Stability versus Volatility: Hungarian Experiences with the First Five Years of Solvency II Regarding Quantitative Elements*

Zsuzsanna Bártfai-Bora – Ádám Huszárik – Norbert Holczinger

It has been more than five years since the introduction of the Solvency II framework (S2), which determines how insurers should operate in Europe, and this allows for a detailed analysis of Hungarian developments. The new approach in S2 that makes it similar to banking regulation, including the market-consistent valuation principles and the application of a risk-based capital requirement, has stood the test of time in recent years: the various shocks did not undermine the stability of the Hungarian sector. This was largely due to the recommendation of the central bank of Hungary (Magyar Nemzeti Bank, MNB) on holding a volatility capital buffer. This is because the robust capital position of the sector as a whole has been maintained in the context of 50–100-basis point reductions in capital adequacy levels in certain individual cases, which justifies the use of the capital buffer. The balanced capital position was also influenced by the conservative investment strategy, which resulted in one of the lowest market risk exposures in Europe, against the backdrop of huge government securities holdings, even by international standards.

Journal of Economic Literature (JEL) codes: G22, G29, G32

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1. Introduction

The Solvency II (S2) insurance regulation introduced on 1 January 2016 brought about several qualitative and quantitative modifications as compared to the previous Solvency I (S1) framework, and its introduction triggered changes not only for insurers but also in regulatory and supervisory practices (*Dénes et al. 2014; Szedlák 2015*). In designing the S2 framework, ensuring harmonisation with the EU financial regulation was a crucial aspect, and therefore, just like in banking, S2 rests

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on three pillars: the calculation methodology of the solvency capital requirement (SCR) and the technical provisions (Pillar 1), the quality requirements with respect to corporate governance practices and the capital add-on that may be imposed by the supervisory authority (Pillar 2), and supervisory reporting and disclosure (Pillar 3) (*Hanák 2014*). Another similarity to banking regulation is the approach based on risk management, risk-based requirements and the relationship between risk exposure and solvency requirements (*EC 2015*).

This study provides a comprehensive picture of the Hungarian experiences in the first five years of S2. The authors do not wish to comment on all Hungarian features, as that is beyond the scope of this paper. The assessment is limited to subjectively chosen phenomena that are nevertheless crucial for the study. The experiences were mainly summarised using the supervisory disclosures for the period from the so-called Day 1 reporting marking the date of the S2 transition to the end of 2020, as well as the reports of the European Insurance and Occupational Pensions Authority (EIOPA). The analyses cover the whole Hungarian insurance market, since all insurers supervised by the MNB are subject to S2, with the exception of small insurers operating as mutual associations.[1] After reviewing the development of the most important quantitative elements, special attention is paid to examining the volatility of the capital position, thereby addressing the adequacy of MNB Recommendation No 6/2016 (VI. 14.) on holding the volatility capital buffer ensuring continuous capital adequacy (VCB Recommendation).

2. A review of the first five years of Solvency II

This section presents the changes in the major quantitative elements of the S2 framework between the transition in 2016 and end-2020, based on the annual data reporting harmonised across the European Union. It details the asset composition of the Hungarian insurance sector, which is conservative even by international standards, the development of technical provisions as well as the different maturity structure of, and changes in, the assets and liabilities related to the non-linked life insurance portfolio. In the insurance sector, compliance with the quantitative requirements is ensured by the capital requirement, the size of which relative to own funds is an important indicator of the sector's resilience. Accordingly, the section focuses specifically on own funds, the capital requirement of individual risk modules and capital adequacy calculated on the basis of the risk-based SCR and the minimum capital requirement (MCR).

[1] In accordance with Section 230 (1) of Act LXXXVIII of 2014 on the Business of Insurance (Insurance Act).

2.1. Assets

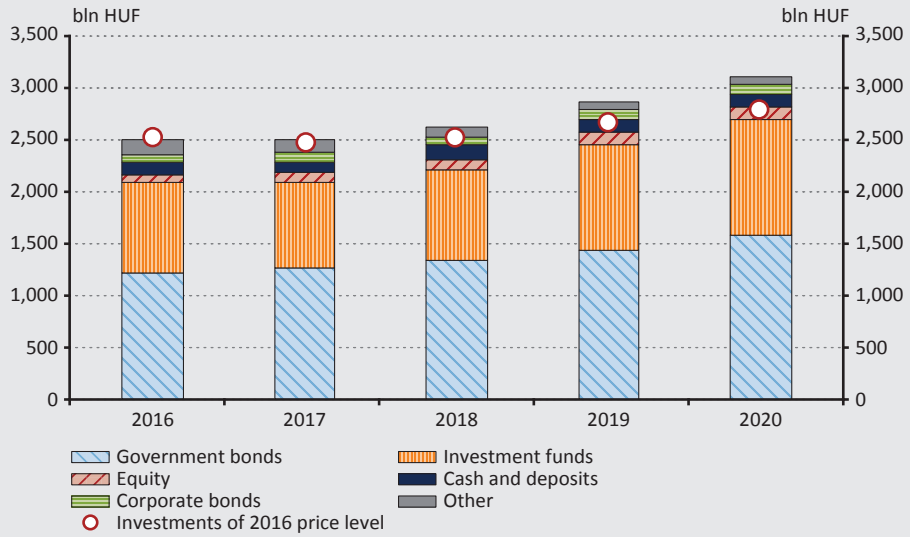
In 2016–2018, the value of insurers' investments did not change much (fluctuating between HUF 2,520 billion and HUF 2,653 billion), but in 2019 it came close to HUF 3 billion, and it exceeded that level in 2020. In 2016 prices (in real terms), the insurance sector's assets increased by 5 per cent between end-2016 and end-2020, on account of the appreciation of the government securities portfolio resulting from the drop in yields as well as the growth in the value of the collective investment funds due to favourable yields (*Figure 1*).

