} \mathrm{Re} \left(\frac{e^{-i\phi \ln(K)} f_j(x, V_t, T, \phi)}{i\phi} \right) d\phi \quad (61)$$

$$x = \ln(S_t) \quad (62)$$

$$f_j(x, V_t, T, \phi) = \exp\{C(T-t, \phi) + D(T-t, \phi) V_t + i\phi x\} \quad (63)$$

$$C(T-t, \phi) = r\phi i(r-q) \frac{a}{\sigma^2} \left[(b_j - \rho\sigma\phi i + d)\tau - 2\ln\left(\frac{1-ge^{d\tau}}{1-g}\right) \right] \quad (64)$$

$$D(T-t, \phi) = \frac{b_j - \rho\sigma\phi i + d}{\sigma^2} \left(\frac{1-e^{d\tau}}{1-ge^{d\tau}} \right) \quad (65)$$

$$g = \frac{b_j - \rho\sigma\phi i + d}{b_j - \rho\sigma\phi i - d} \quad (66)$$

$$d = \sqrt{(\rho\sigma\phi i - b_j)^2 - \sigma^2(2u_j\phi i - \phi^2)} \quad (67)$$

For $j = 1, 2$ where: $u_1 = \frac{1}{2},\ u_2 = -\frac{1}{2},\ a = k\theta,\ b_1 = k - \rho\sigma,\ b_2 = k$

In the formulas, i represents the imaginary unit.

In the cases considered in this study, let us consider the market data of the implied Black-Scholes volatilities associated with the FTSE MIB index as of 16 May 2023, whose surface $\sigma_{IMPL}(K, T)$ is shown in Figure 1.

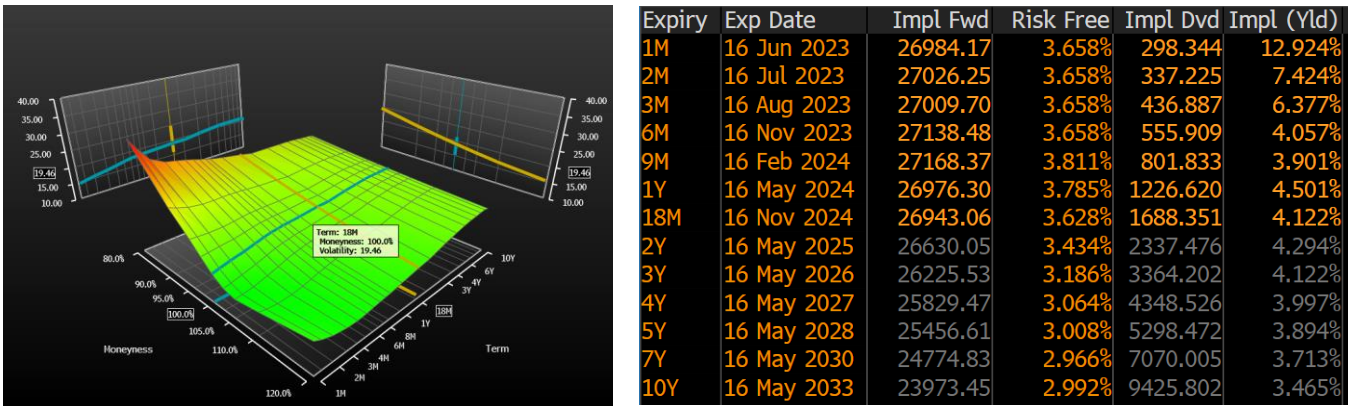
In order to reach a reliable estimation of the parameters associated with the Heston bivariate stochastic model, we should only consider the most liquid European options provided by the Equity/Index markets.

We have consequently applied a filtering of the options in order to select only the most relevant for the calibration process.

The first criterion applied is to consider, in case of multiple contributions, the prices characterized by higher traded volumes.

The second criterion deals with the bid-ask spread: we exclude from the calibration process all the options for which the relative distance between the bid and the ask contribution is greater than a threshold α: $\frac{P^{ASK} - P^{BID}}{P^{BID}} > \alpha$. Typical values for α range between 50% and 70%.

The third criterion regards the so-called “penny option filter”. We exclude all the options characterized by having a Bid price which is less than a percentage threshold (β) of the distance of the quoted strike (ΔK): $P^{BID} < \beta \cdot \Delta K$. Typical values for β range between 20% and 30%.



Expiry	Exp Date	Impl Fwd	Risk Free	Impl Dvd	Impl (Yld)
1M	16 Jun 2023	26984.17	3.658%	298.344	12.924%
2M	16 Jul 2023	27026.25	3.658%	337.225	7.424%
3M	16 Aug 2023	27009.70	3.658%	436.887	6.377%
6M	16 Nov 2023	27138.48	3.658%	555.909	4.057%
9M	16 Feb 2024	27168.37	3.811%	801.833	3.901%
1Y	16 May 2024	26976.30	3.785%	1226.620	4.501%
18M	16 Nov 2024	26943.06	3.628%	1688.351	4.122%
2Y	16 May 2025	26630.05	3.434%	2337.476	4.294%
3Y	16 May 2026	26225.53	3.186%	3364.202	4.122%
4Y	16 May 2027	25829.47	3.064%	4348.526	3.997%
5Y	16 May 2028	25456.61	3.008%	5298.472	3.894%
7Y	16 May 2030	24774.83	2.966%	7070.005	3.713%
10Y	16 May 2033	23973.45	2.992%	9425.802	3.465%

Figure 1: Implied Volatility Surface, Continuous Dividend Yield and Risk Free used for testing the numerical integration schemes– Source: Bloomberg®

Filtering the option market data based on the above criteria, 63 options are used to estimate the five parameters characterizing the Heston dynamics. The values thus obtained applying the minimization reported in Eq. 59 with the market data shown in Figure 1 are as follows:

Initial Variance: $v_0 = 2.923\%$

Variance reversion speed: $\kappa = 2.0517$

Variance reversion level: $\Theta = 0.05572$

Volatility of variance: $\sigma = 0.356267$

Correlation between the two Brownian motions: $\rho = -0.738102$

Using these parameters, the exact analytical formula for the pricing of a call option was implemented in Matlab with the aim of valuing call options with strikes in the moneyness range of 80% - 120% with step equal to 5% (spot equal to the closing value of the index on the calibration date, $S = 27198.9$) and a time to maturity in the range of 3 months – 5 years, with quarterly intervals. The pricing surface thus calculated is shown in Figure 2.

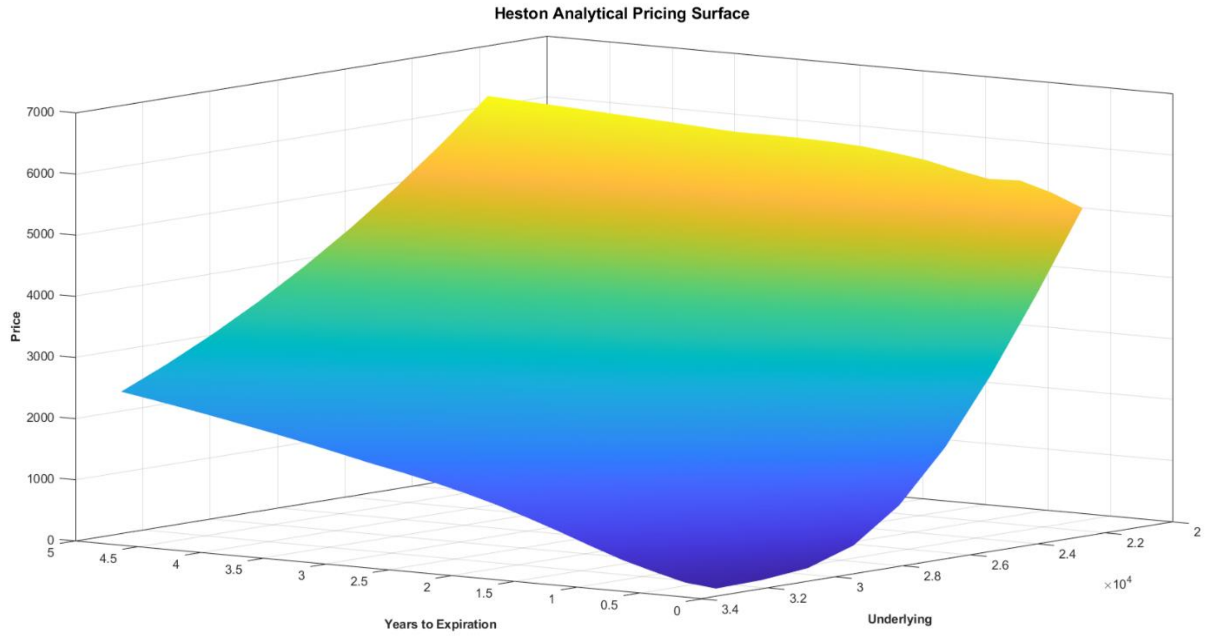


Figure 2: Pricing Surface of the call options written on the FTSE MIB index, priced with the Heston analytical formula

The next step was the programming of all the numerical schemes presented in paragraph 2. The comparison between the results obtained from the Monte Carlo method and the analytical formulas allows us to understand on the one hand the robustness of the discretization schemes (absence of bias), and on the other hand, the potential override of negative variances which unfortunately characterize the Euler traditional approach.

In fact, setting a number of paths equal to 10,000 and a constant discretization interval dt of one day, a non-negligible number of variances are corrected with the full truncation scheme (see Figure 3).

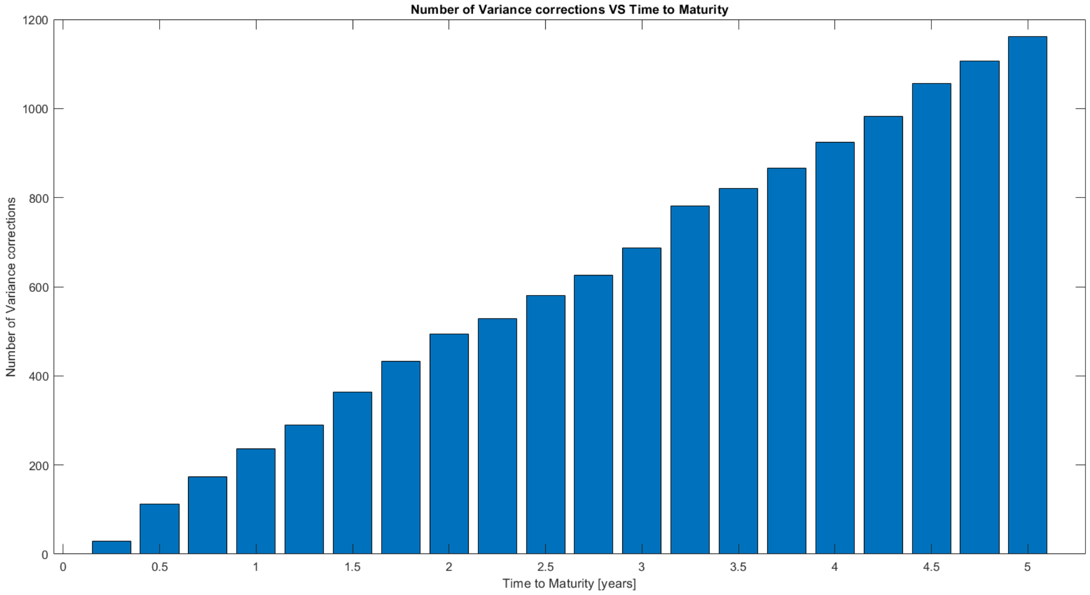


Figure 3: Number of variance corrections in the traditional Euler scheme

The discretization error introduced by the different schemes in the Monte Carlo remained stable and it is consistent with the expectations with respect to the chosen time step.

Furthermore, it should be noted that in all schemes other than Euler the event of obtaining a negative variance never occurred.

4) Numerical simulations for different typologies of certificates

Using market data from 16 May 2023 on the FTSE MIB Index (spot, dividend yield and implied volatility, shown in Figure 1), the interest rates term structure (Figure 1) and the five parameters of the Heston dynamics estimated in paragraph 3, we proceed with the valuation, according to the different numerical schemes described in paragraph 2, of two investment certificates having the characteristics most requested by investors, according to the ACEPI statistics for the first quarter of 2023.

Both certificates are characterized by the same underlying (FTSE MIB), the same maturity date of 21 September 2026 and they both pay coupons conditional on exceeding a barrier level equal to 70% of the initial reference value of the index, which we assumed to be the closing value of the index as of 20 September 2021 (25,048.26).

The value of the conditional amount was set at 3.55% and characterized by an annual frequency, so the four future Coupon Valuation Dates are: 20 September 2023, 20 September 2024, 22 September 2025 and 21 September 2026. We assumed for simplicity of account that the payment dates of the coupon coincide with the valuation dates.

Both certificates analyzed have conditionally protected capital at maturity: if the underlying index at maturity (September 21, 2026) is above the barrier level, set as the coupon trigger equal to 17,533.78, then the entire amount invested in the certificate will be returned; otherwise the negative performance of the underlying will be paid (thus, the redemption is characterized by a traditional pay-off of a short position in a barrier put option with a "European" observation of the barrier level (Giribone and Revetria, 2021), i.e. only at maturity).

The two certificates, on the other hand, differ for two aspects: the first structured product is characterized by standard digital coupons and no autocallability, while the second envisages both the memory effect and the possibility of early automatic callability if, on the Coupon Valuation Dates, the underlying index exceeds the initial reference value (i.e., 25,048.26).

It should be remembered that by memory effect we mean an interest payment that is carried over to the next observation dates if the product, at a given valuation date, fails to meet the coupon payment requirements as defined in the structure.

However, if payment requirements are met at a certain valuation date, all coupons that have not previously been paid will fall due for payment at such date.

We can express the rule for the payment of the t-th conditional amount in accordance with the following formula:

$$Nominal\ Value \times [t - th\ Additional\ Amount[\%] + Memory\ Additional\ Amount\ [\%] \times (t - k - 1)] \quad (68)$$

Where k can assume values between 0 and the number of coupon payment dates and indicates the value of t corresponding to the last conditional additional amount event.

The pay-offs of the two certificates analyzed in this study are quite popular and their features are classified in accordance with the EUSIPA (European Structured Investment Products Association) derivative map under the identification code 1260 - Express Certificates with additional coupon amount. ACEPI has adopted the same European classification typology.

Given that these two structured products are characterized by standard financial features, we suggest consulting the websites of these two associations for further information on the payoff mechanics. In order to value the two certificates, 500 replications of 10,000 simulations each have been implemented on the underlying index, with a daily time discretization step, until the maturity date.

The adjustments for the negative variance, applying the full truncation scheme, were only necessary in the case of the Euler integration method. The distribution of the total number of times for which the full truncation scheme was invoked throughout the 10,000 simulated paths for the 500 replications is shown in Figure 4. As regards the determination of the fair value and its measure of dispersion for the two certificates, all the calculated outputs resulted in line with our expectations given that we have replicated these calculations using other pricing modules, such as the library provided by Bloomberg ® - DLIB. All the results shown in Table 1 have been estimated using the same seed values for the generation of the random numbers stream for each replication. We consider this part very important in order to fairly compare the Monte Carlo outputs across the different numerical schemes. The results for the first and the second certificate are obtained using 10,000 paths and a discretization step equal to one day. Only a slight discrepancy is shown in correspondence with the approximation introduced by Moment Matching.

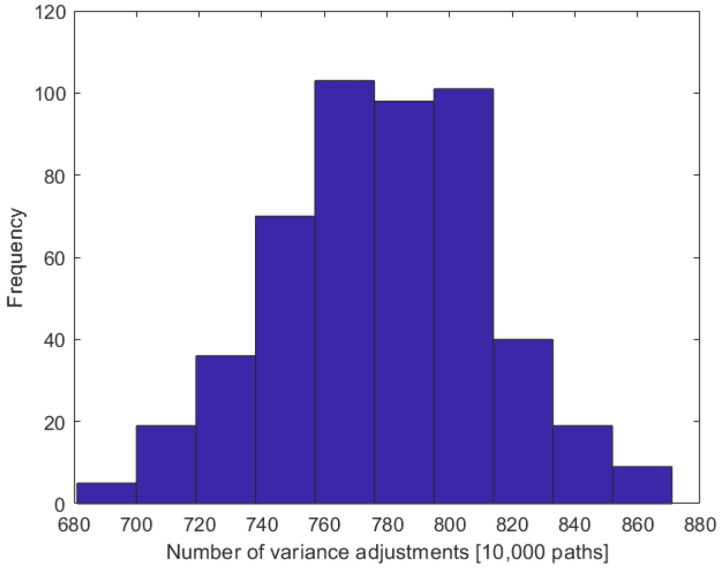


Figure 4: Distribution of variance adjustments in the traditional Euler numerical integration scheme in the example of investment certificates pricing

Numerical Integration Scheme	Fair Value Cert 1	St. Dev. Cert. 1	Fair Value Cert. 2	St. Dev. Cert. 2
Euler [E]	925.2473	2.1653	970.7499	1.4981
Explicit Milstein [M]	925.2754	2.1724	970.7566	1.4985
Implicit Milstein [IM]	925.3123	2.1683	970.7601	1.5012
Weighted Implicit-Explicit Milstein [WM]	925.2952	2.1706	970.7576	1.5008
Transformed Volatility [TV]	925.2381	2.1741	970.7435	1.4993
Balanced Implicit [B]	925.2437	2.1528	970.9811	1.4925
Pathwise Adapted Linearization Quadratic [PW]	925.2174	2.1716	970.7295	1.5011
Kahl-Jackel [IJK]	925.2173	2.1575	970.7443	1.4961
Moment Matching [MM]	926.3386	2.0658	967.6476	1.5211

Table 1: Pricing of the two certificates with different numerical integration schemes. All the measures are expressed in Euro and assuming a nominal value equal to 1,000

Further experiments have been conducted relaxing the constraints imposed on the seeds of the random number generator, with the aim of having the certainty that the results have not been compromised by the specific choice of the random source.

We have made ten replications for a number of simulations that varies from 1,000 to 20,000 with a step equal to 1,000 for both certificates. The alternative numerical schemes that we have implemented display similar performances (see Figures 5 and 6). This similarity can be explained considering that the adjustments for negative variances have never been used for all the simulations, as a result the positive effects on the fair values estimation introduced by the implementation of these schemes is clear.

In order to understand if the performances of the alternative integration methods also work well in a stressed scenario, we have replicated the same pricing experiments using the shocks of the European Banking Authority (EBA) 2023 available on the institution's website (https://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing).

In particular we have applied the following shocks:

- a relative change in the spot level equal to -58.2%.

- an absolute change in the yield of interest rates term structure equal to: 152 bps up to 1 year and 167 bps from 1 year to 5 years. Zero-rates in the periods have been linearly interpolated.

- an absolute change in the credit spread of the issuer equal to + 171 bps, as a result we move from a risk-free to a risk-adjusted evaluation.

- a relative change in the Equity volatility of 268 basis points applied to the Heston v_0 parameter.

As shown in Figures 7 and 8, the price collapses and the severe shocks do not compromise the performances of the alternative methods in terms of the number of negative variance adjustments and, consequently, the standard deviations of the ten replications expressed in function of the number of paths maintain the similarity.

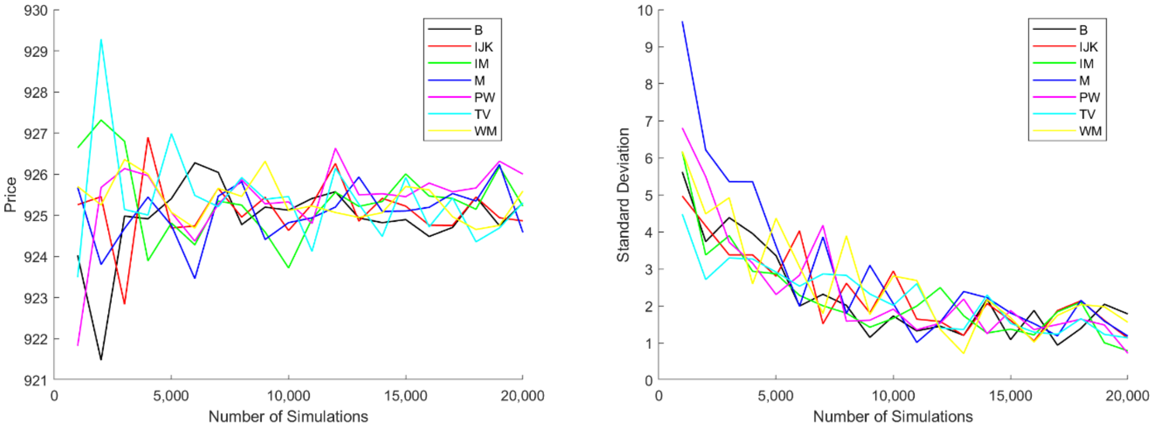


Figure 5: Prices and Standard Deviations of the Monte Carlo Outputs for the first Certificate as the number of paths varies – Base Scenario

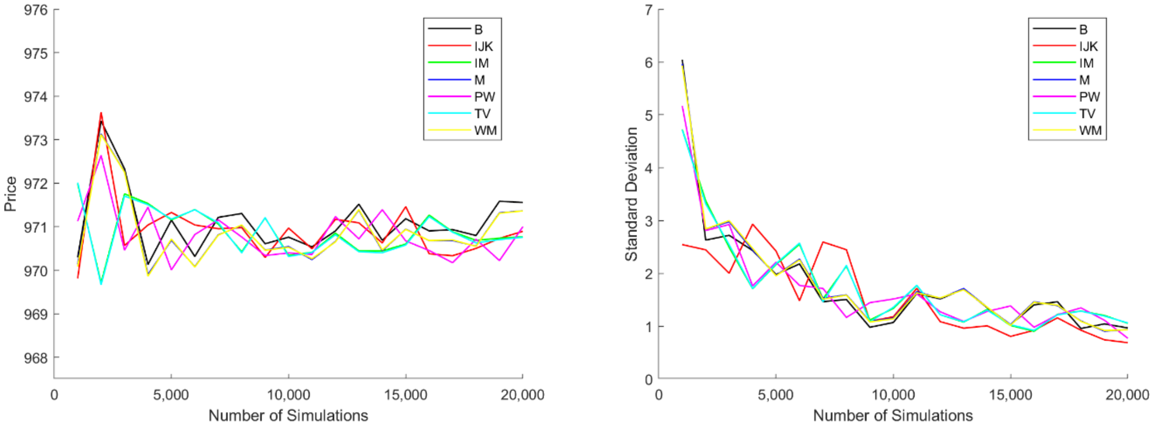


Figure 6: Prices and Standard Deviations of the Outputs for the second Certificate as the number of paths varies – Base Scenario

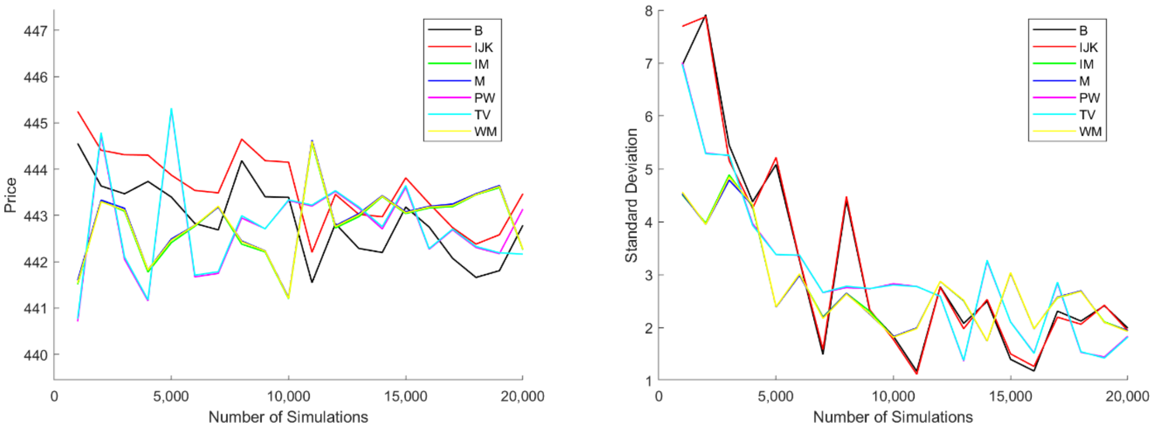


Figure 7: Prices and Standard Deviations of the Monte Carlo Outputs for the first Certificate as the number of paths varies – Stressed Scenario

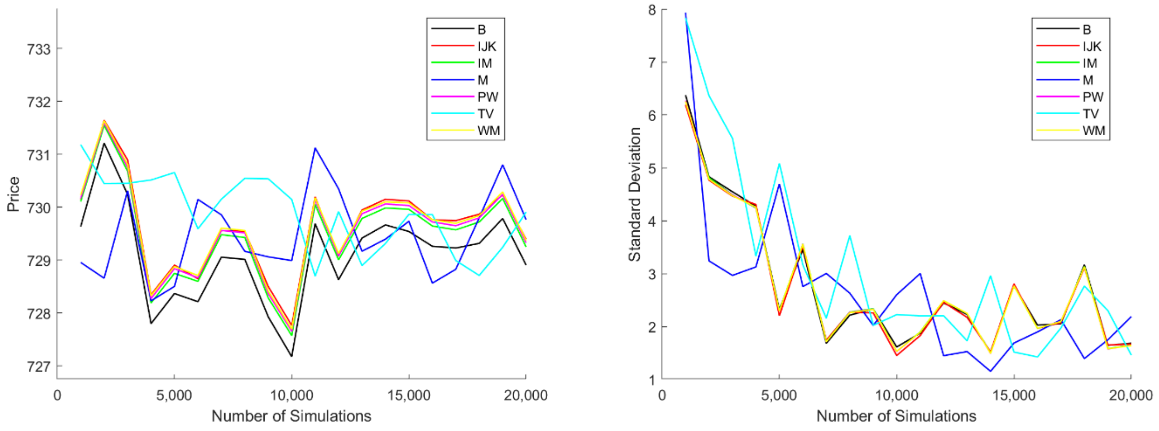


Figure 8: Prices and Standard Deviations of the Monte Carlo Outputs for the second Certificate as the number of paths varies – Stressed Scenario

The Heston model is one of the most widespread pricing frameworks in the financial industry as it allows a good trade-off between the complexity of the model, capable of efficiently representing the dynamics of the underlying price together with the volatility, and the possibility of estimating its characteristic parameters starting from the Black-Scholes log-normal volatilities through an analytical formula. It should be remembered that if we remove the stochastic contribution of the variance, we obtain the traditional dynamics of the Brownian geometric motion ruling the Black-Scholes-Merton pricing framework (which 50th anniversary occurs this year). This is achieved simply resetting the parameters of the variance reversion speed and the volatility of the variance. This reconciliation ultimately gives an idea of the potential pricing gap due to the choice of a different model and helps the trader to compare the prices of structured products valued according to different pricing approaches compared to the market standard (Giudici and Pagnottoni, 2019), (Giudici, Pagnottoni and Polinesi, 2020).

5) Conclusions

In this study the most popular numerical integration schemes for the Heston bivariate dynamical system (S_t, v_t) or $(\ln S_t , v_t)$ (Rouah, 2013) have been described and implemented. The methods which do not intrinsically admit the generation of negative values of the variance proved to be particularly interesting from a theoretical point of view. Among the analyzed methods, we cite the Transformed Volatility scheme (Zhu, 2010), the Balanced Implicit Scheme (Platen & Heath, 2009) and the Moment Matching (Andersen, 2008). Applied to the pricing of the most common investment certificates, the Moment Matching method has shown a lower convergence performance compared to the other techniques. Considering in addition the study by Kahl and Jäckel (2006) in which they showed that the convergence of the Balanced Implicit Scheme does not always prove to be uniformly valid, we can conclude that the Transformed Truncation Scheme has recorded results in line with theoretical expectations in the pricing of structured products and that it is also verified a priori that it is impossible for a negative variance to be generated in the asset projections. It is important to point out that there are other integration schemes for the Heston model in the literature, among which we mention the exact one proposed by Broadie and Kaya (2006). Indeed, the latter has a very important theoretical relevance as it ensures an exact numerical resolution of the integration problem, although it is difficult to implement in practice (Van Haastrecht and Pelsser, 2010) and the numerical processing times can be quite long (Bottasso *et al.*, 2023a).We consider it interesting for the continuation of the study to test the methods discussed in this paper, in particular the Transformed Volatility scheme and possibly others, that guarantee from a theoretical point of view the intrinsic positivity of the stochastic dynamics of the variance, on other types of certificates in order to generalize the conclusions in a multi-asset context.

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The growing importance of digital risk&governance

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Abstract

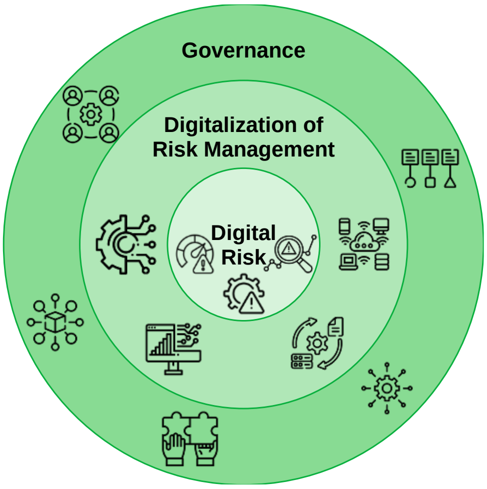
The aim of the paper is to explain what is meant by **Digital Risk&Governance**. For this purpose, it is important to retrace the **technological evolution** that has affected the last few decades: from branches to Mobile Banking, from the digitalization of transactions to the creation of Fintech, from the first process automations to Artificial Intelligence. This evolutionary journey has not only involved and still involves the birth of **new technologies**, but also the possibility of seizing **new business opportunities** and therefore necessarily of facing **new types of risk**, which are not always intuitive and easy to fully understand and manage. In this context, the role of the Regulator is fundamental not only to make available to companies elements for a correct and complete understanding of Digital/ICT Risk, but also to provide guidelines that allow for the construction of an organizational and governance model suitable for gaining awareness risk and to assess, manage and monitor it. A fundamental role is played by the **Digital Operational Resilience Act (DORA)**, which certainly better defines some aspects that until recently did not find a clear place, but - even more important - which allows these aspects to be included in an organic and holistic framework. **Governance and organization** are essential in this panorama, the only functions capable of spreading the risk culture necessary to overcome the silo mentality and to establish the cultural paradigm change essential for managing ICT Risk. Given the extension of the perimeter that is generally included under this risk, the paper goes on to underline the most relevant aspects and suggests in a practical way the components on which companies should concentrate in order to implement and make usable an all-round management framework: from the identification of critical functions to the importance of having tools capable of certifying the correctness, completeness and quality of the data. Another high-sounding and closely related theme, which therefore could not fail to be addressed in the paper, is represented by the **cyberattack** and its impacts on the market. The paper then closes with a theme which, in our opinion, plays an even more stately role than the creation of an overall framework can play: the **Digital Strategy**, consciously accessible only through a Digital Risk&Governance framework, but which represents the ultimate goal to which companies should aspire.

Keywords

Digital Risk&Governance, Risk Management, Risk Management Framework, Digital Risk, ICT Risk, Technological Evolution, Digitalization, Operational Resilience, Cyber Security, Cyberattack, DORA, Digital Operational Resilience Act, Business Continuity, Outsourcing, Data Management, Data Management Framework, Organization, Governance, Organizational Model, Governance Framework, Cultural Paradigm Change, Digital Strategy, Business Strategy

1. Context

In order to better frame the content in the paper, it is essential to define the so-called **“Digital Risk or ICT Risk”**. Generally speaking, it refers to all unexpected consequences that result from digital transformation and disrupt the achievement of business objectives. When an organization decides to scale its operations, its attack surface expands, increasing its exposure to cyber threats. This makes Digital Risk an unavoidable aspect of digital transformation and the advancement of new technology. In the light of this scenario, **Digital Risk protection strategies** have to be developed to mitigate Digital Risk and guarantee that organizations can continue confidently scaling their business. Managing Digital Risk means that the organization understands the implications of adopting certain technologies and acknowledges **Digital Risk as a crucial part of business risk management**. In order to achieve complete comprehension and awareness, the complexity of the Digital Risk landscape can be simplified by clustering risks (e.g., Cybersecurity, Data Leaks, Third-Party Risk). This helps organizations in identifying the most vulnerable areas and targeting risk protection efforts. But how is it possible to adequately manage the Digital Risk? The answer is to be found in **governance**. The Digital Risk context can be fully understood and managed only through setting a proper governance that foresees rules and procedures able to govern how an organization board of directors makes decisions, sets policies, and oversees management.
It is possible to imagine all the elements described above as parts of a puzzle: each component is different and autonomous, but essential to complete the overall picture. The following representation can help to explain this concept.



The first component, in the centre, is represented by **Digital Risk**, associated with the risks inherent in digital products, services and supporting processes. The component of **"digitalization"** indicates the process of moving to a digital business and, more in detail, the use of digital technologies to change a business model, provide new revenue and/or value-producing opportunities. Its application to the risks field allows to use the digital technologies to **modernize the discipline of risk management to create value-producing opportunities**. Finally, the component that embraces the other two concepts is **governance**, representing the indispensable framework, composed by guidelines and organizational rules, that enables an efficient and proper coordination of the other parts.

Viewed together, the three components represent **key aspects of integrated risk management**, that put together views of strategic, operational and technological risk associated with digital products and services.

2. Introduction

2.1 The technological evolution in the financial sector

Technological innovation is becoming a hallmark in the financial sector: it is becoming increasingly difficult to understand whether a new financial service or product stems from a business idea that technology supports or it is the natural outcome of the practical application of a new technology.

Technology has now become an intrinsic factor of some financial products/services as they would exist only through their specific technology.

But what have been the technology trends in the financial world in recent times?

Evolution of distribution channels: from branches to internet banking to mobile banking

Until the last century, for the customers the Bank is synonymous of **branch**, a physical place where human contact with the bank officer gives tangibility to the Bank-customer relationship. The branch in this period plays both a transactional role (provision of cash, payment and credit services) as well as a relational one. The number of branches of a Bank is used as a non-financial indicator of its size and thus its market share.

In the late 1990s and early 2000s, the spread of the first PCs and the Internet gave the spark to **Internet banking**, a tool in which customers independently can manage their financial position. While services were initially limited to the consultation of asset information, banks later made available banking services (digital payments) and then financial services (investment services).

A decade later, around 2010, a second technological wave began, putting two new tools in the hands of customers: the smartphone and the ability to access the mobile Internet. **Mobile banking** was born, accelerating the trend of digitalization of financial services.

Two phenomena demonstrate this trend[1]:

- **the contraction of the distribution network** with a cut of 34 percent (in Italy between 2012 and 2021 branches decreased from 32.881 to 21.650) and a substitution of the branch functions, which is increasingly focused on providing advisory services to customers instead of traditional banking services that are instead provided mainly through digital channels
- **the dematerialization of currency and digitization of transactions**: the number of POS in Italy from 2010 to 2021 increases from 1.497.000 to 3.910.000 (+ 260%) against a 16% reduction of ATMs (which decrease from 44.878 to 37.405 in the same period).

In 2020, these transformations accelerate rapidly due to the Coronavirus pandemic (Covid-19) when financial institutions need to strengthen their digital communication channels towards their customers when social distancing is the norm.

Among the technologies accompanying this evolution of connecting banks and their customers we find: home banking portals, mobile banking apps, trading platforms, customer service via chatbots, etc.

Evolution of banking and financial products

Technological innovation not only enables the evolution of distribution channels but also drives the evolution of the financial services offered to customers, with new players appearing alongside traditional institutions: **Fintech** companies are born.

Compared to traditional banks where the business model is based on the financial service, relegating technology only to a supporting role, in Fintech companies the paradigm is reversed and technology is the essence of the core business and the financial service its declination.

This has enabled prolific and pervasive product innovation with the creation of numerous new banking/financial services and products. Just to mention a few of the most important ones:

- payments: mobile payment services (Paypal, Apple Pay, Satispay, etc.), virtual credit cards
- credit: digital lending, P2P lending, crowdfunding
- finance: robo advisors, cryptocurrencies, copy trading.

Internal bank technology evolution

In the meanwhile, financial institutions, which in the 2010-2020 decade had to manage a complex situation for their profitability due to the central banks' expansionary policy by means of interbank rates at historic lows, are focusing their strategies on efficiency and optimisation of their operational machine to safeguard their profitability.

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[1] ABI Report "Digitalizzazione e retail banking: ottimizzare i modelli di servizio per rafforzare la relazione banca-cliente", March 2023

These strategies, which leverage the use of technology to optimise operating costs, are based on two drivers:

- **Automation of internal processes**: re-engineering processes to make them more streamlined is no longer sufficient. It is necessary to automate all those low value-added operational activities that lengthen process completion times and expose the Bank to operational risks. **Robotic Process Automation** (RPA) and **Process Mining** technologies enable cost savings with improved productivity and flexibility.
- **Outsourcing of application services**: the widespread use of information technology to provide increasingly complex services is increasing the operating costs of ICT Departments. To optimise these costs, new software management models have become increasingly popular over the years: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). These management models make possible to outsource technological complexity from banks and to exploit the scale economies of specialised ICT companies thanks to the scalability of solutions and Pay-per-Use formulas. Among the technological enablers of these management models, we find **cloud computing** technologies in which some IT components (hardware and/or software and/or data) are not located in the bank infrastructure (on premise) but on the ICT provider infrastructure and made available through the Internet.

Reducing operating costs does not represent the only strategy to safeguard profitability. Another technological development has made possible to extract value from what is already available in banks but not adequately exploited: **data**.

In the context we are describing every day financial institutions produce huge amounts of data that can generate value thanks to adequate and sufficiently powerful analysis tools such as **Big Data** and **Machine Learning** technologies.

These technologies enable a better knowledge of customers with two main purposes:

- **marketing**: personalisation of services due to more precise and targeted analyses that allow better customer profiling and enable cross-selling and up-selling of services/products;
- **risk management**: detection of fraud and suspicious transactions, improvement in identifying the correct credit profile of customers.

The new technological frontiers
But what are the next technologies that will change the financial world in the near future?

The technological world is moving faster and faster and new technologies are entering or will soon enter the financial sphere, some even with disruptive impacts.

- **Blockchain or Distributed Ledger Technology (DLT)**: a technology that improves the sharing of information between counterparties while ensuring its inalterability. The financial sector will be impacted in payment services (e.g., in the simplification of payment reconciliation and fraud reduction), in the management of digital currencies (e.g., cryptocurrencies) and in the management of contracts (e.g., smart contracts)
- **Artificial Intelligence (AI)**: a multipurpose technology with a large area of application in financial institutions including improvements in machine learning algorithms, customer behavioural analysis, data mining for a strategic perspective, predictive risk analysis, etc.
- **Quantum computing**: a technology that changes the computational paradigm to perform more complex calculations that are unmanageable with current technologies, regardless of their processing power. The impacts on the financial world will be pervasive and range from solving portfolio optimisation problems to calculating financial risks, from detecting and preventing fraud in digital payments to managing cryptographic security systems.

To close this brief historical excursus on the technological evolution in the financial sector, we quote the prophetic words of Vincenzo Desario, former general director of the Bank of Italy, in a speech he made in 2000, right at the dawn of the story told in this chapter:
"*The banking and financial sector is most involved in the development of the new economy; the immateriality of financial products combines perfectly with new technologies, powerful tools for the collection, processing and distribution of information. Intermediaries play a plurality of roles with the new technology; some more traditional, such as the sale of financial products and the offer of payment services on telematic networks; others innovative, such as the creation of infrastructures for e-commerce, the management of technological services on behalf of third parties, and the provision of advisory services, including non-financial ones, to firms. The scenario outlined for the future of banks is articulated, full of opportunities but also of risks; financial operators need to reflect in depth on the implications for business strategies arising from the ongoing technological evolution.*"

2.2 New technologies, new opportunities, new risks

As we have seen, the increasingly pervasive use of technology leads financial intermediaries to build partnerships with specialised technology companies: the interconnection among the various players is increasingly stronger as their mutual dependency.

The direct consequence of this approach is a greater **systemic risk**, in particular for business continuity: the interruption in the provision of a service by one player could have amplified impacts on the entire financial sector, especially if other market players depend on that service for their business.

This is true when there is a **concentration** of certain services in a **few large ICT companies** that become the unique provider of a given service for the entire sector.

Another source of systemic risk is the **lengthening of the supply chain** of financial services: in fact, technology providers often depend on other ICT companies and, as in all chains, the weakest link determines the robustness of the entire chain. If we add also that IT companies are not always subject to financial regulation, the mix of these factors could be explosive.

While outsourcing of ICT services produces a reduction in the costs of the operational machine, it also entails a **reduction in direct control** by the bank and poses new challenges in the governance of providers.

For this reason, as we will see in the next chapter, regulators have been extending the boundaries of their regulations in recent years to include non-financial companies within a framework aimed at ensuring operational resilience and responsible management of outsourced services.

Besides the outsourcing of activities in terms of process in the supply chain, the health pandemic has also seen a geographical dislocation of work organisation: **remote working**. Above all, the financial industry has been persistently impacted by the new remote/hybrid work made possible by the availability of effective communication and co-working technologies. During the health pandemic, when remote working was an imperative, financial institutions realised that this new organisation of work had minimal impact on productivity and also reduced the costs of office management (real estate). With the pandemic over, hybrid work has become the new normal in the financial sector. However, this new organisation of work brings new risks, especially of an IT nature, since the **attack surface has increased** geographically and at the level of application architecture, which now is **outside the conventional defensive perimeter** of institutions (firewalls, attack detection systems, security of communication channels, hardware vulnerabilities, data breaches, etc.).

But the new work model is not the only source of new risks for the financial sector.

The **standardisation** of technologies for financial services, while on one hand reducing the likelihood of a successful cyberattack (as a standardised technology is more robust because it has had time to correct its weaknesses), on the other hand increases the impact if the attack is successful (as a standardised technology is widely used). In a way, cyber risk could be seen as a **tail risk**, with low frequency of occurrence but high impact.

Furthermore, the use of communication standards (e.g., API interfaces) has allowed the **disaggregation of application components**: but the more disaggregated a system is, the more vulnerable it is to cyberattacks, since the weakness of a single element can be used to enter the system and quickly propagate the attack within it. This is why it is important to use a "security by design" approach when building the ICT architecture.

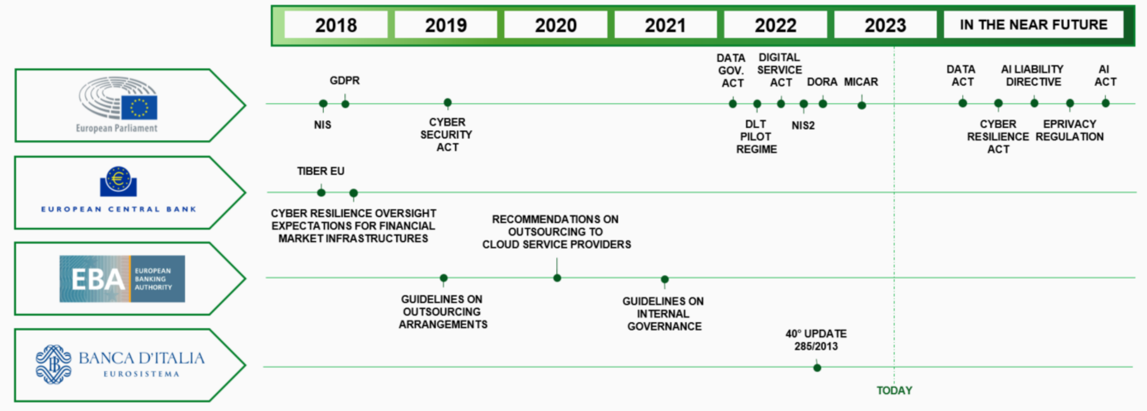
Another source of risk is represented by **pioneering technologies** whose operating mechanics and business implications are not yet well known. Take, for example, Artificial Intelligence, which is increasingly entering the financial world. In some cases, AI is based on recursive logic that reinforces certain tendencies (self-full-filling prophecy) and can lead to a feeling of overconfidence. Using, for instance, AI in the field of KYC to determine a customer credit rating could lead to reputational risks if discriminatory logics arise. Of course, there are also risks more related to the sphere of cyber-security that will be explored in more detail in the following chapters.

2.3 How the Regulator faces the technology evolution

As described above, technological evolution has brought transversal changes to the entire financial sector and new risks to be managed. But how does the legislator address these changes?

In recent years, **traditional Regulators** (e.g., ECB, EBA, Bank of Italy, etc.) have focused on technology governance in banking: regulations have been published on the framework for cybersecurity testing (ECB, 2018), on cyber resilience (ECB, 2018), on ICT outsourcing management (EBA, 2019), on cloud services management (EBA, 2020), on internal governance (EBA 2021) and on ICT management (BoI, 2022).

Furthermore, following the Covid pandemic in 2020, a new political regulator has joined the traditional ones: the **European Parliament** in order to support the EU economic recovery has outlined a strategy for digital finance in which it defines a new approach to encourage responsible innovation in the financial sector. This is the context for the series of regulations from 2022 that will introduce rules on data governance, DLT management, cryptocurrencies and other regulations, now under consultation, that will be issued in the near future.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DATA GOV. ACT
DIGITAL SERVICE ACT
DORA
MICAR
DLT PILOT REGIME
NIS2
DATA ACT
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AI ACT
CYBER RESILIENCE ACT
EPRIVACY REGULATION
EUROPEAN CENTRAL BANK
TIBER EU
CYBER RESILIENCE OVERSIGHT EXPECTATIONS FOR FINANCIAL MARKET INFRASTRUCTURES
EBA EUROPEAN BANKING AUTHORITY
RECOMMENDATIONS ON OUTSOURCING TO CLOUD SERVICE PROVIDERS
GUIDELINES ON OUTSOURCING ARRANGEMENTS
GUIDELINES ON INTERNAL GOVERNANCE
BANCA D'ITALIA EUROSISTEMA
40° UPDATE 285/2013
TODAY

Among the most recently issued/proposal of regulations we find:

- the **Digital Operational Resilience ACT (DORA)**[2] :
    - strengths the IT security of financial entities such as banks, insurance companies and investment firms by uniform requirements for the security of their network and their information systems
    - creates a regulatory framework on digital operational resilience, whereby all firms need to make sure they can withstand, respond to and recover from all types of ICT-related disruptions and threats
    - consolidates and upgrades the ICT risk requirements addressed so far separately in the different Regulations and Directives

- the **Data Act**[3]**:**
    - makes more data available for use and sets up rules on who can use and access what data for which purposes across all economic sectors
    - gives individuals and businesses more control over their data through a reinforced data portability right, easily copying or transferring data across different services
    - improves the conditions under which businesses and consumers can use cloud and edge services
    - introduces mandatory safeguards to protect data held on cloud infrastructures in the EU. This will avoid unlawful access by non-EU/EEA governments

- the **Artificial Intelligence Act**[4]:
    - addresses risks specifically generated by AI applications
    - proposes a list of high-risk applications and set clear requirements for them
    - defines specific obligations for AI users and providers of high-risk applications
    - proposes a conformity assessment before the AI system is put into service or placed on the market and an enforcement after such an AI system is placed in the market
    - proposes a governance structure at European and national level.

3. ICT organizational governance framework

At the beginning of the paper, governance was mentioned as a key element in managing the Digital Risk and leading an organization through an efficient and aware digitalization process. So, how is it possible to ensure that an organization best manages its Digital Risk? In our opinion, the main steps are the following.

1. Identify key assets

First need is represented by the identification of critical assets within the organization and all the ways they may be exposed or vulnerable to threats. Critical assets can be tangible, such as IT systems, or intangible, such as stakeholders and those people who influence organization goals.

2. Understand the potential threats

Second step consists in understanding the threats that the organization is facing, also considering the fact that threats prioritize their attacks based on the shortest path or least effort needed.

3. Monitor for intolerable exposure

After understanding the overall situation, it is essential to consider sources for any intolerable digital exposures (e.g., social media and dark web pages) in order to detect exposed assets.

4. Mitigate the risk

The monitoring process enables the possibility to define a mitigation strategy, that can set short, medium or long-term objectives according to the priority and the stability of the intervention over time. One of the broadest and most effective mitigation actions is certainly represented by the governance, risk and compliance strategy, that can be considered as a cross organizational approach. The three components allow to set an overall system of rules, practices, and standards that guide a business (Governance), to identify potential risks and act to reduce/eliminate their financial impact (Risk Management) and to have processes and procedures that make it possible to conduct business in a legal and ethical manner (Compliance). The strength of this corporate management system is that it is able to overcome the reluctance of sharing information and resources among different departments, avoiding the efficiency reduction and encouraging the development of a positive company culture. The overall purpose of governance, risk and compliance strategy is to reduce risks and costs as well as duplication of effort. It requires company-wide cooperation to achieve results that meet internal guidelines and processes established for each of the three key functions.

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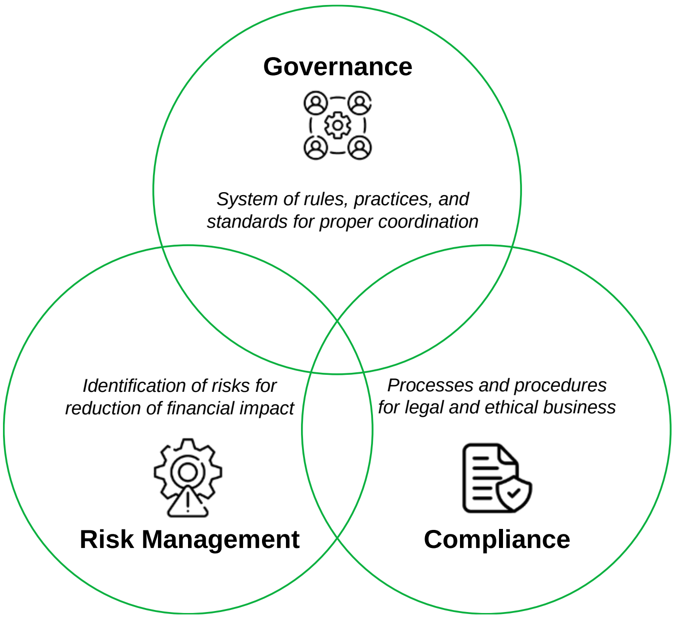
[2] https://www.digital-operational-resilience-act.com/

[3] https://www.eu-data-act.com/

[4] https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai


Governance
System of rules, practices, and standards for proper coordination
Identification of risks for reduction of financial impact
Risk Management
Processes and procedures for legal and ethical business
Compliance

Within this context, also DORA acknowledges the **centricity of organizational model** in order to guarantee a resilient view, even if it highlights the importance of requiring the introduction of more complex governance mechanisms only to financial entities that are not micro-enterprises (proportionality principle). More in detail[5]:

- Organizations shall establish an **internal management and control framework** which ensures effective and prudent management of all IT risks in order to achieve a high level of digital operational resilience; this means that the search for synergies and the necessary coordination and integration mechanisms between all the players involved takes on particular importance. Moreover, an **adequate chain of command and control** must be ensured, such as a decision-making architecture capable of governing the entire value chain.
- The management body of the financial entity shall define and approve the implementation of all provisions relating to the Digital Risk management framework, supervise and be responsible for such implementation. This means that the management body is called to:
  - **assume ultimate responsibility** for the IT risk management of the financial entity
  - **prepare policies** aimed at guaranteeing the maintenance of high standards of availability, authenticity, integrity and confidentiality of data
  - **clearly define roles and responsibilities** for all ICT-related functions and establish appropriate governance arrangements to ensure effective and timely communication, cooperation and coordination between these functions
  - **have overall responsibility** for defining and approving the digital operational resilience strategy, including determining the appropriate level of tolerance for IT risks of the financial entity
  - **approve, supervise and periodically review** the implementation of the **ICT business continuity policy** and the ICT-related response and recovery plans of the financial entity
  - **approve and periodically review the internal ICT audit plans** of the financial entity, the ICT audits and the most important changes made to them
  - **allocate and periodically review adequate financial resources** to meet the financial entity digital operational resilience needs across all types of resources, including relevant ICT security awareness programs and digital operational resilience training activities
  - **approve and periodically review the financial entity policy** on how to use the ICT services provided by the third-party ICT service supplier
  - **establish company-wide communication channels** that allow it to be duly informed about agreements concluded with third-party ICT service providers on the use of such services, any significant and relevant planned changes relating to third party ICT service providers and the potential impact of these changes on the critical or important functions subject to the agreements in question, including a summary of the risk analysis to assess the impact of these changes, as well as at least the major ICT incidents and their impact, measures of response and recovery and corrective measures.
- Organizations establish **a role in order to monitor the agreements concluded with service providers** for the use of such services, or designate a senior manager to be responsible for overseeing the related risk exposure and relevant documentation
- Members of the financial entity management body **actively maintain adequate knowledge and skills to understand and assess cyber risks** and their impact on the operations of the financial entity, including by undergoing specific training on a regular basis, commensurate with the manged IT risks.

As we will also read in the next chapter, **an ICT organizational governance framework at 360 degrees allows to change the cultural paradigm and to respond to the "silo mentality"**. It can be defined as the reluctance to share information with employees of different divisions in the same company. This attitude is seen as reducing the organization efficiency and, at worst, contributing to a damaged corporate culture. In order to be able to understand the current situation of companies facing Digital Risk, it is essential to analyse the complexity of digital landscape, the nature of the information and its location. To do this it is fundamental to prefer social exchanges rather than the individual ones: this means, for example, a decision-making centre acting with others or a mesh network where each, in turn, uses information shared by others. In general, companies are called to make people understand that **having no risk culture creates culture risk** and does not allow them to have sufficient skills to deal adequately and effectively with the context that technological evolution, understood in the broadest sense, is creating.

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[5] https://www.digital-operational-resilience-act.com/

4. ICT Risk Management framework

4.1 Cultural paradigm change

Risk management structures in financial institutions, due to their mandate of second-level control office, built over time a dialogue with business offices aimed at defining and implementing risk management measures.
Until now, the main sources of risks in a Bank have been identified in the functions, processes and products of the core business, hence the focus on credit risk, market risk, liquidity risk, etc.
From this view comes the fact that ICT risk has not its own dignity but it has always been included, at the regulatory level, in the broader spectrum of operational risks.
Even at the organizational level, ICT security management has never been included among the objectives of risk management but has always been associated with a "security" structure often located in the Bank ICT area, with which risk management structures have only in rare cases built a stable and structured channel of communication.
The increasingly strategic role of ICT technologies within each financial institution and the resulting impact on the business requires an evolution in the vision of ICT risk and its management: in this context, it becomes essential to **change the cultural paradigm** that Risk Management and Security structures have had toward ICT risks.
The former will have to broaden their scope on issues hitherto left at the borders of their activity scope; the latter must adopt a risk-based approach in ICT risk management.
From this point of view, the **synergy between risk management and information security structures** is high: one could contribute with its risk approach, the other with its technical expertise.

4.2 What to do to create an ICT Risk Management Framework

On the basis of the change in the cultural paradigm, in the terms just described, it is essential to have guidelines for the creation of a framework that can manage ICT Risk at 360 degrees. Here below the main steps.

STEP 1: Perimeter
The first step is to define the perimeter of the critical or important functions and the relative processes.

A function is critical or important when its disruption "*would materially impair the financial performance of a financial entity, or the soundness or continuity of its services and activities, or the discontinued, defective or failed performance of that function would materially impair the continuing compliance of a financial entity with the conditions and obligations of its authorisation, or with its other obligations under applicable financial services law.*"[6]

In order to define the perimeter, it is essential to have a mapping of all ICT functions, their linkage to the company process taxonomy, and all the interrelationships among the various ICT components since the interruption of one service can lead to the failure or interruption of other services.

In doing this, both risk and technical competencies are required

STEP 2: Data
The perimeter of critical functions is also reflected in the data used in the processes: risk analysis should be also conducted by assessing data confidentiality, integrity and availability. Implementations to ensure operational resilience should in fact be proportionate to the degree to which the three aforementioned drivers have been assessed: for example, highly confidential data or 24/7 available data requires greater security and resilience measures than public data or non-urgent data.

STEP 3: Tolerance thresholds
ICT risk should also be considered in the Risk Appetite Framework, in order to define specific threshold for risk appetite, risk tolerance and risk capacity. A clarification is needed: since ICT risk involves only costs and no revenue, theoretically its risk appetite should be zero. However, as we saw in the introduction, new technologies have embedded some risks due to their innovative nature so the Bank willingness to have a cutting-edge technology leads to define a risk appetite, even if unintentionally.

STEP 4: Security testing
From a preventive point of view, it is fundamental to carry out testing campaigns on ICT infrastructures to assess their resilience from cyberattacks.

Although this is not the place to deep dive into the testing typologies and how they should be performed, we would like to recall what was said in the opening of this chapter: testing activities should not only involve the Bank ICT security functions but should also actively involve the risk management as they provide realistic evidence of the Bank exposure to ICT Risk and its operational resilience.

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[6] Digital Operational Resilience Act, European Parliament, 2022

STEP 5: Mitigation plan
With the outcomes from the testing activities and additional evidences gathered over time, banks must activate a remediation plan to address the identified weaknesses: priority should be given to those activities that most mitigate the impacts of a possible cyberattack.

As ICT Risk is a part of Operational Risk, this plan should be integrated in the operational mitigation plan, giving value to possible synergies

STEP 6: Monitoring
Some institutions already have dashboards for technical monitoring of application security: the most effective way to improve their operational resilience is to evolve these dashboards by integrating new risk-based metrics.

Evolving current dashboards instead of creating new ones not only has time and cost advantages, but also ensures a holistic view in monitoring: keeping technical security dashboards separate from risk dashboards would in fact lead to inconsistent and unambiguous monitoring.

5. Data Management Framework

The availability of high-quality data is very important both to define new digital strategy and to predispose effective Risk Management analysis with meaningful Key Risk Indicator (KRI). In fact, every financial service or industrial activity generates a big amount of data; however, a study[7] estimates that less than 40% in the best case or even less than 30% of these data are used by companies to create business insights or key indicators. In order to guarantee the data availability, it is important to ensure also the security of data. In detail, the critical components are the following:

- **Confidentiality of data**: Data need to be maintained confidential and protected from unauthorized access; they also need to be encrypted if they are personal, also in consideration of GDPR regulation.
- **Integrity**: data need to be integer as they are acquired and captured in the system the first time; this is also connected to the point of ensuring high quality data.
- **Availability**: data need to be accessible only to the authorized persons, but data need to be accessible on-time.

However, this is only the starting point to have high-quality data available, since it is fundamental also that data are of high-quality to use it for Business analysis. So, to define an effective Data Management framework, an important part is represented by the data quality controls that need to be performed to ensure it.

In more detail, the **high-quality data assurance** could be achieved by implementing the following controls:

- **Zero values check:** it checks for the anomalous presence of zero values, in cases where the zero value does not belong to the domain.
- **Univocity checks:** it checks the uniqueness of some variables, both singularly and in tuple; it is essential to avoid data duplicates and any potential relation between them.
- **Anomalies:** verification of possible anomalies on data with respect to the context in which they appear (e.g., data equal to the one of the previous periods in the case it was expected to change or the opposite).
- **Discontinuity in historical series:** it checks on the trend of the data historical series to identify discrepancies or jumps in the numbers.
- **Accuracy:** it aims at calculating percentage of values to check if this percentage is outside the variable domain (out of range).
- **Missing data:** it checks on the completeness and availability of the input data.

Finally, it is important to protect all these data from the possibility to lose them, that could come both from internal issues (e.g., physical damage of the hardware in case are not on the cloud) and from external sources (e.g., cyberattacks). Some examples of the important components to protect the security of data are the following:

- **Access limited through authentication rules:** segregation of the access to the data on the basis of functions, responsibilities, etc.;
- **Change traceability:** traceability through logs of all the changes made to the data (e.g., who has done it, when, how was the previous datum);
- **Secured back-up of the data**: back-up of all the relevant information and storage in a secured location.

6. Impact of the cyberattacks

The increased amount of available data has increased the attention to the possibility of the cyberattacks and their impacts.

A study of Morningstar Sustainalytics[8] shows that there has been an increase in the frequency and in the impact of the cyberattacks.

In detail, this study shows that cyberattacks have impact, among others, on the following aspects:

- Share price on the market
- ESG Ratings.

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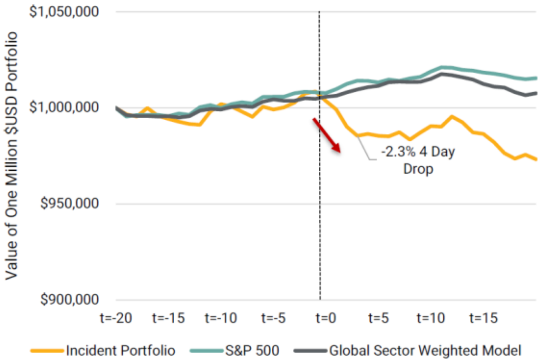
[7] https://www.forrester.com/blogs/hadoop-is-datas-darling-for-a-reason/
[8] Morningstar Sustainalytics: “The impact of Cyberattacks on stock prices”, October 2022

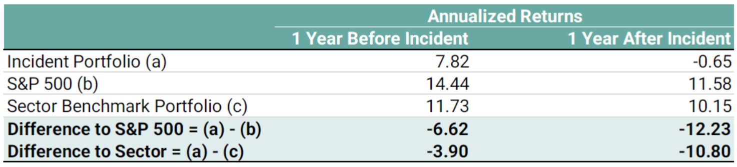
The study shows that there is a drop of around 2.3% on average compared to the index (S&P500 in this study) performance in the first 4 days after the news of successful cyberattacks with a consequent increase in the volatility of stock prices.

Exhibit 3: Time Series (Short-Term) - Share Price Reaction to Cyberattacks



*Companies are selected based on clear evidence describing a cyberattack
**Duplicate companies were permitted, given that each cyberattack is unique for that company
Source: Morningstar Sustainalytics

The same study shows also that the portfolio of companies that has had a cyber-attack shows an annualised return of around 12% less that the reference index.



	Annualized Returns	
	1 Year Before Incident	1 Year After Incident
Incident Portfolio (a)	7.82	-0.65
S&P 500 (b)	14.44	11.58
Sector Benchmark Portfolio (c)	11.73	10.15
Difference to S&P 500 = (a) - (b)	**-6.62**	**-12.23**
Difference to Sector = (a) - (c)	**-3.90**	**-10.80**

*Currency in use: Base Currency[7]

Source: Morningstar Sustainalytics

The high level of impact on stock prices shows the importance of having a Digital/ICT Risk&Governance framework in place in order to prevent cyberattacks and limits its impact in the case it happens. In addition, the same study indicates also that companies that have implemented more rigorous Data Protection and Security Programmes are more prepared to deal with cyberattacks. This will lead to a double positive effect: one on the stock price and the other one on ESG Ratings. In fact, one methodology adopted to define the ESG rating is a score model based on each of the three dimensions: Environmental, Social and Governance. As discussed in the previous chapter, the cyber incidents have a high probability of negative impact on stakeholders and especially on shareholders; this is also one of the factors considered to define the Governance score inside the ESG Ratings. In particular, this will impact the second-dimension of ESG rating methodology adopted by Morningstar Sustainalytics: the management assessing of the exposure to ESG risks.

7. The importance of digital strategy alignment with the business strategy

As discussed above, the **technology infrastructure** has become **strategic** for the financial services institutions, since it allows to transform a big amount of raw data into analytics and visualization in order to have business insights.

Business insight could be obtained both with **traditional IT models** with a formula developed and considered inside the code or through the **new IT models** such as Generative Artificial Intelligence (Natural Language Processing, Machine Learning, etc.). An example of the potentiality of the Generative Artificial Intelligence (in the following also “AI”) has been shown by the recent diffusion of ChatGPT, an AI that is able to answer to questions with indistinguishable human-like outputs.

However, since all these models need a strong technological infrastructure to work it is important that financial services institutions **consider their Digital Strategy together their Business Strategy**. The first point to highlight is the fact that Digital Strategy is not the IT Strategy, but a more widespread concept; in fact, the digital strategy considers **how to leverage on technology evolution to meet the business goals**. In fact, digital technologies have changed the way we communicate and now customers expect a more personalized experience and instant gratification.

Furthermore, a Digital Strategy aligned with business strategy and connected with an effective execution plan will most likely help to improve internal collaboration through different teams and it would **break the silos to have a more holistic view of the company**.

On the other side the increase in digitalization will bring also an increase in the Digital Risk of cyberattack, so it is important to align also a **Risk Management Strategy together with the Business Strategy and the Digital Strategy**. In detail, it is important to define a **resilient ICT Risk Management framework** (see paragraph 4).

8. Conclusion

In this paper we have seen how technology evolution is pervasive in the financial sector and has become a strategic resource due to the deep changes in the core business and in the organization of all financial institutions.

Technology brings new risks that must be addressed with a risk-based approach from both regulatory, organizational, and cybersecurity perspectives. This new approach is made possible only in light of a shift in the cultural paradigm that requires new forms of collaboration, especially between Risk Management and ICT Security units.

New frameworks are required from the point of view of organization, governance, risk management and data management because there is only one certainty: **the question is not "if it will happen" but "when it will happen"**, so you need to be ready for the next cyberattack and the sooner the financial institutions adopt the appropriate frameworks, the lower the impacts will be.

This readiness could be reached through **integrating Risk Management Strategy** with **Digital Strategy** and **Business Strategy**, since one of the points is the mitigation of cyber risk through having a wide data management framework that includes not only the high-quality data checks, but also the guarantee of confidentiality, integrity and security of the data.

In fact, it is becoming every day more important to **break down the silos** and to consider the activities inside a **comprehensive view** of the **company**.

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The revision of the banking crisis management and deposit insurance framework in Europe: Why is it important to enhance flexibility?

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Abstract

The Crisis Management and Deposit Insurance Framework - which came into force about ten years ago - is under review by the European Commission. The need for its revision stems from the identification of certain shortcomings and inconsistencies that have emerged in its application in Europe and especially in Italy. The central topics of the debate focus on how resolution should be applied and on possible innovations regarding the tools that can be used to manage the crises of small and medium-sized banks, which until now have been managed on the basis of procedures and tools decided at the national level.

The aim of this paper is to investigate the areas subject to reform, using as an evaluation parameter the objective of increasing the flexibility of the framework, as this is considered a fundamental requirement to ensure the full effectiveness of the overall banking crisis management system.

Key words

Banking crisis management; Supervision; Early intervention measures; Resolution; Deposit Insurance; Preventative and alternative measures; Public intervention; State Aid regulation

1. Foreword

Bank insolvencies are harmful events; if not addressed and managed properly, with effective tools, they can cause serious damage to various categories of stakeholders, first and foremost to depositors. Every banking crisis, be it systemic or idiosyncratic, represents a discontinuity in the regular course of relations between the various actors of an economic system, given the close link they have with the financial system.

Timely intervention is a key factor in mitigating the disruptive effects of insolvencies on other financial institutions, through contagion mechanisms, and on the real economy; in many cases, bank insolvencies may impact the public budgets, which are called upon to step in to cover the losses, ultimately passing the buck to taxpayers. This is why bank crisis management has always received the utmost attention from policymakers in all advanced countries, in order to preserve financial stability, alongside prudential regulation and banking and financial supervision. Taken together, these activities help to determine the safety net arrangements for safeguarding financial stability, which is a public good because it contributes to determining the conditions for a country's economic growth and welfare.

In Europe, the bank crisis management legislation (Crisis Management and Deposit Insurance Framework – CMDI) was introduced in 2013-2015 as a remedy to the bank insolvencies that occurred during the global financial crisis. It was based on a series of international standards issued by the Financial Stability Board[1] and other standard setters. This framework includes the Bank Recovery and Resolution Directive (BRRD) and the Deposit Guarantee Schemes Directive (DGSD), as well as the rules on State aid (2013 "Banking Communication"[2]). Moreover, in the Eurozone, with the implementation of the Banking Union project, crisis management and, in particular, the regulation and application of the resolution procedure, has been partly centralised at European level, through the Single Resolution Mechanism (SRM Regulation, which constitutes the second pillar of the Banking Union).

Nearly a decade after its entry into force, the CMDI framework is about to be changed, as the need to address certain critical issues and inconsistencies in its application has come to the fore. Consequently, the forthcoming regulatory reform is also bound to be reflected in crisis management within the Eurozone Banking Union, through the amendment of the SRM Regulation and, hopefully, the introduction of the third pillar (European Deposit Insurance Scheme). However, this latter project is still far from being implemented due to the lack of political agreement among the participating countries.

The experience gained in implementing the European framework offers much food for thought to policymakers on some of the weaknesses of the current system and the complex fundamental choices to be made, which concern, first of all, the general structure of the crisis management model to be achieved. Reflecting on the design of the model is of the utmost importance and, one might say, unavoidable, when a new regulation is to be introduced or amended, because it leads to a critical re-examination of the overall architecture of the existing arrangements - in terms of principles, objectives, instruments and procedures - and to an assessment of their consistency with the public policy objectives to be pursued.

In particular, the banking crises that have occurred in Europe over the last decade, especially in Italy, have been a useful test of the effectiveness of the current European framework: they have shown that the present arrangements certainly represent a significant improvement over the crisis management system in place before the global financial crisis. However, certain criticalities and shortcomings in terms of organicity, clarity and efficiency have been highlighted, resulting in inconsistencies within a European banking sector that is highly diversified in terms of size, legal form, business models and organisation of intermediaries.

Among the many issues that have been raised in the current debate, key importance has been attached to the need to increase the flexibility of the regulatory model as a prerequisite for strengthening the robustness, effectiveness and efficiency of the overall crisis management system: greater flexibility could also require overcoming some notions and paradigms that characterise the present regulatory framework. The need for flexibility has been reinforced by the most recent banking crises in the United States (Silicon Valley Bank, Signature Bank, Silvergate Bank and First Republic Bank) and Europe (Credit Suisse and Getin Noble Bank), which have given rise to far-reaching government interventions or evolutionary interpretations of existing regulations, motivated by the need to protect financial stability.

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[1] FINANCIAL STABILITY BOARD, *Key attributes of effective resolution regimes for financial institutions (KA)*, 15 October 2014.

[2] EUROPEAN COMMISSION, *Communication from the Commission on the application, from 1 August 2013, of State Aid rules to support measures in favour of banks in the context of financial crisis*, 2013/C 216/01, 30.7.2013.

Similar pressures in this direction are the numerous challenges facing the European and national banking sector, which is increasingly being called upon to deal with a macroeconomic and geopolitical framework marked by growing uncertainties and vulnerabilities, thus resulting in continuous stress for the sector and insolvencies of individual intermediaries or groups of intermediaries.

Therefore, the heterogeneity and complexity of the European banking sector pose the overriding issue of identifying the most appropriate regulatory model, by choosing among several theoretical frameworks:

(i) a scheme that is the same for all types of banking institutions, regardless of their characteristics (the "one size fits all" model), or a diversified model that takes into account the specific features of the various institutions or markets;

(ii) a system based on rigid, automatic, strictly enforceable rules (based on one-to-one correspondence between objective prerequisites, type of procedures and applicable instruments) or a scheme that provides for flexibility in the use of intervention tools, in order to leave the authorities adequate margins of discretion;

iii) a scheme in which the extent of flexibility is clearly defined, i.e. the choice between a model that assigns very broad discretionary powers to the authorities, or a model of controlled flexibility, aimed at establishing the conditions (i.e.: the principles and objectives) under which flexibility can apply (purpose-bound discretion), in order to allow third parties to perform ex-post scrutiny on the choices made by the authorities.

On a general level, these models are all theoretically viable and can be modulated in various ways depending also on the institutional frameworks of the various jurisdictions; if necessary, they could be accompanied by appropriate check-and-balance mechanisms aimed at ensuring the consistency of the chosen scheme with the public policies established by the legislator.

It is evident that the extreme models (automatism-rigidity or flexibility-discretion) may give rise to issues in their actual application. On the one hand, the automatism-rigidity scheme could clash, as has been said, with a European banking system featuring extreme heterogeneity and variability in many structural and functional elements: this may entail the risk that the rules established may prove not entirely suitable to effectively resolve complex crisis situations, which may require not just a single measure, but a combination of procedures and measures. On the other hand, the flexible-discretionary scheme carries the risk of opportunistic conduct on the part of the authorities and could lead to differences in application that generate unequal treatment.

The conundrum is not new; it is typical of the phases of regulatory innovation; the debate on the regulatory model of banking crisis management in Italy reached its peak at the beginning of the 1990s following the general banking reform that led to the enactment of the Consolidated Banking Act (Legislative Decree no. 385 of 1 September 1993), also implementing the EU directive reforming the banking sector[3].

In the wake of the reform, a large body of research - conducted by academics, authorities and practitioners - on the various topics of Italian banking legislation was launched, resulting in numerous collective and individual studies. The overall consensus of scholars was that, despite the major innovations in the basic principles of banking regulation and supervision, marked to a considerable extent by market rules, the subject of bank crisis management had followed a path of substantial continuity with the consolidated administrative model dating back to the 1936-38 Banking Law (Royal Decree no. 375 of 12 March 1936), based essentially on the same rules and procedures[4], the direction and management of which was entrusted to the administrative authorities.

One of the major themes highlighted by the research concerned precisely the consistency with market rules of the administrative model of crisis management, which strongly hinges on the discretion granted to administrative authorities. In particular, the discussion focused on the implications of this model on the autonomy of banking corporations and on the protection of the rights of the various stakeholders involved, with particular reference to the search for an appropriate balance between the protection of creditors and that of shareholders[5].

The generalisation of the administrative model of bank crisis management (Special Resolution Regime) introduced at a EU level by the BRRD, which was confirmed in the second pillar of the Banking Union (SRM Regulation), once again brought these issues to the attention of regulators, within the framework of the ongoing regulatory review, in order to assess the degree of effectiveness of the current model and its adequacy in pursuing the public policy objectives stated by the legislator. The weaknesses shown by application experience call for reconsideration of certain choices made at the time, without overturning them, with the aim of regaining flexibility and create a system that can best contribute to the pursuit of financial stability.

2. The regulatory model of the crisis of the ordinary commercial enterprise.

Striking a delicate balance between automatism (greater rigidity) and flexibility (greater discretion) of rules is a topic that has always characterised the world of law, when the legal system entrusts an administrative authority or a judge with decision-making powers of various kinds on economic and legal relations between private parties.

The issue is of great relevance to the functioning of the economy, because depending on the model chosen, the expectations of the parties subject to the rules will vary and, therefore, so will the assessments to be made and the decisions to be taken in the course of normal economic activity. Business crisis law does not deviate from this paradigm, and establishes a range of conditions for access to procedures and instruments that can be activated in crisis or insolvency situations, implying different degrees of interference by the administrative[6] and judicial authorities in business affairs.

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[3] Second Directive 89/646/EEC of 15 December 1989 on the coordination of laws, regulations and administrative provisions relating to the taking up and pursuit of the business of credit institutions and amending Directive 77/780/EEC.

[4] Two main proceedings for the treatment of banking crises were applied: the special administration and the compulsory administrative liquidation.

[5] G. BOCCUZZI, *La gestione delle crisi bancarie tra discrezionalità e mercato,* in Scritti in memoria di Pietro De Vecchis, Banca d'Italia, Volume I, Rome, 1999; G. VISENTINI, *Gestione amministrativa delle crisi bancarie*, Speech given at the seminar on "*Le crisi bancarie in Italia: un approccio interdisciplinare*", Luiss-Guido Carli University, 9 December 1998, organised by CERADI and NEWFIN; G. VISENTINI, *Il governamento delle società per azioni: il caso delle banche*, Quaderni di Moneta e Credito, March 1997.

From time to time, one recurring question arises: is automatism or flexibility preferable? The answer is not a simple one, if the question is posed in such clear-cut and simplistic terms, because very often intermediate solutions prevail, in which automatism and flexibility can be appropriately combined, by placing appropriate limits on discretion. In some circumstances, as mentioned above, automatism ensures certainty of the behaviour of those called upon to decide on the appropriate paths to follow to resolve the crisis and to choose the most suitable instruments. This solution, however, in some real situations may prove to be an impediment to the pursuit of the most effective solution, as it may prevent the adoption of certain instruments that, although part of the available toolkit, are prescribed by law to deal with situations governed by other types of proceedings. Flexibility, on the other hand, implying a certain degree of discretion, guarantees greater capacity to find broader and more diversified solutions for cases of particular complexity and for meeting the best interests of the multiple actors involved in the crisis.

This matter becomes key in the reform process of the legal system, when policymakers are called upon to strategically assess, from a forward-looking perspective, the compliance of the principles and objectives of insolvency law with the needs of the business world and the economy at large, while ensuring the protection of rights.

By its very nature, the enterprise crisis framework tends towards automatism and rigidity, for a number of reasons. The first reason is that it affects the private autonomy of the entrepreneur and, therefore, the rules of the framework must be clearly defined and circumscribed, to ensure their effects do not go beyond those intended by the legislator. The room for manoeuvre for the judge is limited, except where the law expressly grants him/her certain discretionary powers. Moreover these rules must be correctly applied to ensure homogeneity of treatment of the target companies. Secondly, insolvency rules affect the rights of the different categories of stakeholders involved in the crisis, in particular shareholders and creditors, so they must be applied consistently and uniformly in order to avoid any enforcement distortions, in time and space, and thus ensure equal treatment.

To some extent, the areas of discretion are related to the nature of crisis management procedures:

(a) in insolvency proceedings these areas are normally narrower: the intervention of the courts - which are very active in the governance of the proceedings - is aimed at ensuring the correct application of the rules and the protection of the rights of the parties concerned. Significant examples are the roles played by the court in verifying the correct application of the rules established by law for the drafting of the statement of liabilities, for the realisation of assets and for the participation of creditors in the distribution of realised assets (*par condicio creditorum*).

Thus, the insolvency framework, due to its collective bankruptcy nature, is of strict application, since it deals with regulatory provisions that affect, on the one hand, the autonomy of private entities, i.e. the companies subject to insolvency proceedings, and, on the other hand, the rights of the various categories of stakeholders, in particular those of shareholders and creditors. Even the verification of the conditions for access to insolvency proceedings, despite the many complex situations that may be at the root of the failure (illiquidity, asset losses, operating loss), has very limited margins of discretion, because, in any case, a state of insolvency is based on the creditors demonstrating that the entrepreneur is unable to duly fulfil his obligations or on the entrepreneur making such declaration himself.

In Italy, insolvency is managed through the judicial liquidation procedure, introduced with the recent reform of the Crisis and Insolvency Code (Legislative Decree No. 14 of 12 January 2019), replacing bankruptcy, which was previously governed by the bankruptcy law (Royal Decree No. 267 of 16 March 1942);

(b) on the other hand, where procedures and measures aimed at the reorganisation of the enterprise, i.e. alternatives to judicial liquidation, are applied, the national legal systems offer different solutions, with wide margins of flexibility, since the initiative to open the procedure is normally left to the debtor and the settlement of the crisis to agreements, of various legal forms, between the debtor and the creditors. The European Insolvency Directive, transposed in the aforementioned Crisis Code, sets out clear guidelines for prevention, to which national laws are now conforming[7]; in many of these procedures the intervention of the courts is variously modulated and may even be absent.

These procedures therefore represent the greatest expression of flexibility, because the settlement of claims is entrusted to the company's stakeholders themselves, with limited involvement of judicial or administrative authorities. The latter may in some cases have the power of deciding which type of procedure is applicable, which implies an evaluation of access requirements, normally based on technical assessments of the company's assets and liabilities, recovery prospects and restoration of economic balance: these are, however, decisions based on appropriate expert estimates of the enterprise's situation and the factors of the crisis, to be framed in the legal categories (the objective requirements) that underlie prevention and reorganisation procedures. The discretion of the authorities, therefore, is very restricted; the flexibility lies in the assessments left to the actors involved in the enterprise.

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[6] The reference is to the existence in the Italian insolvency system of a specific administrative procedure for large companies or groups of companies, subject to the "extraordinary administration of large insolvent companies". Extraordinary administration - the regulation of which has been modified many times - has the primary objective of pursuing 'the preservation of productive assets, through the continuation, reactivation or reconversion of entrepreneurial activities' (Article 1 of Legislative Decree 270/1999). It therefore aims to reconcile different interests: on the one hand, satisfying the creditors of the insolvent company, and on the other, saving the productive complex and preserving employment, thus avoiding liquidation solutions that inevitably have disruptive effects on the company and jeopardise important private and public interests connected to the preservation and recovery of the company.

[7] DIRECTIVE (EU) 2019/1023 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 June 2019 on preventive restructuring frameworks, on discharge of debt and disqualifications, and on measures to increase the efficiency of procedures concerning restructuring, insolvency and discharge of debt, and amending Directive (EU) 2017/1132 (Directive on restructuring and insolvency)

In Italian insolvency law, this part of the regulation has been progressively extended by the reforms of the last two decades. The new procedures introduced by the 2005 reform (composition with creditors in the two forms of business continuity and liquidation, debt restructuring plans, certified reorganisation plans, moratorium agreements), crisis management has been entrusted to the negotiating autonomy of the parties involved; the judge's intervention, if required, is essentially limited to verifying the conditions for access to the procedures and possible endorsement of the agreements reached, in various ways and with varying intensity in the different types of agreements.

The reform process has continued in recent years, by expanding procedures and instruments aimed at the early detection of the crisis and the reorganisation of the enterprise. The new Business Crisis and Insolvency Code[8] has introduced a more proactive approach to strengthen the warning measures for an early emergence of the crisis, which for the first time is defined by the legislator as 'the state of the debtor that makes insolvency likely and is manifested by the inadequacy of prospective cash flows to meet obligations in the next twelve months'.

This definition essentially transposes business logic, based on ex ante assessments, which are the only possible way of identifying an economic phenomenon of such complexity and wide-ranging impacts; it defines crisis as a phenomenon that is likely to lead to insolvency and could result into an imbalance of prospective cash flows such as to make it impossible to meet obligations within a twelve-month period (the same time horizon against which the directors are called upon to assess the company's continuity in the financial statements). To this end, the negotiated crisis settlement procedure has been introduced (Decree-Law no. 118/2021 converted into Law no. 147/2021), based on reports of difficult business situations. The aim is to lead the entrepreneur to promptly initiate corrective measures to prevent the opening of formal crisis proceedings: such are the warning measures, intended as early warning systems of anomalous situations in business management, to prevent further deterioration of the economic, financial and equity situation which could lead to insolvency, in order to ensure business continuity.[9] They leverage, alongside organisational measures the entrepreneur is required to take[10], the initiatives of certain qualified bodies of the company (board of statutory auditors, auditor, auditing company) to make reports internally or externally to the company in order to stimulate the adoption of the necessary remedial measures.

A similar report must be made to the entrepreneur and, where applicable, to the supervisory body by qualified public entities (INPS, INAIL, Revenue Agency) in the presence of particular debt situations. Finally, the figure of the independent expert has been created, to facilitate dialogue between the entrepreneur, creditors and other stakeholders and stimulate possible corrective measures within the "negotiated crisis settlement". Lastly, new procedures have been introduced, such as the "homologated restructuring plan", consisting of restructuring agreements with extended effects, aimed at facilitating business continuity.

The latest reforms just described place strong emphasis on crisis prevention and business reorganisation as an alternative to judicial liquidation; to this end, they have introduced a range of restructuring tools, with different legal structure depending on whether they are consensual (meaning that they apply only to the creditors that accept the agreement), whether they are also binding on a minority of non-consenting creditors, or whether they are binding on both a minority of creditors included in consenting classes and entire classes of dissenting creditors. The new corporate crisis management system, outside insolvency, is based on a model that has a strong focus on flexibility and gives broad decision-making powers on how to resolve the crisis to the company's main stakeholders - entrepreneur and creditors - in the pursuit of business recovery.

3. Which model for banking crisis management? How to combine flexibility and discretion?

In bank crisis law, the focus on crisis prevention and reorganisation has always been very high, given the distinctive characteristics of the bank's business and the consequent risks of contagion and financial instability that its crisis may entail; these features require a crisis management system designed around principles, systems and procedures that are very different from those of the ordinary commercial enterprises, as it would be very complex to apply a regime based on agreements between the entrepreneur and creditors, given the high number of creditors in the banking business (especially depositors)[11] and the need to intervene promptly to preserve the business assets (the sooner one intervenes, the greater the chances of an orderly resolution of the crisis).

In line with this development, the involvement of the courts in the management of banking crises has also steadily decreased over time, following the general application of the Special Resolution Regime at international level: this is based on entrusting administrative authorities (the resolution authorities) with the power to manage banking crises, while limiting the courts' intervention limited to cases in which it is necessary to resolve conflicts arising within (and in connection with) the procedure.

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[8] The Business Crisis and Insolvency Code was introduced by Legislative Decree no. 14 of 12 January 2019 and was amended several times, most recently by Legislative Decree no. 83 of 17.6.2022, which entered into force on 15.7.2022, implementing the Insolvency Directive. On this topic, A.NIGRO-D.VATTERMOLI, Diritto della crisi delle imprese. Le procedure concorsuali, Quinta Edizione, Il Mulino, 2021; S. DI AMATO, Diritto della crisi d'impresa. Aggiornamento al D. Lgs. 17 giugno 2022, N. 83 (G.U. N. 152 del 1° luglio 2022), Seconda Edizione, Giuffrè Editore, 2022; A. CAIAFA-A.PETTERUTI, Diritto della crisi d'impresa e dell'insolvenza. Aggiornato con la legge 21 ottobre 2021, N. 147, e 29 dicembre 2021, N. 233, Dike Giuridica, 2022.

[9] On this topic, R. RANALLI, *Le misure di allerta. Dagli adeguati assetti fino al procedimento avanti all'OCRI*, Giuffrè Editore, 2019; A. PANIZZA, *Crisi e adeguati assetti per la gestione dell'impresa*, ebook IPSOA Guide Operative, giugno 2020; G. ANDREANI-A. TUBELLI, *Transazione fiscale nel codice della crisi*, IPSOA-Manuali, luglio 2022; P. VELLA, *L'epocale introduzione degli strumenti di allerta nel sistema concorsuale italiano*, Questione Giustizia, Rivista on line, n. 2, 2019.

[10] Reference is made, in this regard, to the introduction of a specific regulatory provision - Article 2806 of the Civil Code, referred to by Article 3 of the Crisis Code - which requires the entrepreneur to adopt an organisational, administrative and accounting structure appropriate to the size and nature of the business, this being the prerequisite for putting in place planning and control tools favouring the early detection of a state of crisis and the activation of measures to overcome it, such as the negotiated crisis settlement procedure (introduced by Decree-Law no. 118/2021 converted into Law no. 147/2021).

[11] Evidently, if one disregards depositors, especially insured depositors, one cannot exclude situations in which there is room for negotiation between the bank in crisis and its creditors for the restructuring of debts, with a view to restoring capital equilibrium. In this regard, reference should be made to Article 27(1)(e) of the BRRD, according to which the supervisory authority may require the bank's board of directors to prepare a plan to negotiate debt restructuring with all or certain creditors in accordance with the recovery plan, where applicable.

The application of a special regime in the banking sector is justified on multiple grounds, on which legal and economic doctrine has reached broad consensus. The approach advocating an ordinary regime for the banking business has remained in the minority and its application is now just a memory of the past. In essence, the special regime is attributable to the broader range of interests to be protected compared to ordinary commercial enterprises and in light of the general objectives underlying banking activities, which make the banking sector a highly regulated and supervised system with administrative authorities exercising a wide spectrum of powers of control and intervention. Consistent with the nature of the banking business are the objectives of banking crisis management: protecting financial stability, ensuring the continuity of the essential functions performed by banks, including those related to the payments system, preserving credit relationships with enterprises, and protecting depositors. The combination of these elements makes banking crisis management an intrinsic complex process, as reflected above all in the extent of the requirements for activating the various procedures, the resolution methods and the tools required for resolution to be conducted in an orderly way, in order to minimise the burden on the various categories of stakeholders.

The issue of the banking crisis management model is key in view of the fact that the direction and management of crisis procedures is entrusted to public authorities (in Europe, the resolution authorities in liaison with the supervisory authorities and the European Commission), to which the law gives broad powers and tools aimed at preventing and mitigating the consequences of failures, including: the assessment of the objective preconditions for activating the various procedures, the application of resolution proceedings and the different resolution tools, the opening of the liquidation procedure and the implementation of the various forms of orderly liquidation, the intervention of deposit insurance and application of alternative measures with respect to the reimbursement of depositors, the modalities for the use of the Resolution Fund and, in exceptional cases, public intervention.

By definition, the granting of these powers to the administrative authority implies they are granted a degree of certain flexibility and discretion; under this arrangement, the main issue is to set reasonable limits on discretion, i.e. on how it can be exercised and submitted to external control.

In the first respect, it is in accordance with a principle of reasonableness and fairness to define a system in which discretion and its scope are attributed by law to the decision-makers; discretion cannot be exercised solely in application or on the basis of the interpretation of the legislation in force, because it runs the risk of degenerating into arbitrariness; in the second respect, appropriate parameters and instruments must be established to enable the parties targeted by the Authority's measures to effectively verify the legitimacy and adequacy of the powers exercised and of the instruments used; this includes establishing the scope and limits of judicial review. It is therefore necessary to strike a delicate balance between ensuring the efficiency and effectiveness of administrative action and protecting those affected by the measures: the balance between these two objectives can be achieved by a system in which the decisions of the administrative authorities are underpinned by a clear indication of the principles and objectives governing crisis management (as in the BRRD in Articles 31 and 34, which establish the objectives and principles of resolution), to the pursuit of which the use of the available tools, all clearly identified and defined by law, must be directed. According to this approach, the choice of crisis resolution tools should be the result of careful technical analysis, on a case-by-case basis, of individual crisis situations and the measures needed to resolve them, making the best use of the available tools within the framework of the principles and objectives laid down by law.

4. Areas for regulatory review. How broad should they be?

4.1 The EU Commission's Initiative, the Public Consultation and Recent Legislative Proposal.

A few years after the introduction of the CMDI framework and on the basis of the experience gained in the management of banking crises in Europe, the EU Commission launched a specific initiative to revise the legal framework, through a broad public consultation involving various categories of stakeholders, according to the precepts of better regulation. A summary of the results of this consultation was published in early 2021[12]. The consultation covered all the major issues in bank crisis management, particularly those that proved to be the hardest to implement. The scope of the issues raised in the consultation is undoubtedly very broad; its results suggest that what is needed is not mere fine-tuning of the existing arrangements, but a significant overhaul of the framework, so as to strengthen the flexibility and effectiveness of the overall crisis management system. The proposals put forward during the consultation do not seem to lead to unambiguous conclusions. This was to be expected, given the different legal and economic systems of the various countries, in terms of the structure and solidity of the banking systems, corporate and bankruptcy systems, and regulatory and supervisory frameworks. This makes the task facing the European legislator of striking an appropriate balance among the various approaches envisaged extremely complex. At the end of this consultation process and having heard the other authorities concerned, on 18 April 2023 the EU Commission presented a proposal for the reform of the CMDI, through three legislative initiatives aimed at amending the Directive on Recovery and Resolution (Directive 2014/59/EU), the Single Resolution Mechanism Regulation (Regulation 806/2014) and the Directive on Deposit Guarantee Schemes (Directive 2014/49/EU). The package also includes a fourth legislative proposal amending the Directive on Recovery and Resolution and the Single Resolution Mechanism (the 'daisy chain' proposal), regarding the determination of MREL within banking groups. This proposal follows a review clause introduced by the European Parliament and the Council in the daisy chain Regulation of October 2022 (Regulation (EU) 2022/2036). The legislative process will require quite some time, given the sensitivity and complexity of the subject matter and the analytical scrutiny that the European Council and Parliament will need to carry out. Therefore, the Commission, in its Communication accompanying the proposal[13], asked the European Parliament to approve these amendments before the EU elections of 2024.

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[12] EU COMMISSION, *Banking Union. Review of the bank crisis management & deposit insurance framework (DGSD review)*. In particular, see *Summary Report of the Public and Targeted Consultation on the review of the Crisis Management and Deposit Insurance framework (CMDI)*, Q1 2021.

[13] EU COMMISSION, Communication from the Commission to the European Parliament, the Council, the European Central Bank, the European Economic and Social Committee and the Committee of the Regions on the review of the crisis management and deposit insurance framework contributing to completing the Banking Union, Strasbourg, 18.4.2023 COM(2023) 225 final.

The reform of legislative package does not include the revision of the State aid rules, which has been postponed by the EU Commission until the adoption of the new CMDI framework. In this regard, a separate regulatory process is underway, in parallel with the co-legislators' review of the CMDI, with the stated aim of achieving the simultaneous enactment of the relevant regulatory acts: this would be made possible by the fact that, unlike the complex CMDI legislative process, the amendment of the State aid framework only requires a Communication from the European Commission which, once approved, is immediately applicable. The simultaneous entry into force of the two regulatory packages (CMDI and State aid) is considered of paramount importance, given the need to ensure their mutual consistency.

Finally, the package of options envisaged by the EU Commission does not include other important regulatory areas, among which, in particular: i) the completion of the Banking Union through the establishment of the Single Deposit Guarantee Scheme (EDIS); as emphasised in the proposal, the design undertaken identifies the reform of the CMDI framework as an important step towards the strengthening of the second pillar, paving the way for more significant developments with a view to the realisation of the third pillar; and ii) the harmonisation of the national insolvency systems applicable to bank liquidation.

The main stated objective of the CMDI's reform is to ensure that the rules governing bank crisis management and deposit insurance in the EU are applied effectively, with the aim of better preserving financial stability, depositor confidence and minimising the use of taxpayers' resources for public intervention. Thus, what is envisaged is not a radical change of the framework, but an adjustment of some areas of the current arrangements in order to improve their functioning.

In this context, the crucial issue under review is **the treatment of small and medium-sized banks.** As pointed out by the Commission, experience has shown that in many cases of failure of these banks, national authorities have adopted solutions outside the harmonised resolution framework, applying national measures, often resorting to taxpayers' resources instead of the insolvent banks' own resources (bail-in) or private resources from the industry (resolution fund and deposit guarantee scheme funds)[14].

Thus, the amendments aim to give the authorities more effective tools to deal with crises of small and medium-sized banks, through wider use of the resolution procedure, to ensure that, when financial stability is in danger, depositors, i.e. citizens, businesses and public entities, can continue to have access to bank deposits through their transfer to another bank. The resolution procedure is therefore regarded as the key component of the crisis management toolbox, as it is considered less disruptive to the economy and local communities than the liquidation procedure.

Whether this design approach is the most appropriate for solving the problems of small and medium-sized banks will have to be investigated in depth, also to assess its effectiveness in terms of flexibility. The risk that it could result in additional rigidity and burdens for the operators concerned must be avoided. Therefore, at this stage, an analytical assessment of the robustness and effectiveness of the solutions identified, with respect to alternative hypotheses that are also viable, as well as their actual compliance with the expectations put forward during the consultation, seems premature and will require in-depth reflection, also with a view to the debate that will be opened in the context of the examination and assessments by the co-legislators (European Council and Parliament).

Therefore, a few key points of the proposed package are analysed in the next section, postponing to subsequent reflections a more comprehensive and exhaustive evaluation of the technical profiles and operational implications of the choices made by the EU Commission.

4.2 Some reflections and indications on possible regulatory areas to be reviewed.

In identifying the areas for reform, it is first necessary to reflect on what the model of regulation should be, i.e. the general architecture of the foundational and unifying elements, the structural features, of regulation: these can be expressed in terms of principles and objectives to be pursued, which must be clearly identified in order to manage increasingly complex and variable situations. The key elements to be considered in redesigning crisis regulation are essentially two: Flexibility and Proportionality.

Why are these two elements so important?

Flexibility responds to a priority need that has emerged in the application of the current rules, which are characterised by rigidity and inefficiencies: only flexibility can enable the authorities to adequately address the diversity of national systems and the multiplicity of crisis situations that may arise in a macroeconomic scenario marked by increasing complexity and systemic crises of various kinds.

Flexibility must go hand in hand with **proportionality**, which is a cardinal principle of EU law; however, proportionality must not remain a mere statement of principle, but must be effectively applied, in order to use the procedures and instruments in a way that takes into account the diversity of the various components of the system. Specifically, proportionality should counter the risk that, in the name of uniform treatment and the level playing field - also important principles of regulation – rules are established that would entail an unjustified cost for a large number of banks, especially small and medium-sized ones, which pose much lower systemic risk, leading to regulatory diseconomies. Rules, therefore, must be carefully tailored to diversity in order to increase the efficiency and effectiveness of overall administrative action**.**

In concrete terms, principles and objectives concur to defining the policies informing regulation (**public policy objectives**). In the BRRD they are the principles and objectives of resolution (Articles 34 and 31 of the BRRD, respectively): they represent the legal foundation underpinning the activities of the resolution authorities.

The principles establish specific guiding parameters for administrative action and the framework for verifying its legitimacy and consistency, while allowing a degree of flexibility and discretion. In this regard, the aforementioned provision of the BRRD clearly spells out the general principles governing resolution, some of the key ones being: the participation in the losses first and foremost of the shareholders and creditors of the failed bank; the replacement of the management bodies and senior management of the bank; the accountability of those liable for the failure; the equal treatment of creditors of the same class; the rule that no creditor shall incur greater losses than those it would have sustained if the banking firm had been wound up under normal insolvency rules and procedures (No Creditor Worse Off - NCWO); the preservation of covered deposits; and compliance with the safeguards laid down in the directive.

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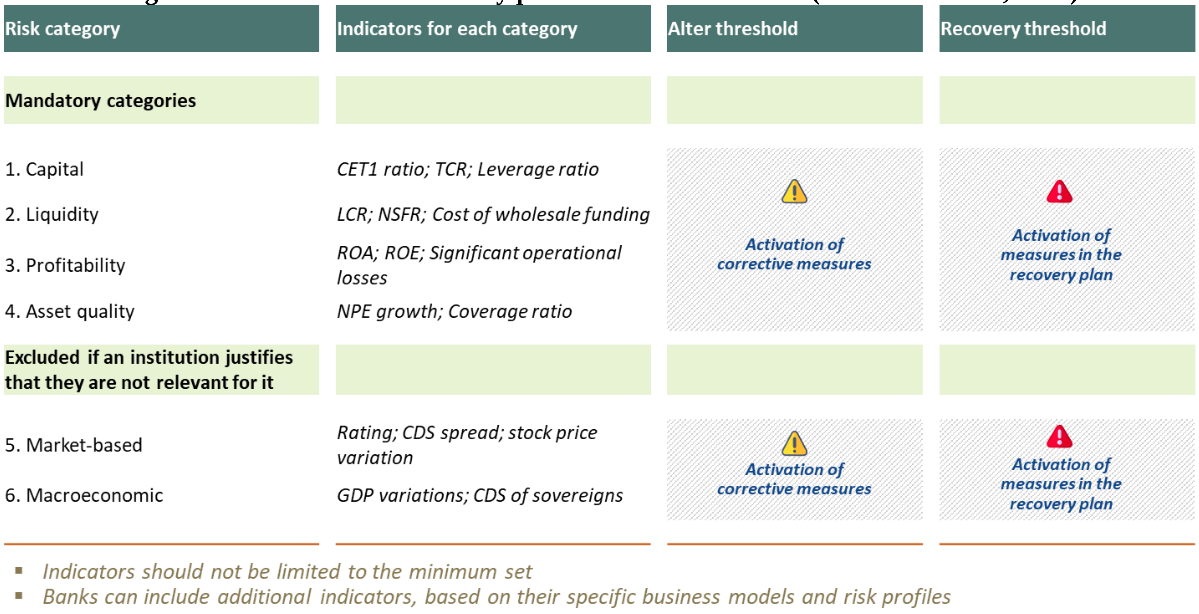
[14] The funds of deposit guarantee schemes and the resolution fund, safety nets financed by the private sector, are estimated to reach over EUR 55 billion and EUR 80 billion respectively by 2024 in the Banking Union.

These principles are undoubtedly valid, as they express the purpose and the direction in which crisis management is moving; they can therefore be considered adequate to address the specific features and complexity of banking crises; however, it cannot be ruled out that they might need to be aligned with the new framework that will result from the current revision, not least because a hierarchy between the different principles might need to be established.

The same consideration applies to the **resolution objectives**, to the pursuit of which the use of resolution powers and tools must be oriented: a) to ensure the continuity of critical functions; b) to avoid significant adverse effects on financial stability, in particular by preventing contagion, including to market infrastructures, and by maintaining market discipline; c) to protect public funds by minimising reliance on extraordinary public financial support; d) to protect depositors covered by Directive 2014/49/EU and investors covered by Directive 97/9/EC; and e) to protect client funds and assets.

Like the principles, the objectives are also placed in the context of the resolution and refer to the use of the resolution tools. In this regard, a different approach could be followed by referring the principles and objectives not only to the resolution process, but to all crisis management measures, They could therefore have a more general scope, through their application to all crisis situations, even those dealt with outside resolution, such as liquidation, precautionary recapitalisation and preventive and alternative interventions of deposit guarantee schemes. On this basis, with principles and objectives clearly enshrined in law, the use of instruments would be entrusted to the authorities in a flexible manner, with administrative discretion in the exercise of powers: the balancing of the system would be achieved through the obligation imposed on the resolution authority to strengthen the grounds for the measures taken and the tools used, by demonstrating their clear compliance with the principles and objectives and tangibly specifying their effectiveness in resolving the crises. Finally, the choice of model also includes an assessment of the completeness of the instruments and their adequacy with respect to the principles and objectives to be pursued. On this point, the innovative element of the current European framework expressed in the 2014-15 directives is to be warmly welcomed: **the integrated approach to crisis management**. The integrated approach means that the legislation aims to regulate not only the management of bank insolvency situations, to establish how to intervene when they occur, but also all the various stages in which a crisis situation may develop, with the aim of intervening proactively to avoid the failure or reduce its harmful consequences. To this end, the 2014-2015 framework was enriched with **preparatory measures** (mainly, recovery and resolution planning exercises) and **early intervention measures** (EIM). Precisely in light of this crisis prevention purpose, the set of measures should be fully confirmed, subject to their adaptation to increase their application effectiveness and compliance with the principle of proportionality, to take into account the size and complexity of intermediaries. The preparatory measures were the real innovative element of the European reform. The **Recovery Plan** is based on the bank's ability - through an appropriate governance process - to plan for and cope with any deteriorating situations that may arise in the life of the bank; they are identified through a system of indicators that reflect the most relevant management categories (capital, profitability, liquidity, asset quality, market and macroeconomic indicators). The indicators are shared by the supervisory authorities when assessing the recovery plan. Exceeding the pre-established thresholds of the indicators determines the need for corrective actions. The plan is prepared by the bank and assessed annually by the supervisory authorities. It is an extremely important tool that is fully embedded in the bank's risk management process and in the Risk Appetite Framework (RAF), which is its highest expression in terms of methodology. Both exercises, the RAF and the Recovery Plan, which are subject to the approval of the bank's strategic supervisory bodies, must be appropriately structured, in order to enable the timely activation of the operational mechanisms necessary for launching and implementing remedial actions.

Figure 1 - The content of recovery plan: the set of indicators (EBA Guidelines, 2015)



Risk category	Indicators for each category	Alter threshold	Recovery threshold
Mandatory categories			
1. Capital	*CET1 ratio; TCR; Leverage ratio*	⚠ *Activation of corrective measures*	⚠ *Activation of measures in the recovery plan*
2. Liquidity	*LCR; NSFR; Cost of wholesale funding*		
3. Profitability	*ROA; ROE; Significant operational losses*		
4. Asset quality	*NPE growth; Coverage ratio*		
Excluded if an institution justifies that they are not relevant for it			
5. Market-based	*Rating; CDS spread; stock price variation*	⚠ *Activation of corrective measures*	⚠ *Activation of measures in the recovery plan*
6. Macroeconomic	*GDP variations; CDS of sovereigns*		

- *Indicators should not be limited to the minimum set*
- *Banks can include additional indicators, based on their specific business models and risk profiles*

The **Resolution Plan** is prepared by the Resolution Authority, with data and information provided by the bank, after consultation with the relevant supervisory authority. It is a key planning document, containing an analysis of the bank's characteristics, its essential functions, the possible existence of impediments to resolvability, and the determination of the bank's MREL (Minimum Requirement of Own Funds and Liabilities), the requirement to ensure that the bank maintains a minimum amount of capital and certain eligible liabilities to support an effective resolution.

The resolution plan concludes with an indication of:

(i) the resolution strategy, i.e. whether the bank in the event of insolvency should be liquidated in accordance with national insolvency proceedings or subject to resolution;

(ii) the possibility of submitting the bank to resolution (resolvability) without serious effects on the financial system and the economy. In this regard, the legislation specifies that resolution of an institution is deemed feasible when: i) in the opinion of the resolution authority, it is considered feasible and credible to wind up the institution under normal insolvency rules and procedures or ii) to resolve the institution by applying the various resolution tools and powers to it, while avoiding to the maximum extent possible any significant adverse effects – including in situations of financial instability or system-wide events – on the financial system in the Member State where the institution is established or in other Member States of the Union – and with a view to ensuring the continuity of critical functions carried out by the institution. For this reason, the resolution authority is required to assess whether there are impediments to the resolution of a bank (impediments to resolvability).

In this matter, discretion is very wide, both because the plan is prepared by the resolution authorities themselves, and because they can impose specific measures on financial institutions if resolution is not deemed possible due to significant impediments. In this case, the authority will initiate an administrative procedure aimed at inducing the bank to remedy the relevant impediments, by submitting a plan for implementing the identified measures[15].

The latter regulatory provision is particularly critical in terms of administrative action, because under it the resolution authority may require the bank – after assessing negatively the measures proposed by the bank itself - to take specific measures of particular complexity (alternative measures). These include requiring the institution to review any intra-group financing arrangements or assessing the absence or formulation of service contracts, either intra-group or with third parties, for the provision of essential economic functions; imposing limits on risk exposure; imposing additional disclosure requirements and divestment of specific assets; requiring changes to the business model and legal and operational structure of the institution to reduce its complexity; and issuing eligible liabilities to comply with the requirements of Article 45.

These measures are distinguished by the fact that they are not taken when the bank is failing or likely to fail, but when it is in an ordinary management situation (going concern) and the existence of impediments to resolvability is the result of the authority's assessment of whether the bank may be subject to resolution. In imposing these measures, the resolution authority must take into account the threat to financial stability that such impediments may pose and the effect of the measures on the institution's business, its stability and its ability to contribute to economic activity[16].

Early intervention measures are different from preparatory measures; they fall within the competence of the supervisory authority as they refer to situations (objective requirements) occurring prior to the bank's actual crisis and are aimed at preventing its occurrence. Such measures may be triggered by actual or expected breaches of prudential requirements, serious violations of regulatory provisions or serious administrative irregularities, or significant deterioration of the financial situation (Articles 27-29 BRRD). The measures may be of varying types and scope, such as, for example: the removal of all members of the management bodies, the removal of one or more members of senior management, the removal of individual executives, the placement of the bank under extraordinary administration or the appointment of extraordinary administrators to temporarily work alongside the ordinary bodies of the bank, the implementation of the measures set out in the recovery plan, including the request to the bank to agree on a debt restructuring plan with its creditors[17].

Early intervention measures - although rarely used by the European supervisory authorities - should also be confirmed, as they expand the toolbox for the prevention of bank insolvency. However, it is necessary to verify whether they may overlap with the supervisory measures envisaged in prudential regulation (CRD and Directive (EU) 2019/203419 concerning investment firms - IFD) and, if so, to identify ways to clearly distinguish them at the regulatory level, bearing in mind that some situations in which EI measures can be activated imply the existence of conditions of a certain severity (Figure 2), different from those underlying "ordinary" supervisory interventions.

These are measures whose activation must necessarily be marked by flexibility and not by rigid criteria and parameters, so that they can be initiated with the necessary timeliness and effectiveness, according to the technical and administrative discretionary assessment conducted by the supervisory authority. However, legislative clarification on when and to what extent non-compliance with prudential capital and liquidity requirements would trigger early intervention or resolution/liquidation measures would be welcome[18]. In this logic, early intervention measures must therefore remain entrusted to the prudential supervisory authority and not be transferred to the resolution authority, whose powers can only be activated in the presence of situations that denote an actual or prospective insolvency of the bank. The distinction between early intervention and resolution measures must therefore remain very clear, with no confusion between the situations underlying the two. The BRRD itself (Article 32(3)) states that the previous adoption of an early intervention measure is not a condition for taking a resolution action. To ensure effective interaction between supervisors and resolution authorities for the purpose of early intervention or resolution measures, cooperation and information exchange between the two authorities should be strengthened.

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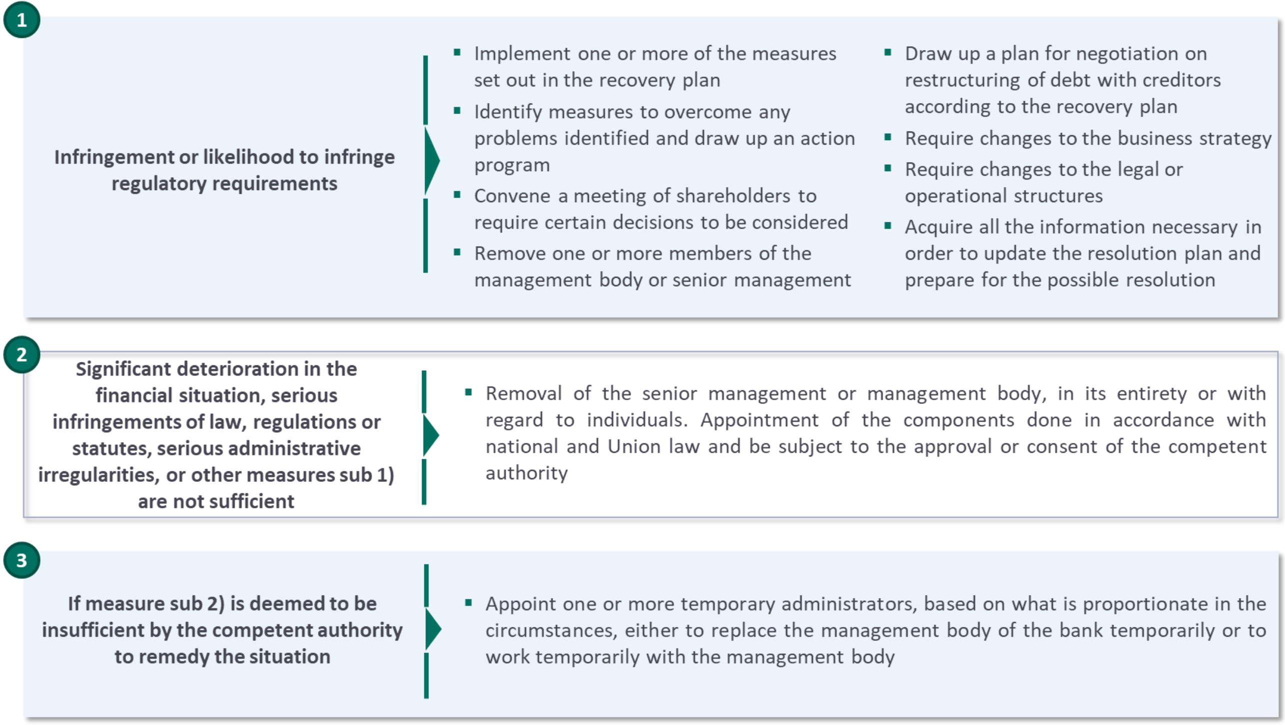
[15] THE SINGLE RESOLUTION BOARD, *Introduction to Resolution Planning*, 2016; EUROPEAN COURT OF AUDITORS, *Resolution Planning in the Single Resolution Mechanism*, Special Report, 01, 2021.

[16] This is one of the cases in which the Authority's discretion must be carefully calibrated in order to balance the measures necessary to simplify the structure and operations of the institution with the sole purpose of improving the possibility of resolving its crisis. Measures imposed in this regard should also comply with Union law, should not discriminate, directly or indirectly, on grounds of nationality, and should be justified in the public interest of financial stability. Moreover, intervention should be limited to the minimum necessary to achieve the desired objectives.

[17] Similar to these early measures are the preventive operations that DGSs can put in place as an alternative to the repayment of depositors and the precautionary recapitalisation or liquidity interventions with the use of public funds that the BRRD allows, under certain conditions, following supervisory stress tests.

Figure 2 - Early intervention measures and their triggers



1

Infringement or likelihood to infringe regulatory requirements

- Implement one or more of the measures set out in the recovery plan
- Identify measures to overcome any problems identified and draw up an action program
- Convene a meeting of shareholders to require certain decisions to be considered
- Remove one or more members of the management body or senior management
- Draw up a plan for negotiation on restructuring of debt with creditors according to the recovery plan
- Require changes to the business strategy
- Require changes to the legal or operational structures
- Acquire all the information necessary in order to update the resolution plan and prepare for the possible resolution

2

Significant deterioration in the financial situation, serious infringements of law, regulations or statutes, serious administrative irregularities, or other measures sub 1) are not sufficient

- Removal of the senior management or management body, in its entirety or with regard to individuals. Appointment of the components done in accordance with national and Union law and be subject to the approval or consent of the competent authority

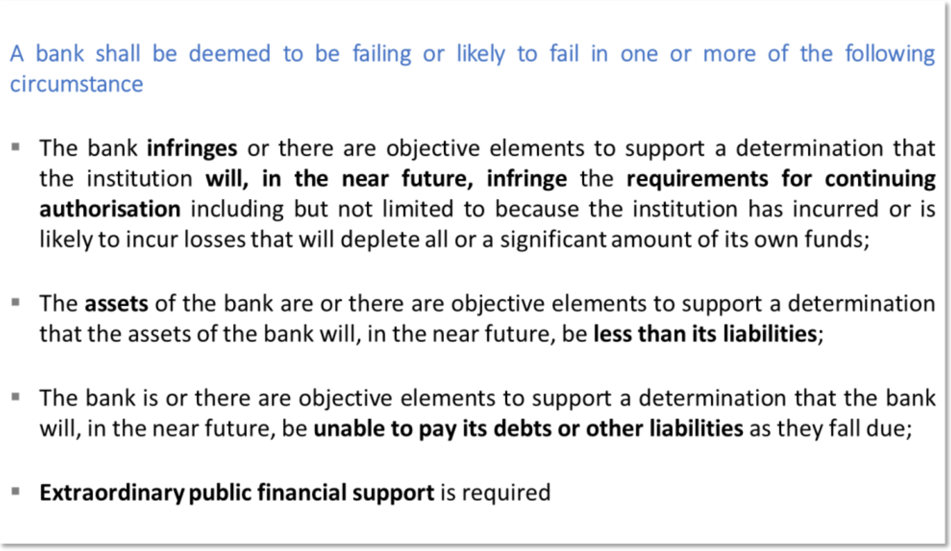
3

If measure sub 2) is deemed to be insufficient by the competent authority to remedy the situation

- Appoint one or more temporary administrators, based on what is proportionate in the circumstances, either to replace the management body of the bank temporarily or to work temporarily with the management body

In this sense, the objective conditions for triggering the resolution are relevant, in particular the ascertainment of the situation of failing or likely to fail (FOLF). The regulatory definition of this condition appears sufficiently clear and adequate (Article 32(4) BRRD), as it brings together all the possible conditions that can give rise to a bank's insolvency, in the sense of regulatory insolvency (capital, liquidity, non-compliance with legislation such as to require withdrawal of authorisation) and which may give rise to the application of crisis management measures (reduction and conversion of capital instruments, resolution, liquidation). There are, therefore, no sound reasons for revising these conditions, not least in light of the difficulty of capturing in a regulatory formula the highly disparate and complex situations that may indicate a state of irreversible crisis.

Figure 3 The notion of failing or likely to fail



A bank shall be deemed to be failing or likely to fail in one or more of the following circumstance

- The bank **infringes** or there are objective elements to support a determination that the institution **will, in the near future, infringe** the **requirements for continuing authorisation** including but not limited to because the institution has incurred or is likely to incur losses that will deplete all or a significant amount of its own funds;
- The **assets** of the bank are or there are objective elements to support a determination that the assets of the bank will, in the near future, be **less than its liabilities**;
- The bank is or there are objective elements to support a determination that the bank will, in the near future, be **unable to pay its debts or other liabilities** as they fall due;
- **Extraordinary public financial support** is required

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[18] On the subject of objective prerequisites, it should be clarified how breaches of rules or serious irregularities or actual or expected violations of prudential requirements or significant deterioration of the bank's situation, established for the activation of certain early intervention measures, differ from the similar conditions (irregularities, capital losses, illiquidity situations) established for the initiation of resolution.

The concept of FOLF fully meets the objective of preventing a resolution intervention, and thus of flexibility, since the conditions it covers are not necessarily current, but may also be prospective, i.e. where "there is objective evidence to support the belief that in the near future" serious situations may occur[19], such as, for example, the loss of a significant part of the capital or the inability to pay debts or other liabilities as they fall due. Therefore, with the forward-looking view that characterises each starting requirement, the authorities are able to intervene in good time to open the resolution or liquidation procedure, before the business values are excessively reduced. Therefore, the timing of enforcement action does not depend on how the objective conditions are identified in law, but on how they are applied, because they are defined in very broad terms and from a forward-looking perspective, to enable prompt intervention for the protection of creditors. Therefore, supervisory and resolution authorities must liaise very closely in this field as well.

As a parameter innovating and clarifying the framework, the objective criterion of failing or likely to fail should be aligned with the requirements triggering liquidation in national laws, as the Italian legislator has done. In addition, on a procedural level, it should logically be for the supervisory authority (national or European, depending on competences) to determine the FOLF, given that the same authority has the powers to ascertain the technical situations of banks, including inspections, and to make assessments within the SREP.

Under current law, FOLF may also be determined directly by the resolution authority, after consulting with the supervisory authority, if it has the necessary tools to make such a determination, such as adequate access to relevant information.

The decision to align the objective requirements for resolution and liquidation should, however, be part of the process of harmonising national insolvency regimes. In this regard, as clarified by the Commission, during the public consultation 18 national resolution authorities stated that such harmonisation would be useful, possibly by aligning the factors that trigger national insolvency regimes with those that trigger resolution and, in particular, with the conditions under which a bank is declared failing or likely to fail. On this point, however, some difficulties in achieving said alignment have been pointed out, as it involves areas of law that remain within the competence of Member States, such as company law and other legislation applicable to insolvency situations.

The wide range of **resolution tools** provided by the current legislation (bail-in, sale of business, bridge bank, bad bank-good bank separation) is a positive factor, as these tools can be applied to the bank in crisis to pursue reorganisation/re-capitalisation solutions or to transfer the business to other intermediaries, depending on the actual circumstances, to be assessed individually. It is difficult to imagine other solutions outside those envisaged by the legislation.

From the point of view of the general architecture of crisis management legislation, as already observed for the principles and objectives of resolution, the tools should also more properly refer to all the ways of resolving banking crises and not only to resolution; this would overcome the current rigidity, under which the principles, objectives and tools are only applicable to large or complex banks, through resolution, and not to small and medium-sized banks, which would be destined to essentially liquidation solutions, as emphasised some years ago by the Chairman of the Single Resolution Board, according to whom 'resolution is for the few, not for the many' [20] .

This alternative proposal aims to make the principles, objectives and tools currently provided for resolution applicable to all banks, regardless of their size or complexity, thereby extending the potential application of the resolution tools (not of the resolution procedure) to all crisis situations. Indeed, in many countries restructuring measures in insolvency situations have been applied to small and medium-sized banks as well, through recapitalisation, the sale of the business, the creation of bad banks for the management of non-performing assets and the establishment of bridge banks for the temporary management of the business, when there are no banks on the market willing to take over the insolvent bank. In some cases, even small and medium-sized banks may be 'too big to liquidate' under national insolvency rules, due to the systemic impact that the failure of a small and medium-sized bank may have.

Such an approach fully reflects the principle of flexibility, under which procedures and instruments should be chosen on the basis of a technical assessment of the most appropriate solution to best pursue the principles and objectives outlined by the legislator, and not on the basis of rigid rules, laid down by law, excluding a priori the application of some instruments to certain categories of banks.

In order to achieve this result, it would be necessary to go beyond the current requirements for activating the resolution procedure, which include, in addition to the other requirements (FOLF, lack of private or supervisory initiatives to overcome the crisis), the ascertainment of the existence of a **public interest** (PIA - *Public Interest Assessment* - Article 32.5 BRRD). This requirement implies that when a bank is declared to be failing or likely to fail, in order to trigger resolution it is necessary to establish that resolution serves the public interest; according to the same provision, resolution action serves the public interest if it is necessary for the achievement of one or more of the resolution objectives set out in Article 31 and is proportionate to them, and if winding up the institution under ordinary insolvency proceedings would not achieve those objectives to the same extent.

In reality, experience has shown that the assessment of the existence of this condition is fraught with problems, and has given rise to different interpretations and implementation practices; it has often led to the non-application of the resolution procedure, with the result that national solutions have been adopted that have also involved the use of public money for fear of triggering the bail-in of certain categories of creditors and depositors, in the absence of adequate loss-absorbing capacity on the part of the insolvent bank. Therefore - as demonstrated by some banking crisis events - the definition of public interest should be reconsidered and clarified, as it does not consider that public interest might also apply to small and medium-sized banks, when they have certain structural and functional characteristics, such as, for example, being rooted in a certain local or regional area, the degree of credit assistance provided to small and medium-sized enterprises in the local economy, entailing the need to ensure continuity of the essential functions performed, or significant participation in the payment system; these banks also imply the objectives of protecting depositors and clients' funds and assets, which are independent of the banks' size.

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[19] G. BOCCUZZI, *Il regime speciale della risoluzione bancaria. Obiettivi e strumenti*, Cacucci Editore, 2018, pp. 132 ss.

[20] E. KOENIG, *Developments in the SRB: Setting MREL and Safeguarding Operational Continuity*, Speech to the BPFI in Dublin, 29 January 2019.

In this regard, there could be essentially two ways forward:

(i) broadening the concept and scope of public interest so as to allow the application of the resolution process and related tools also to small and medium-sized banks, depending on the specific circumstances of individual cases. This option implies that, compared to the current definition of PIA, an additional number of banks, previously subject to the liquidation strategy, would be eligible for resolution. The number of these banks would not be determinable in advance, as assessment of the existence of public interest would be made on a case-by-case basis by the resolution authorities at the time of insolvency, based on the bank's financial situation and its ability to access internal and external funding (the bank's loss-absorbing capacity and the use of private safety net funds, respectively). This is the approach followed by the Commission in its legislative proposal[21]; however, it remains to be assessed whether this solution is the most appropriate one, as the application of resolution to small and medium-sized banks could lead to unjustified burdens on them (MREL, application of bail-in, reporting requirements), which are currently not applicable or are applicable to a lesser extent;

(ii) alternatively, the concept of public interest might be removed altogether, on the assumption that the management of banking crises always implies the pursuit of a public interest or, better, a general interest. Under such a model, the choice of crisis management measures and tools, as mentioned, would not be linked to conditions rigidly predetermined by law, but to the specific features of the banks' financial conditions at the time of the crisis and to assessments of a predominantly technical nature assigned to the authorities. Consistent with this approach, the resolution tools would be potentially applicable to all banks, with the consequent possibility of activating restructuring measures or transferring the company or business, with recourse to external funding provided by the banking industry (Resolution Fund and DGS).

In conclusion, the regulatory definition of principles and objectives referable to all banks and not only to certain categories of banks (large, small and medium-sized banks; international, national and regional banks) is of crucial importance, because it constitutes the legal basis for giving to the administrative authority the power to take the most correct and consistent decisions in terms of the instruments that can be used in concrete cases. The proposed approach aimed at flexibility recognises a certain margin of discretion for resolution authorities, provided that its exercise is tied to clear principles and objectives, which thus constitute the limit to the discretionary power itself and the most effective way for third parties affected by measures of the authorities to review their legitimacy.

Here lies the **distinction between resolution and liquidation**. Both are procedures involving the insolvency of the bank (failing or likely to fail), but the operational mechanisms are different. In its current legislative configuration, resolution constitutes a measure for the restructuring of the insolvent bank, either through recapitalisation with the bank's internal resources (bail-in - going concern) or sale of the business (gone concern), together with other resolution tools. In both operational perspectives, resolution allows for the continuity of essential functions of the failing bank, i.e. those activities, services and operations whose interruption could jeopardise financial stability or the performance of certain services of key importance to the real economy. If, on the other hand, the failure poses no risk to financial stability (because the bank is small and does not serve a public interest), the bank is liquidated according to national insolvency laws. This distinction does not appear fully satisfactory and should be overcome, through a process that aims primarily at the restructuring/disposal of all banks in FOLF situations and in all cases where this is feasible in terms of both economics and market conditions, leaving winding up as a last resort.

In any case, even where liquidation proceedings are opened, they should be conducted in such a way as to minimise risks for creditors and safeguard the continuity of credit relationships, through - as far as possible - the transfer of assets and liabilities (preferably all deposits, covered and uncovered) to another bank (**Orderly Liquidation**). In this configuration, resolution and orderly liquidation would have many aspects in common and the distance between the two procedures would be very short. OL leads to the termination of the liquidated bank's business and its exit from the market, but its assets and liabilities are sold in a lump sum, in the same way as the sale of business in resolution, possibly accompanied by the establishment of a bridge bank and/or the separation of bad and good banks. Thus, OL is also a form of resolution, if one looks at the economic substance of the operation. It would differ from resolution in that only the latter makes it possible to recapitalise the bank through bail-in (open bank bail-in). Orderly Liquidation (OL) is a crisis management procedure already applied in many jurisdictions, including Italy since 1936.

On the other hand, pure and simple liquidation, so-called **'atomistic' liquidation**, would remain different. It would maintain its own physiognomy as a procedure that determines the closure of the bank's activity and the intervention of the deposit guarantee system to reimburse depositors within the limits provided for by law. It would constitute a last resort, applicable to small banks for which a 'resolution' operation cannot be achieved through a business transfer, also due to the lack of interest from potential buyers.

The approach outlined above would have inevitable repercussions in the drafting of the resolution plan, for the purpose of identifying the applicable resolution strategy, since - despite the difference between the two procedures from a legal point of view - substantial identity of the solutions that can be implemented in the context of resolution and liquidation could be achieved, with the exception of internal recapitalisation through bail-in, which is exclusive to resolution; the other tools, in fact (transfer of business, bridge bank, bad bank-good bank separation), are also applicable in the context of liquidation.

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[21] Under the Commission's proposal, resolution authorities would determine on a case-by-case basis whether a bank should undergo resolution or liquidation, based on an assessment of the public interest and of how the two alternatives would serve the objectives of financial stability, protection of depositors and taxpayers. To this end, the proposal clarifies that the effects of the bank's critical functions on financial stability should be assessed at the regional level and not only at the national level, and that the resolution framework should be applied appropriately to banks of any size when it is capable of achieving the objectives of orderly crisis management, reducing the likelihood that the choice made by the resolution authority in the planning phase may change at the time of failure.

In theory, both procedures (resolution and orderly winding-up) should converge in the determination of losses; should this parity not be achieved, the **No Creditor Worse Off (NCWO)** principle would be triggered in the resolution, which provides for the intervention of the Resolution Fund to indemnify creditors who have been treated less well in the resolution than they would have been in the winding-up procedure, had it been applied.

A further point is the definition of the objective extent of the transfer, i.e. the determination of the scope of the transferable assets and liabilities; in this field, flexibility should be maximised: there should be no limiting regulatory provisions, given that the scope of the compendium to be transferred (assets, in whole or in part, total deposits, only protected deposits, other liabilities, all liabilities) may not depend on the rules but on the concrete technical situation of the insolvent bank and the objectives to be pursued, subject to compliance with the principle of *par condicio creditorum*, taking into account the loss coverage that may be provided by the deposit guarantee scheme or by public support for larger and more complex banks.

Another area of flexibility concerns the modalities of **intervention of deposit guarantee schemes**[22], for which the European experience presents different institutional and operational architectures: some are limited to the simple reimbursement of depositors (pay-box function), others include further operational modalities aimed at intervening to avoid the insolvency of the bank (preventive measures - Article 11(3) DGSD) or as part of liquidation proceedings through the transfer of assets and liabilities of the liquidated bank to another bank (alternative measures, similar to the OL - Article 11(6) DGSD). Both types of measures, as mentioned, could be defined as quasi-resolution.

The way forward to increase the flexibility and effectiveness in the use of DGS funds should be to privilege, as far as possible, the intervention of DGSs to implement preventive and alternative measures with respect to the reimbursement of depositors, if such intervention is less costly than a payout[23]. However, the least cost parameter should be more clearly defined at regulatory level, especially in qualitative terms, leaving the quantitative technical assessment and the underlying parameters to the DGSs. On the other hand, the actual achievement of least cost depends on the ranking accorded to depositors and to the deposit guarantee scheme in the creditor priority scale in insolvency and resolution proceedings (depositor preference); moreover, these interventions should not be qualified as State aid, since they are supporting operations carried out with private funds from the banking sector.

Under the current framework, deposits of less than EUR 100,000 are protected by law, regardless of their position in the hierarchy of creditors in insolvency proceedings. The treatment of deposit guarantee schemes that are subrogated to reimbursed depositors is also highly privileged (super depositor preference). The current regime provides for a three-tier ranking of depositors (three-tier depositor preference): 1. at the highest tier are protected deposits and the claims of deposit-guarantee schemes subrogated to reimbursed protected depositors; 2. after tier-1 creditors, are the unprotected deposits of households and small and medium-sized enterprises; 3. at the third tier, after tier-2 deposits, are the other unprotected deposits. The configuration of depositor preference differs in the EU Member States: in most countries, unprotected deposits have the same priority as ordinary unsecured claims (e.g. senior bonds); in other countries, unprotected deposits are placed above ordinary unsecured claims.

There can be several options for modifying depositor preference, depending on the solutions to be favoured, including for the application of the least cost parameter. The legislative proposal put forward by the Commission, accepting the suggestions made by some countries, aims to eliminate the super-preference of protected deposits and deposit guarantee schemes and to create a single-tier for all deposits (protected deposits and deposit guarantee schemes, unprotected deposits of households and small and medium-sized enterprises and other unprotected deposits). In particular, by removing the super-preference of DGSs, the proposal aims to eliminate one of the main difficulties in the current system in using DGSs for non-payout transactions (in particular, business transfers), given the difficulty in overcoming the least-cost constraint; indeed, under the least-cost principle, a DGS, for preventive and alternative interventions, can only cover charges up to the amount of the losses it would incur in the event of a hypothetical payout of protected deposits in insolvency proceedings, losses that would be equal to the difference between the amount disbursed to repay depositors and the amount a DGS would recover from the realisation of the liquidation assets. A two-tier depositor preference option could also be considered, eliminating only the super-priority of protected deposits and DGSs in the creditor hierarchy.

The underlying rationale behind the legislative proposal is to expand the **intervention in the resolution of DGSs**, whose resources may be needed to supplement the Resolution Fund's funding for interventions in favour of small and medium-sized banks. The innovative aspects contained in the proposal are many, and their implications must be carefully assessed.

Currently, the BRRD reserves a secondary role for DGSs in financing resolution, with the guarantee system being able to intervene only in limited cases and under stringent conditions; in contrast, the role of the Resolution Fund is broader since, in the event of a bank undergoing resolution, it can intervene to cover losses and replenish capital or to make it possible to transfer the business, under certain conditions (Article 101 BRRD).

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[22] The Commission's legislative proposal aims to further harmonise deposit protection at EU level, extending protection to public entities (such as hospitals, schools, municipalities) and to the holdings of customers of non-bank intermediaries (investment firms, payment institutions and electronic money institutions). Also to be harmonised is the protection of temporary high balances deposited with a bank in excess of EUR 100,000 linked to specific life events (inheritance, insurance benefits).

[23] According to the European Central Bank, each Member State has at least one medium-sized or smaller bank for which a payout of deposits would exhaust the funds of the national deposit guarantee scheme. Therefore, the implementation of payouts in case of liquidation entails the risk of a shortfall of resources for deposit guarantee schemes..

Paragraph 2 of the same Article states that the Resolution Fund cannot be used "directly" to absorb losses or to recapitalise an institution or entity referred to in Article 1(1)(b), (c) or (d). However, where the use of the resolution financing arrangement results "indirectly" in the transfer of part of the losses of an institution or entity to the resolution financing arrangement, the principles set out in Article 44 BRRD shall apply.

Article 44 stipulates that the use of the Resolution Fund for loss coverage and recapitalisation of the bank in resolution is possible, based on the assessment made by an independent valuer, if: i) there has been a contribution to losses and recapitalisation by shareholders and creditors (bail-in) to the extent of at least 8% of the bank's liabilities, including own funds; ii) the contribution of the Resolution Fund does not exceed 5% of the liabilities, including own funds, of the bank. The provisions on indirect activation of the Resolution Fund to cover losses were later clarified by the EBA[24].

Pursuant to the BRRD, the Deposit Guarantee Scheme may also be called upon to intervene on a compulsory basis for the financing of resolution, subject to certain limits and conditions; but it should be specified immediately that this type of intervention, governed by the rules established by the BRRD, is merely a possibility and a last resort.

Under Article 109 of the BRRD, the Deposit Guarantee Scheme (DGS) may intervene to cover losses resulting from resolution in those limited cases where they affect depositors' claims under ordinary national insolvency rules. In such cases, the DGS intervenes in place of protected depositors in order to hold them harmless from the effects of resolution. The Resolution Authority shall determine, in consultation with the DGS, the amount to be paid by the DGS in cash, in accordance with the assessment made by the independent valuer. Therefore, the mechanism identified consists in a loss-absorbing function at the DGS's expense, and not the function of reimbursing depositors where the bank is wound up.

Article 109 also lays down the criteria for determining the amount required from DGS to cover losses; in particular:

a. if the bail-in tool (Article 43 BRRD) applies, the amount is equal to the amount by which the protected deposits would have been written down for the purpose of absorbing the bank's losses pursuant to Article 46(1)(a), had the protected deposits been included in the bail-in and written down to the same extent as creditors having the same priority level under national insolvency law;

b. if the other resolution tools, other than the bail-in, apply, the amount corresponds to the losses that the covered depositors would have suffered if the covered depositors had suffered losses in proportion to the losses suffered by creditors with the same priority level under national insolvency law.

The same provision is confirmed by the DGSD in Article 11(2), which provides that the financial means of the DGSs are used to finance the resolution of credit institutions in accordance with Article 109 of the BRRD and that the amount to be borne by the Guarantee Scheme shall be determined by the resolution authority, after consultation with the DGS.

To summarise, the following are required to determine this amount:

- the prior application of the bail-in in the aforementioned minimum amount of 8% of liabilities, including own funds;

- the use of the resolution fund (up to the maximum limit of 5% of the same liabilities per bank);

- where losses have not been fully covered, further bail-in on other eligible liabilities, taking into account the applicable depositor preference rules[25];

- the DGS shall intervene to contribute to the coverage of losses only after all other creditors lower in the order of priority have participated in the coverage of the bank's losses and only for the portion that may remain.

Finally, DGSs also benefit from the application of the No Creditor Worse Off (NCWO) rule, under which a DGS cannot be called upon to cover losses exceeding those it would have incurred had the bank been liquidated under national insolvency rules; if this were to occur, DGS would be entitled to compensation from the Resolution Fund for the difference, in the same way as any creditor affected to a greater extent than in ordinary insolvency proceedings.

There is also an overall quantitative limit on a DGS's intervention, as it may not exceed 50 % of its target level of available resources.

The combination of these constraints means that the intervention of DGSs in resolution is limited to very few cases, and is in practice not usable[26].

A different, more flexible application of Article 109 BRRD was followed in the case of the Polish Getin Noble Bank[27], through the simultaneous use of voluntary funds injected into the resolution by the largest Polish banks in order to avoid loss-sharing on the part of depositors with funds above the protection level (so-called eligible deposits)[28]. This solution amounted in substance to bail-in through recourse to the banks' private funding; otherwise, achieving the same result would have required greater recourse to DGS resources, beyond the limits set by Article 109.

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[24] According to the EBA, as a general principle, under Article 101(2) BRRD, the Resolution Fund may indirectly absorb part of the losses of the institution under resolution, applying the principles set forth in Article 44 BRRD. It is clarified that even if not all losses are absorbed by the creditors of the institution but the absorbed losses amount to at least 8 % %of total liabilities, the Resolution Fund may be used for the purposes indicated in Article 101(1): for example, to cover the difference between the assets and liabilities transferred to a bridge bank.

[25] The bail-in requires not only shareholders and subordinated creditors, but also other eligible creditors (in general, unsecured creditors, subject to expressly provided exceptions) to contribute to covering the losses of the bank in resolution, in accordance with national insolvency rules. In this regard, Article 48 BRRD establishes the sequence in which the Resolution Authority must order the write-down or conversion of the bonds of a bank in resolution; this sequence has been further specified by the EBA, which issued guidelines on this point to facilitate the application of the bail-in. On this topic, EBA, Final guidelines concerning the interrelationship between the BRRD sequence of write-down and conversion and Crr/Crd, 5 April 2017.

[26] G. BOCCUZZI, *Il regime speciale della risoluzione bancaria. Obiettivi e strumenti*, Cacucci Editore, 1998;

[27] G. BOCCUZZI, *La risoluzione della banca polacca Getin Noble: la disciplina europea alla prova della flessibilità*, Bancaria, 2023.

This was a case where substance prevailed over the letter of the bail-in rule, made possible through the voluntary intervention of the banks, which ensured parity of outcome, through a certain margin of flexibility in interpretation. But the question arises as to whether greater flexibility might be achieved through appropriate revision of the current rules on the joint intervention of the various sources of resolution funding.

A more structured solution is outlined in the Commission's reform proposal, which, as already pointed out, tends to extend the application of resolution to small and medium-sized banks, through broader recourse to DGSs in resolution, in order to carry out transactions to transfer the failing bank to another larger bank (sale of business), with the former exiting the market. The rationale for such an approach is that, in the absence of the EDIS, the failures of such banks can be dealt with more efficiently through resolution, if there is a public interest, through the use of the SRF, thus avoiding recourse to public intervention. The activation of such a mechanism would be conditional on compliance with the SRF access condition of a minimum bail-in of 8% of the TOFL.

This condition would be met through a DGS 'financing bridge' to cover the part of the losses not covered by the bank's loss absorption capacity[29]. As clarified by the Commission, the use of DGS funds for interventions in favour of small and medium-sized banks in resolution would only be possible (i) when the resolution authority deems it necessary to safeguard financial stability and to protect taxpayers by ensuring the exit of the insolvent bank from the market; (ii) when it avoids losses for depositors, which would be bailed-in, including those with assets above the coverage level; and (iii) when appropriate conditions and safeguards are met (minimum bail-in; that the bank concerned is eligible for resolution, as set out in the resolution plan; that the use of DGS funds in resolution as a bridging measure meets the least-cost condition, which, in turn, requires the removal of DGS super-preference).

In the current framework, resolution authorities set - bank by bank - the MREL, which constitutes the minimum amount of equity and 'bail-inable' instruments that a bank must possess to absorb losses and replenish capital in the event of resolution. In this approach, the MREL constitutes the first line of defence to ensure that the bank has sufficient internal equity to meet the cost of its failure. Even in the new perspective outlined in the Commission's proposal, internal loss-absorbing capacity would remain the primary tool for financing bank insolvency; when it is necessary to use DGS in resolution, appropriate safeguards are foreseen: (1) that the resolution authority considers that bailing-in depositors (to achieve the minimum bail-in of 8 %) could pose risks to financial stability; (2) when the resolution strategy envisages that the insolvent bank is targeted for market exit; and (3) a cap on the amount of funds to be used is provided, in order to protect the funds of deposit guarantee schemes.

Regarding, more generally, funding, the current framework is based - and would also continue to be based in the reform proposed by the Commission - on two sources: the RF/SRF in resolution and national guarantee schemes for different types of intervention (preventive measures, resolution, payout of covered deposits and alternative measures in insolvency). Access to the RF/SRF for solvency support to certain small and medium-sized banks would remain a critical issue, in view of the minimum bail-in of 8% TLOF that needs to be achieved. In a broader perspective, the question arises as to whether the banking crisis management system should use two distinct financing mechanisms - **DGS/EDIS funds and Resolution Fund/SRF** - in view of the uniqueness of the crisis phenomenon and the source of the funding, i.e. financial resources from the banks, hence private funds.

These are all issues that will emerge when the **European Deposits Insurance Scheme (EDIS)** is set up, the third pillar of the Banking Union, which is still in the planning stage despite the time that has elapsed since the proposed regulation (2015). Roadmaps of the project's path have been prepared for years, but the timetable inexorably moves further and further ahead. There are political obstacles that cannot be easily removed, because there is a tendency to make risk-sharing associated with EDIS conditional on the reduction of risks in banks' balance sheets, including sovereign risks: the issue on which the EDIS project has so far stalled. This is an issue on which attention must remain high, in light of the serious consequences that may result from imposing constraints on weaker countries in terms of bank balance sheets composition and public budget management.

Finally, an issue of crucial importance for the recovery of flexibility, efficiency and effectiveness in crisis management concerns the rules on **State aid**, established by the Commission's Communication of 30 July 2013, which lays down specific provisions for State intervention in bank bailouts. The current rigidity lies in the fact that the Commission brings under the notion of State aid certain types of intervention that do not actually give rise to the use of State funds, as they use financial resources that come from the banking sector and, therefore, have a private nature, even though they can be activated under the direction of public authorities (resolution authorities, public guarantee system).

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[28] It should be considered that, at present, the information on the Getin Noble Bank transaction is insufficient for its proper positioning in the existing regulatory framework, since the documents relating to the various components of the transaction have not yet been published: it should be noted that the case of Getin falls outside the scenario of use of the Guarantee System under the DGSD; indeed, where resolution is implemented, given the letter of the provisions, the preventive and alternative interventions provided for in Articles 11(3) and (6) of the DGSD and the least cost principle are not applicable, because, as mentioned, in a resolution the intervention of the DGS is determined by the Resolution Authority, in cash, to help cover losses after the application of the bail-in and the intervention of the Resolution Fund.

[29] The DGS would intervene to support the transfer of the bank in resolution, resulting in its exit from the market, by covering losses that would otherwise be incurred by depositors in order to meet the 8 % TLOF requirement, which is a condition for access to the RF/SRF. As pointed out by the EU Commission, evidence shows that for certain banks with a high prevalence of deposits, meeting the 8 % requirement could lead to losses for depositors, with possible serious effects on the economy, depositor confidence and financial stability. Therefore, DGS funds would contribute to supplementing the bank's loss absorbing capacity (i.e. the resources of shareholders and creditors other than depositors) in order to reach the 8 % TLOF and allow access to RF/SRF resources.

On this point, the most appropriate solution would be to separate the public nature of crisis management actors, decision-making processes and intervention methods, on the one hand, and the source of the financial resources used, on the other. This could be done by excluding from State aid rules interventions implemented with the resources of resolution funds and DGSs, given their nature as private external support interventions for financing the solution of the crisis, protecting financial stability.

On the other hand, interventions carried out through the use of State funds in resolution (public financial stabilisation instruments - Article 56-58 BRRD) and those carried out outside resolution (issuance of guarantees against liabilities and precautionary recapitalisation - Article 32(4)(d) BRRD) would remain included in the notion of State aid. However, the conditions for their implementation should be better regulated, as the lack of sufficiently precise rules in the current legislation risks generating uncertainties in interpretation and application[30].

5. Conclusions

The analysis carried out in the previous chapters aimed at providing a sufficiently broad picture of the strengths and weaknesses of the current European banking crisis management legislation introduced in the 2013-2015 period. The experience of the first decade of application of this legislation, including that of Italy, has clearly highlighted that the main instruments of the new framework have had very limited or no application (resolution procedure, bail-in, single resolution fund), resulting in the application of other tools available at national level, deemed more effective by the relevant resolution authorities.

It is from this consideration that we must start when thinking about a revision of the current legislation, enhancing all the positive aspects that national experiences have shown. To do this, it is necessary to increase the flexibility of regulation, in order to stimulate the widest application of all available procedures and tools, overcoming certain shortcomings and inconsistencies that mark the existing rules. These weaknesses have been due to some extent to rigidity, which has led to a close correlation between procedures, instruments and funding methods, often preventing a more efficient and effective resolution of the crisis. This rigidity was justified, as it was primarily aimed at remedying the excessive propensity of States, in order to cope with the chain of bank insolvencies that occurred during the global financial crisis, to rescue banks through the use of public intervention tools, passing the costs onto taxpayers.

This rigidity, when tested, has proved to be excessive and now requires correction in order to improve the functioning of the entire crisis management system. Flexibility is essential to enable the Authorities to manage increasingly complex situations in macroeconomic and regulatory contexts characterised by accentuated variability and systemic crises of various kinds[31].

The reflections in section 4.2 support the validity of the principles, objectives and instruments governed by the current framework, while outlining a different way of using them in order to increase their flexibility and strengthen their effectiveness.

The changes to be introduced are not few, as they concern essential junctions of the overall framework. In order to do so, it is necessary to break free from some of the patterns of the current legislation in order to create a new framework that makes the most of the best national experiences.

Some elements in the direction of flexibility seem to emerge from recent solutions to banking crises, as in the case of the resolution of the Polish Getin Noble Bank[32]. In the Getin Noble Bank insolvency, the European and national authorities used a comprehensive set of measures, creating a bridge bank while also using in the resolution the resources of private safety nets (the Resolution Fund, the Deposit Guarantee Scheme and the financial means made available, on a voluntary basis, by the largest Polish banks). The activation of voluntary private resources to cover part of the losses allowed a substantial application of the bail-in in the amount of at least 8% of TLOF, which was necessary for the mobilisation of the Resolution Fund. Furthermore, it has been recognised that the resources from the Resolution Fund and the Deposit Guarantee Fund - although constituting State aid - are nevertheless resources from private bank contributions that avoid recourse to public intervention. Based on this distinction, the transition to qualifying these resources as private sources of funding or as a *tertium genus* is quite straightforward, in order to exclude them from the application of the State aid rules. This would create an arrangement in which the goal of financial stability would take precedence over that of competition and the decision-making process would be speeded up, making crisis management more efficient.

In this regard, it is worth recalling the events that occurred in Italy with Banca Tercas and the four banks in resolution, in which the Commission considered the resources of the DGSs used for preventive interventions as State aid, an approach that was subsequently considered unlawful by a landmark ruling of the Court of Justice[33]. On the other hand, among the various options under study for funding banking crises, there is also that of concentrating in a single fund the private resources provided by the banking system, regardless of the type of solution to which they are applied (resolution, liquidation, DGSs' preventive and alternative measures): this would be an effective response to the problem of the failure to use the single resolution fund in this decade, with the consequent immobilisation of resources of the European banking system and the activation, instead, of national deposit guarantee funds.

Thus, the way forward would appear to be not to revise the instruments, but the manner of their application, on the basis of clear principles and objectives, to which the authorities must refer for their flexible application, according to the specificities of the cases to be resolved. This approach would be significantly different from the current one, based on the rigid correspondence between types of procedures and instruments.

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[30] On the functioning of precautionary recapitalisation, applied in Italy to the Monte dei Paschi di Siena case, see G. BOCCUZZI, Banking Crises in Italy. An Application and Evaluation of the European Framework, Palgrave Studies in Financial Instability and Banking Crisis Regulation, 2022.

[31] G. BOCCUZZI, *Il settore bancario tra crisi sistemiche e regolamentazione. Le nuove sfide della complessità nella dimensione europea*, I battelli del Reno, Bari, 2022.

[32] G. BOCCUZZI, *The resolution of the Polish bank Getin Noble: European legislation put to the test of flexibility*, Bancaria, 2023.

[33] Court of Justice of the European Union, 2 March 2021, Judgement in case C-425/19 P, Commission v Italy, Fondo Interbancario di Tutela dei Depositi, Banca d'Italia et Banca Popolare di Bari ScpA.

In this approach, in fact, it is precisely the contextual participation of financing mechanisms based on private contributions (Resolution Fund and DGS) that can be a solid motivation, from a competitive point of view, that justifies the use of the public instrument in cases of crises of greater complexity and systemic relevance. In such situations, public and private resources may effectively concur to financial stability. The CMDI reform proposal now put forward by the Commission requires careful reflection on the choices made with regard to the most sensitive aspects of the current regulation, in order to assess whether they are able to respond effectively to the critical issues encountered in application and the policy indications that emerged during the public consultation.

In the debate that will develop in the legislative fora (Council and Parliament), these choices will certainly undergo critical scrutiny and their robustness will be verified compared to other options that are equally technically and operationally feasible. In this context, particular consideration should be given to the proposal to apply the resolution to small and medium-sized banks, consequently subjecting them to the requirements and rules currently applicable to large and complex banks and centralising decision-making processes and decisions at European level (SRB). Will this institutional set-up be effective? How would the coordination between national and European authorities work? Would such a system be consistent with the proportionality principle? Would it ensure flexibility in the utilisation of tools and procedures?

On the other hand, the incompleteness of the legislative proposal raises many questions, given that the reform of the State aid rules, the completion of the Banking Union through the establishment of EDIS, and the harmonisation of national insolvency laws are left out of the package: all issues on which the debate has been extensive for years, with multiple solutions proposed. The approach that is being followed is a policy of small steps, which does not seem to adequately meet the need for a comprehensive intervention in which all components are regulated in a coherent manner. Hence the basic question as to whether the strategic approach followed by the European legislator is adequate to such a sensitive and complex subject - crisis management - involving the treatment of insolvent banking enterprises, with consequent implications in terms of the protection of third parties’ rights and the effectiveness of interventions in terms of financial stability.

As has been emphasised, the complexity of the matter requires flexibility in intervention, a value that is well above other objectives - albeit significant in the logic of the European system - such as uniformity and levelling of the playing field - which are important in situations of normal management, but take a back seat to the higher objectives that come to the fore in crisis situations: to protect financial stability, depositors and the continuity of the essential functions performed by banks.

COMMISSIONI DI RICERCA AIFIRM: EDUCAZIONE FINANZIARIA PER LA SCUOLA

UNA PILLOLA SUL RISK MANAGEMENT RIVOLTA AGLI STUDENTI ITALIANI DEL TRIENNIO DELLA SCUOLA SUPERIORE

AIFIRM – con l’obiettivo di diffondere cultura e suscitare attenzione sui temi dell’educazione finanziaria – intende proporre materiale didattico ad uso di chiunque abbia buona volontà di porsi come educatore sui temi finanziari. Tale materiale, sottoposto al Consiglio di AIFIRM, è rivolto agli alunni delle classi della scuola primaria, secondaria di primo grado e superiore ed è stato predisposto ed è in corso di predisposizione in coerenza alle linee guida per lo sviluppo delle competenze di educazione finanziaria nella scuola del Comitato per la Programmazione e il Coordinamento delle attività di educazione finanziaria.

L’obiettivo principale è quello di porre le basi per costruire le competenze utili ad avere un corretto rapporto con il denaro, un’adeguata percezione e gestione dei rischi e per comprendere come le decisioni collettive abbiano implicazioni economiche per se stessi e per la società a cui si appartiene.

Il seguente articolo sull’evoluzione del Risk Management è rivolto agli studenti italiani del triennio della scuola superiore come parte del percorso di Educazione Finanziaria AIFIRM sviluppato nell’ambito della Commissione di ricerca AIFIRM sul tema.

L'evoluzione del Risk Management: dal Passato al Presente, un “Pilastro” della Stabilità Finanziaria

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Imparare a comprendere e gestire il rischio è un aspetto fondamentale per prendere decisioni finanziarie consapevoli e responsabili.

Perché è così importante per le nuove generazioni comprendere cosa è il risk management?

La risposta la troviamo nella vita quotidiana dove in ambito personale e professionale, **siamo spesso chiamati a prendere decisioni che comportano un certo grado di rischio**. Conoscere le logiche del risk management aiuta a sviluppare una **mentalità prudente e consapevole** che potrà aiutare a valutare le opzioni disponibili, a minimizzare i rischi, a massimizzare le opportunità, riducendo la probabilità di incorrere in perdite finanziarie.

Il risk management include la comprensione dei rischi non solo finanziari o delle attività core aziendali, ma anche di altre aree della vita, come la **salute, la sicurezza personale e la gestione del tempo**. Acquisire queste competenze potrà aiutare i giovani a prevenire o affrontare in modo migliore le situazioni di rischio, aumentando la loro resilienza e la capacità di adattarsi alle avversità.

Infine, seguire un percorso di studio rivolto al risk management potrà essere un **vantaggio competitivo per l’accesso al mondo del lavoro**, le aziende sono sempre pronte a valutare le competenze di potenziali dipendenti che comprendono e attuano pratiche di gestione del rischio.

In conclusione, conoscere il risk management è importante per i giovani perché aiuta a prendere decisioni informate, a prevenire rischi, a raggiungere obiettivi finanziari a lungo termine e può essere un vantaggio in ambito lavorativo.

Cosa è il risk management?

Prima di addentrarci nella sua evoluzione, cerchiamo di capire **cosa sia il risk management** con focus sul risk management nelle banche.

In parole semplici, il risk management è l’insieme delle regole, delle procedure, delle risorse (umane, tecnologiche e organizzative) e delle attività di controllo volte a identificare, misurare, monitorare, prevenire o mitigare tutti i rischi assunti cogliendone una logica integrata. In altre parole, **il risk management in banca ha l’obiettivo di identificare, valutare, gestire e monitorare i rischi** a cui la banca è esposta al fine di proteggere la solidità finanziaria, la stabilità e la sostenibilità della banca stessa.

Inoltre, il risk management in banca svolge un ruolo cruciale nel **garantire la stabilità del sistema economico finanziario**. Le banche, essendo istituzioni finanziarie centrali, hanno un ruolo fondamentale nell'intermediazione finanziaria e nell'allocazione delle risorse nell'economia. Un'inadeguata gestione dei rischi da parte delle banche potrebbe portare a gravi conseguenze per il sistema finanziario e l'economia nel suo complesso.

Ecco **alcuni degli obiettivi chiave** del risk management in banca:

- **Sostenibilità e redditività a lungo termine**. La gestione dei rischi in modo olistico[1] e strategico consente di prendere decisioni informate e prudenti, massimizzando le opportunità di profitto e minimizzando le potenziali perdite.
- **Preservare la solidità finanziaria**. Il risk management mira a garantire che la banca abbia un'adeguata base patrimoniale e disponga di capitale sufficiente per far fronte a potenziali perdite o crisi finanziarie.
- **Mitigare i rischi finanziari**. Il risk management mira a identificare e ridurre i rischi a cui la banca è esposta, come il rischio di credito, il rischio di mercato e il rischio operativo. Questo può essere raggiunto attraverso misure come l'adeguata diversificazione del portafoglio, la richiesta di garanzie a fronte di prestiti concessi, l'utilizzo di strumenti di copertura per proteggere dalle fluttuazioni dei tassi di interesse o delle valute e l'implementazione di sistemi e procedure per prevenire perdite operative.

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[1] Olistico: gestione del rischio totale, fa riferimento ad una visione del rischio come un “unicum” e non come la somma di rischi.

- **Conformità alle normative e regolamentazioni**. Il risk management è essenziale per garantire che la banca sia conforme alle normative e alle regolamentazioni del settore finanziario. Le istituzioni bancarie sono soggette a una serie di norme e requisiti imposti dagli organismi di regolamentazione e di vigilanza finanziaria per proteggere la stabilità del sistema finanziario e prevenire rischi sistematici. Un solido risk management aiuta la banca a rispettare queste regole e a evitare sanzioni e rischi reputazionali associati alla non conformità.

- **Gestione degli scenari di stress**. Il risk management in banca include la valutazione della resilienza dell'istituzione in situazioni di stress o crisi finanziarie. Le banche sono spesso soggette a prove di resilienza (stress test) che simulano scenari ipotetici di tensione finanziaria. Queste prove consentono di valutare la capacità della banca di sopportare situazioni difficili e, se necessario, prendere misure preventive per rafforzare la propria posizione finanziaria.

- **Stabilità del sistema economico-finanziario**. Il risk management svolge una funzione importante nel garantire il ruolo delle banche nell'attuazione della politica monetaria della Banca Centrale Europea (BCE) e nel mantenimento della stabilità finanziaria nell'area dell'euro. Questo avviene ad esempio nella gestione del rischio di liquidità, contribuendo così al trasferimento delle decisioni di politica monetaria della BCE all'economia reale.

Evoluzione della gestione del rischio e della figura del risk manager

Ma vediamo ora come si è **evoluta la gestione del rischio nel tempo** e le **circostanze** che hanno portato a far **emergere la figura del risk manager come un ruolo chiave** all'interno delle banche e delle istituzioni finanziarie.

Partiamo dall'inizio:

- Nell'antichità le popolazioni affrontavano i rischi e incertezze, come malattie, carestie, eventi naturali devastanti e conflitti adottando le prime forme di risk management che contemplavano strategie di **riduzione del rischio attraverso l'accumulo di risorse**, come cibo e beni, per far fronte a periodi difficili.

- Nel tardo medioevo agli albori dell'attività bancaria i banchieri erano abituati a gestire il rischio di credito, infatti, a partire dal 1100 i banchieri lombardi che operavano in Francia, Germania ed Inghilterra utilizzavano già efficaci **tecniche di mitigazione del rischio di credito**, quali ad esempio la richiesta di cessione in pegno di oggetti di valore. Uno dei primi sviluppi organizzati nel risk management fu **l'assicurazione marittima** dove i mercanti, per proteggere i loro investimenti contro i pericoli dei viaggi in mare, crearono un sistema in cui contribuivano finanziariamente a un fondo comune che sarebbe stato utilizzato per risarcire coloro che avessero subito perdite a causa di incidenti o pirateria.

- Negli anni successivi alla Seconda guerra mondiale con lo sviluppo dei mercati finanziari nei paesi più industrializzati, tra la fine degli anni '50 e la seconda metà degli anni '80 non esisteva una figura specializzata nella gestione dei rischi. Gli operatori finanziari spinti dalla necessità di **maggiore trasparenza, comprensione e comparabilità** iniziarono ad utilizzare indicatori di rischio che potessero aiutarli a misurare e valutare il rischio associato agli investimenti in particolare di obbligazioni e azioni:
    - Sul **comparto obbligazionario** si consolida l'utilizzo degli indicatori di **duration** la cui definizione risale al 1938 da parte di un economista canadese di nome Frederick Robertson Macaulay che riuscì nell'intento di confezionare una elegante espressione matematica in grado di offrire una misura della rischiosità di un bond. La Macaulay Duration rappresenta ancora oggi una delle colonne portanti della Finanza, oltre che la base di pressoché tutta la modellistica inerente il mercato dei titoli a reddito fisso. La sua caratteristica unica risiede nella **capacità di sintetizzare il grado di sensibilità del valore di un'obbligazione al variare del tasso di interesse di mercato**: Inoltre a partire dalla definizione fornita da Macaulay si riesce a derivare una sua versione modificata, detta modified duration, che permette di stimare, se pur in modo approssimato, l'impatto in termini di prezzo di una variazione dei tassi di mercato sul valore di un titolo.
    - Nel 1964 nasce il modello di equilibrio dei mercati finanziari Capital asset pricing model (CAPM) che **stabilisce una relazione tra il rendimento di un titolo e il suo grado di rischiosità tramite un unico fattore di rischio, detto beta.** Il Beta misura il modo in cui il titolo si muove rispetto al mercato. Il CAPM rappresenta una delle teorie fondamentali nella finanza moderna ed è uno dei principali modelli utilizzati per valutare il rischio e il rendimento degli asset finanziari, **come le azioni**, e per determinare il costo del capitale per le imprese. Il modello si basa sull'idea che il rendimento di un asset dovrebbe essere proporzionale al rischio di mercato (misurato dal beta) e al tasso di rendimento privo di rischio.
    - Sul fronte della gestione del **rischio di credito** si è passati, negli anni '20-'30, da una valutazione della qualità creditizia di un'emittente o di un titolo di debito basata sull'analisi dei singoli creditori e sul giudizio dei banchieri alla formulazione strutturata dei rating, che a partire dagli anni '60-'70 furono definiti e pubblicati in maniera sistematica da parte delle agenzie di rating. Esigenza legata all'aumento delle emissioni di obbligazioni e dalla complessità crescente dei mercati finanziari, diventando via via negli anni successivi un elemento fondamentale per la valutazione del rendimento atteso e del rischio degli investimenti.
    - Con lo **sviluppo** nella seconda metà degli anni '70 e per tutti gli anni '80 dei **mercati dei derivati** trainato dalla negoziazione di opzioni l'economista statunitense Fischer Black gettò le basi teoriche sulla teoria della valutazione delle opzioni e relative tecniche di replica. Nel 1973, Fischer Black e Myron Scholes hanno pubblicato il celebre articolo "The Pricing of Options and Corporate Liabilities" in cui hanno presentato il modello di valutazione delle opzioni oggi noto come Modello di Black-Scholes. Il modello di Black-Scholes ha rivoluzionato il modo in cui le opzioni vengono valutate e ha fornito un metodo matematico per stimare il prezzo teorico di un'opzione finanziaria.

  - Iniziano a svilupparsi le **prime tecniche di asset and liability management**, basate sull'idea che le attività e le passività delle banche devono essere gestite in maniera integrata e coordinata dopo i fallimenti delle banche americane (c.d. Savings and Loans) legato ai rialzi dei tassi di interesse degli inizi degli anni '80.

L'evoluzione del risk management vista fin qui aveva portato allo sviluppo di analisi di rischio volte soprattutto alla massimizzazione del rendimento seguendo una logica di "asset management" considerando i rischi come entità indipendenti. Alla fine degli anni '80 inizia a diffondersi un orientamento di **gestione del rischio integrato** e si avvia una fase che vede lo sviluppo di **importanti sofisticazioni metodologiche di risk management** dettate sia dalla nuova view che le attività e le passività della banca devono essere gestite in maniera integrata sia come risposta **all'evoluzione del sistema economico intervallato da intense crisi finanziarie** che hanno reso necessaria una profonda revisione della regolamentazione bancaria.

Andiamo per ordine:

- Nascono nel 1988 gli accordi di Basilea I tra le autorità di vigilanza mondiali, che introducono un requisito minimo di capitale che tutte le banche devono detenere per fronteggiare **le perdite inattese derivanti dai rischi di credito**. Tale requisito è calcolato con metodi standard molto semplificati, **ma deve essere rispettato da tutte le banche del mondo.**
  All'accordo si giunse all'inizio degli anni Ottanta con l'insorgere della crisi del debito dell'America Latina che aveva accentuato le preoccupazioni del Comitato per il deterioramento dei coefficienti patrimoniali delle principali banche internazionali in un periodo di crescenti rischi internazionali. Sostenuti dai governatori del G10[2], i membri del Comitato decisero di arrestare l'erosione degli standard patrimoniali nei loro sistemi bancari e di lavorare per una maggiore convergenza nella misurazione dell'adeguatezza patrimoniale. Ne è scaturito un ampio consenso su un approccio ponderato alla misurazione del rischio, sia all'interno che all'esterno dei bilanci bancari. **L'Accordo del 1988 obbligava le banche ad accantonare l'8% del capitale erogato al fine di garantire solidità e fiducia nel sistema creditizio**. Prevedeva infatti il mantenimento di un rapporto minimo tra capitale e attività ponderate per il rischio (rischio di credito) dell'8%, da attuarsi entro la fine del 1992.

  Basilea I segnò il **passaggio dalla cosiddetta vigilanza "strutturale",** basata in molti paesi (Italia inclusa) su autorizzazioni e controlli amministrativi, **a una vigilanza di tipo "prudenziale"**. I principi di Basilea sui mezzi patrimoniali minimi delle banche poggiano sul concetto di **"patrimonio di vigilanza"** che rappresenta la dotazione patrimoniale regolamentare che ogni banca deve detenere per soddisfare i requisiti di vigilanza prudenziale, tale patrimonio non corrisponde esattamente al Patrimonio netto contabile. Nel primo accordo si distinse un aggregato patrimoniale di base (detto anche patrimonio di classe 1 o Tier 1 *capital*) da un patrimonio supplementare (detto anche patrimonio di classe 2 o Tier 2 *capital*).

- Sul fronte della **misurazione del rischio**, sul finire degli anni '80, l'amministratore delegato della banca d'investimento J.P. Morgan specializzata nella gestione di portafogli obbligazionari e azionari chiese ai propri analisti esperti di finanza quantitativa di elaborare un report con cadenza giornaliera, entro le 4:15' pomeridiane, che riassumesse in una solo indicatore quanti soldi rischiava la banca, su tutti i suoi portafogli in essere, su un certo orizzonte temporale e con un livello di confidenza molto elevato. **Nacque così un indicatore sintetico: il Valore a Rischio (VaR)** che forniva una misura di rischio comune alle differenti posizioni di un portafoglio (portafoglio composto da posizioni in obbligazioni, azioni, cambi, derivati, tassi) oltre a quantificare la perdita potenziale inattesa espressa in unità di moneta (euro).

- A partire dagli anni '90 inizia un periodo di **rapida crescita dei modelli e delle tecniche di misurazione dei rischi** che a tutt'oggi caratterizzano il risk management delle banche (esempio il modello VaR Creditmetrics di J.P. Morgan del 1997).

- **Nascita di Basilea II**. Nel giugno 1999, il Comitato di Basilea ha presentato una proposta per un nuovo schema di adeguatezza patrimoniale, in sostituzione dell'Accordo del 1988. Il primo Accordo di Basilea presentava infatti due limiti principali: (i) il fatto di prendere in considerazione solo il rischio di credito; (ii) sempre sul rischio di credito un sistema di ponderazione troppo grossolano, basato sulla natura giuridica della controparte, ma privo di criteri per approssimarne la rischiosità effettiva a livello individuale. **Nel giugno 2004 è stato pubblicato un nuovo accordo** sui requisiti minimi di capitale Basilea II per migliorare il modo in cui i requisiti patrimoniali riflettono i rischi sottostanti e per affrontare meglio l'innovazione finanziaria degli ultimi anni.
  Basilea II stabilisce che i requisiti minimi patrimoniali devono coprire le perdite inattese dovute ai rischi: **i) Rischio di credito ii) Rischio di mercato iii) Rischio operativo.**

  Basilea II presenta un'architettura **rinnovata**, basata su **tre Pilastri (*Pillars*). In dettaglio:**

  - **Il primo pilastro** prevede, per tre categorie di rischio (di credito, di mercato e operativo), requisiti patrimoniali quantitativi, che le banche possono calcolare facendo riferimento a un approccio standardizzato oppure a modelli interni;

  - **Il secondo pilastro**, più qualitativo, richiede alle banche di dotarsi di un proprio processo di valutazione di rischi e di controllo dell'adeguatezza patrimoniale, e affida alla Vigilanza il compito di verificarne la correttezza;

  - **Il terzo pilastro** fa leva sulla disciplina di mercato, con stringenti obblighi di comunicazione al pubblico di dati sul patrimonio, sull'esposizione ai rischi e sui sistemi di gestione e controllo.

- **Verso Basilea III.** Nel **2007 ha avuto inizio una grave crisi finanziaria globale**, innescata da alcuni eventi manifestatisi a partire dal 2003 nel sistema bancario statunitense. Tale situazione si è verificata a seguito dello scoppio della cd bolla immobiliare americana, della crisi dei prestiti subprime e dell'uso scorretto dei meccanismi di cartolarizzazione. Si sviluppò una crisi di liquidità con una significativa contrazione della disponibilità delle banche a concedere credito ad altre banche e pesanti perdite caratterizzarono molti istituti per via delle esposizioni verso soggetti colpiti dalla crisi. Molte banche statunitensi sarebbero state destinate al fallimento se non fossero intervenuti gli aiuti statali di concerto con la FED. L'insolvenza della banca d'affari americana **Lehman Brothers**, che non beneficiò degli aiuti di stato, e che era caratterizzata da una rilevante operatività fuori dagli Stati Uniti, determinò una **profonda crisi di fiducia** degli operatori che generò sui mercati fortissime tensioni e un clima di incertezza nonché un repentino aumento del rischio di controparte che determinò a sua volta una drastica **riduzione della liquidità sul mercato** dei depositi interbancari e un aumento dei tassi a breve termine, nonostante le banche centrali, avessero già avviato massicce iniezioni di liquidità. Già prima del crollo di Lehman Brothers nel settembre 2008, era apparso fondamentale **un rafforzamento dello schema di Basilea II**. Il settore bancario è entrato nella crisi finanziaria con una leva finanziaria eccessiva e riserve di liquidità inadeguate. Queste debolezze erano accompagnate da una governance e da una gestione del rischio inadeguate, nonché da strutture di incentivi inadatto. La pericolosa combinazione di questi fattori è stata dimostrata dall'errata valutazione dei rischi di credito e di liquidità e dalla crescita eccessiva del credito. Sulla base dell'esperienza traumatica della crisi, nel **2010 il Comitato pubblicò il primo testo di Basilea III**, con due documenti:

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[2] Il Gruppo dei Dieci (G-10) è una organizzazione internazionale che riunisce undici paesi di grande rilevanza economica nel mondo. Il G-10 fu fondato nel 1962 dalle dieci maggiori economie capitalistiche.

- schema internazionale per la misurazione, la standardizzazione e il monitoraggio del rischio di liquidità;
- uno schema normativo globale per banche e sistemi bancari più resilienti.

Lo schema rafforzato di Basilea rivede e irrobustisce i tre pilastri istituiti da Basilea II e li amplia in diverse aree con riforme da introdurre tra il 2013 e il 2019.

Di seguito i più rilevanti:

- un **buffer di capitale anticiclico**[3], che pone restrizioni alla partecipazione delle banche ai boom creditizi a livello di sistema con l'obiettivo di ridurre le loro perdite nelle crisi creditizi;
- **requisiti di liquidità** - un coefficiente minimo di liquidità, il Liquidity Coverage Ratio (LCR), volto a fornire liquidità sufficiente a coprire il fabbisogno di finanziamento in un periodo di stress di 30 giorni; e un coefficiente a più lungo termine, il Net Stable Funding Ratio (NSFR), volto a risolvere i disallineamenti di scadenza sull'intero bilancio;
- **requisiti aggiuntivi** per le banche **di importanza sistemica**[4], tra cui una maggiore capacità di assorbimento delle perdite e disposizioni rafforzate per la vigilanza e la risoluzione delle crisi transfrontaliere.

Dove siamo arrivati?

La crisi finanziaria del 2008 e l'analisi delle sue molteplici cause ha fornito lo spunto per una discussione sul tema **della cultura del rischio** – e più in generale della cultura d'azienda.

La disciplina sul Sistema dei Controlli Interni (SCI) e della Funzione Risk Management contenuta nella Circolare n. 285/2013 dettaglia in modo articolato i compiti della Funzione Risk Management, che ha "la finalità di collaborare alla definizione e all'attuazione del Risk Appetite Framework (RAF)[5] e delle relative politiche di governo dei rischi, attraverso un adeguato processo di gestione dei rischi e va tenuta distinta e indipendente dalle funzioni aziendali incaricate della "gestione operativa" dei rischi, che incidono sull'assunzione dei rischi da parte delle unità di business e modificano il profilo di rischio della banca". Inoltre, la funzione risk management "concorre alla definizione delle politiche e dei processi di gestione del rischio di liquidità, verifica il rispetto dei limiti imposti alle varie funzioni aziendali e propone agli organi con funzioni di supervisione strategica e di gestione iniziative di attenuazione del rischio".

Nelle banche oggi l'approccio seguito per la gestione dei rischi è di tipo globale identificato nel sistema **Enterprise Risk Management (ERM),** in cui tutta l'organizzazione è coinvolta in modo trasversale nella gestione dei rischi.

Quali sono le nuove sfide del risk management e come si sta ancora evolvendo?

Le nuove sfide del risk management sono rappresentate dall'integrazione e valutazione di nuovi rischi emergenti come **l'ICT Risk**[6] (Information and Communication Technology Risk), il **Cyber Risk e ESG Risk**.

Nello specifico il **Cyber Risk** è legato all'aumento dell'interconnessione e della digitalizzazione delle operazioni aziendali il cui rischio è rappresentato da possibili attacchi informatici, violazioni della sicurezza dei dati dei clienti. **Questi rischi se non gestiti possono causare perdite finanziarie, danneggiare la reputazione e compromettere la fiducia dei clienti**. L'integrazione dell'ICT e cyber risk nella governance dei rischi implica l'implementazione di misure di sicurezza informatica, la formazione del personale e il monitoraggio costante per prevenire, rilevare e rispondere alle minacce informatiche.

La quantificazione del rischio ESG (Environmental, Social, and Governance) è una sfida complessa per i risk manager, infatti, l'obiettivo è la **quantificazione del rischio fisico e di transizione.** Il rischio fisico è legato al rischio di subire perdite inattese da eventi climatici direttamente collegati all'inquinamento, mentre il rischio di transizione è la quantificazione dell'impatto della transizione delle imprese dall'utilizzo di fonti energetiche fossili a fonti energetiche rinnovabili.

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[3] Anticiclico: si riferisce a misure o strategie adottate con l'obiettivo di ridurre o mitigare gli effetti dei cicli economici o finanziari.

[4] Rischio sistemico: si riferisce al tipo di rischio che può minacciare l'intero sistema finanziario o l'economia nel suo complesso. Esso deriva dalle interconnessioni e interdipendenze tra le diverse parti del sistema finanziario e può propagarsi rapidamente attraverso tutto il sistema, causando instabilità o crisi finanziarie su larga scala.

[5] RAF (Risk Appetite Framework): ai sensi della 285/2013, il RAF (sistema degli obiettivi di rischio) è "il quadro di riferimento che definisce – in coerenza con il massimo rischio assumibile, il business model e il piano strategico – la propensione al rischio, le soglie di tolleranza, i limiti di rischio, le politiche di governo dei rischi, i processi di riferimento necessari per definirli e attuarli".

[6] l'ICT risk e il Cyber risk sono concetti strettamente correlati, l'ICT risk è un termine più ampio che copre tutti i rischi tecnologici correlati all'IT aziendale, mentre il cyber risk è un sottoinsieme specifico dell'ICT risk che si concentra specificamente sulla minaccia di attacchi e violazioni della sicurezza informatica.

Le metodologie di misurazione e valutazione dei rischi, dopo la pandemia Covid-19, si stanno sempre di più orientando verso esercizi di simulazione finalizzati a misurare la capacità di un'impresa di fronteggiare scenari avversi (analisi di stress testing) e la predisposizione di piani periodici di resilienza operativa per verificare la capacità di resistere agli impatti negativi di eventi avversi.

È forte oggi l'esigenza di ottimizzare ulteriormente l'approccio **Enterprise Risk Management** facendolo evolvere verso una gestione **Integrata e Sostenibile dei rischi**. Saranno le proposte di Basilea IV, ancora in fase di completamento, da cui si attendono dei cambiamenti in merito ai requisiti di capitale per le banche e l'introduzione di nuovi strumenti per affrontare rischi emergenti, a dettare **il nuovo ritmo per il risk management del futuro**.

Il risk manager c'è solo in banca?

La figura del risk manager è presente in molte realtà aziendali e organizzazioni, poiché è una figura cruciale per affrontare i rischi e garantire la sostenibilità delle aziende stesse, **la figura del risk manager è oggi presente in tutte le istituzioni che lavorano in ambito finanziario** come le assicurazioni, i fondi comuni di investimento, le sim ecc.

Le grosse aziende industriali, tecnologiche, del settore energetico, del settore logistico stanno avviando lo **sviluppo di una visione strategica** basata sull'identificazione e sulla gestione dei rischi aziendali con l'obiettivo di una sostenibilità delle attività d'impresa nel medio-lungo periodo. Infatti, la crescente sensibilità degli investitori che chiede di conoscere in maniera sempre più approfondita le linee strategiche e gestionali delle società **spinge verso lo sviluppo di strutture dedicate al risk management**.

Il bisogno di strutture specifiche di risk management nelle aziende è indispensabile per riconoscere e affrontare i rischi strategici emergenti come **i rischi relativi alla gestione delle catene di approvvigionamento** (supply chain) che stanno diventando sempre più sensibili alle dinamiche geopolitiche, ai disastri ambientali, ai prezzi delle commodities e alla dipendenza dai sistemi informativi e tecnologici e in generale ai **rischi informatici, rischi reputazionali e legati all'ESG**.

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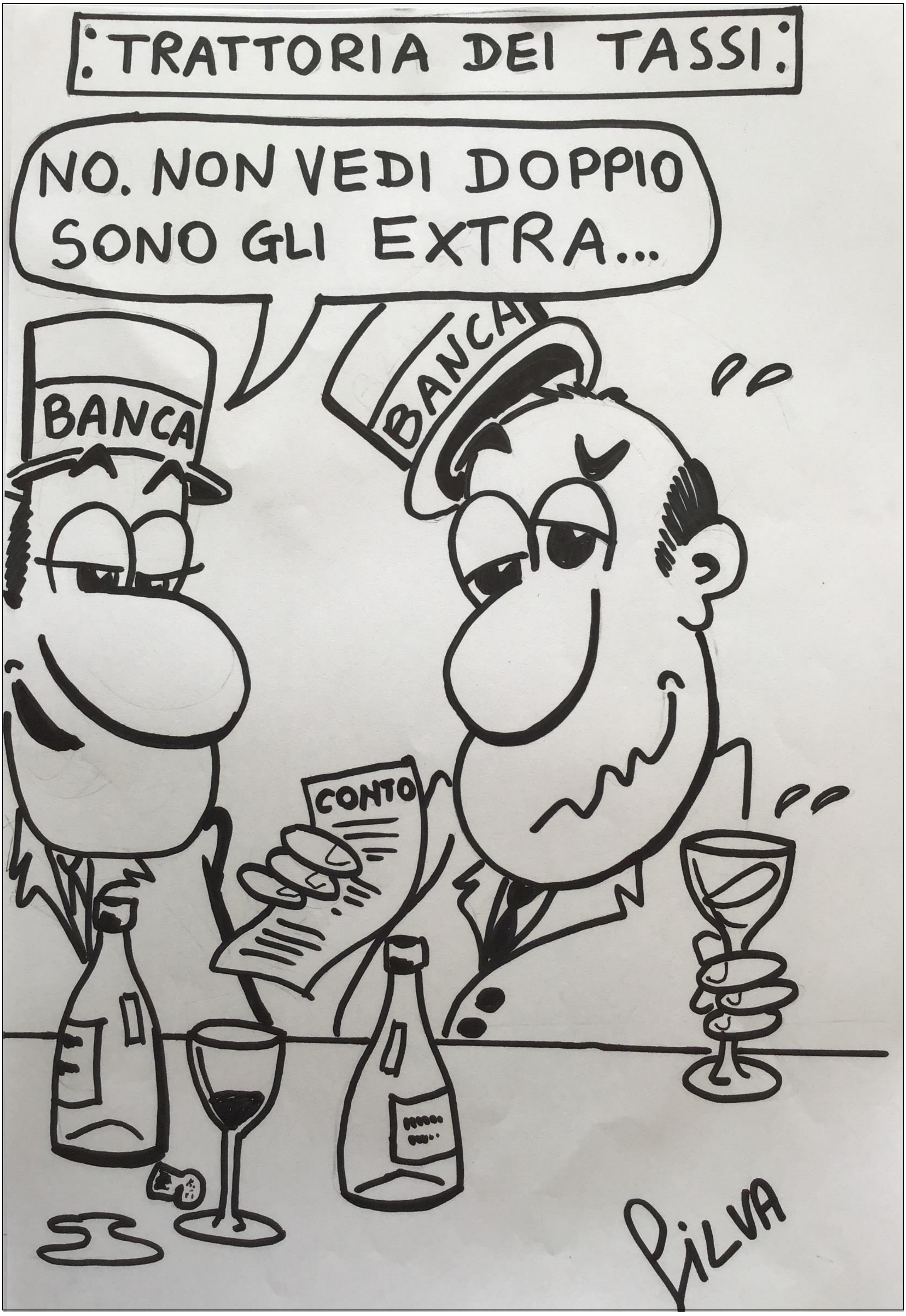
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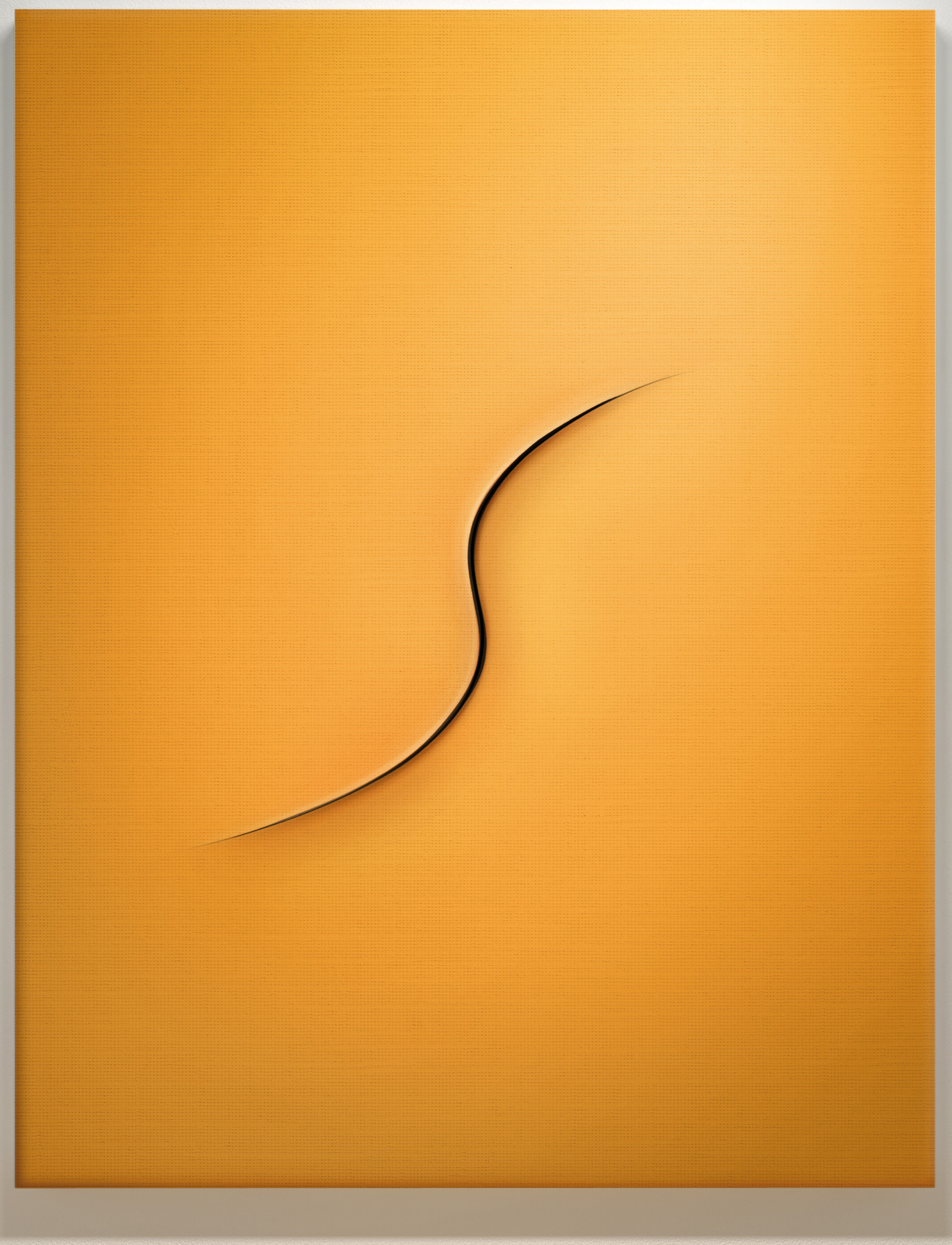

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