There was no major change in asset composition between 2016 and 2020, with 50 per cent of the assets comprising government securities and almost one third consisting of investment fund shares. Despite the prolonged low yield environment during the period, the Hungarian insurance sector was characterised by a conservative investment strategy: at end-2020, 79 per cent of non-linked investments[2] comprised government securities (fixed-rate Hungarian government bonds and discount treasury bills), which reflects the exceptionally high share of such papers, even by international standards, that has been maintained since the transition to the S2 framework (*OECD 2021*). Globally, only Montenegro and Uruguay surpass Hungary, which is ranked first in the European Union regarding the government securities exposure of non-linked assets, followed by Lithuania, Spain, Greece and Portugal. The high share of government securities is attributable to the conservative investment strategy and several other factors. First, insurers seek to manage the investment risk related to the traditional life insurance portfolio with profit share through government securities investments aligned with the maturity structure and guaranteed yield of life insurance products. Second, the Insurance Act in effect between 2003–2014[3] prescribed limits on the risky assets constituting cover for technical provisions, with the exception of funds covering the reserves of unit-linked life insurance, but this did not apply to debt securities guaranteed by the state. Although the investment limit rules were repealed with the rollout of the S2 framework, and insurers can invest in any asset complying with the prudent person principle, long-term government securities investments with a guaranteed yield, covering insurance obligations and held until maturity did not change much. This is partly attributable to the S2 framework, as it favours forint-denominated government securities investments over other investment instruments, because the former can be considered risk-free as regards the interest rate spread and market concentration risk.

The share of direct equity investments and corporate bonds remains negligible (4 and 3 per cent, respectively).

[2] Asset coverage of traditional life and non-life provisions as well as institutions' own assets and assets not allocated to any business.
[3] In accordance with Section 136 (2) of Act LX of 2003 on Insurers and the Insurance Business (old Insurance Act).

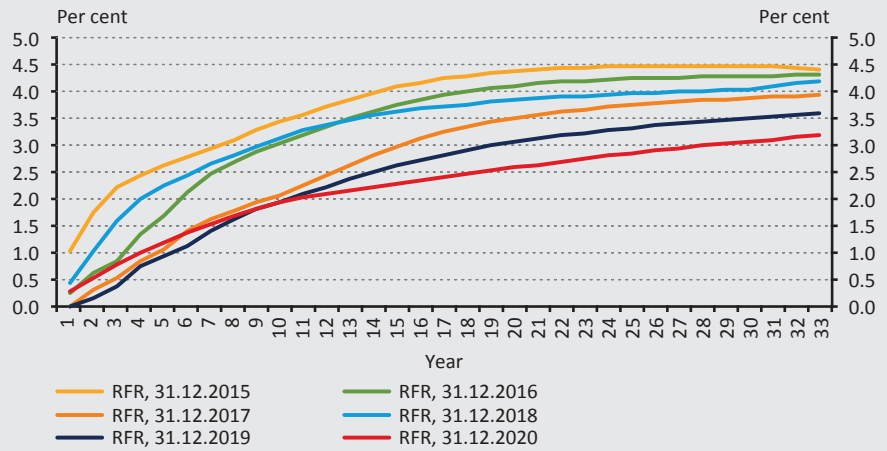
Figure 1
Changes in asset composition in 2016–2020



Note: 2016 = 100%, the data show the values as of 31 December.
Source: MNB data reporting

The low yield environment already seen during the transition to the S2 framework in early 2016 persisted throughout the period under review and even intensified as the years passed, which is exemplified by the evolution of the forint-denominated risk-free interest rate term structure (*Figure 2*). The risk-free interest rate term structure has flattened, and its level has shifted downwards considerably, as yields dropped all along the curve. This contraction in yields was much more pronounced on the long end: while the 1-year yield was 75 basis points lower at the end of 2020 than at the end of 2015, medium- and long-term yields were 120–180 basis points lower than at end-2015. These shifts in yields resulted in wide fluctuations in the market value of existing government securities portfolios, which increased the volatility of the capital position of certain Hungarian insurers. The persistently low yield environment put pressure on the Hungarian and also the international insurance sector. But whereas the search for yield, i.e. a shift towards riskier assets, appeared in several places around the globe, there was no such sector-wide trend in Hungary, and only a handful of institutions changed their practices (*MNB 2020a*).

Figure 2
Changes in the risk-free interest rate term structure in 2015–2020



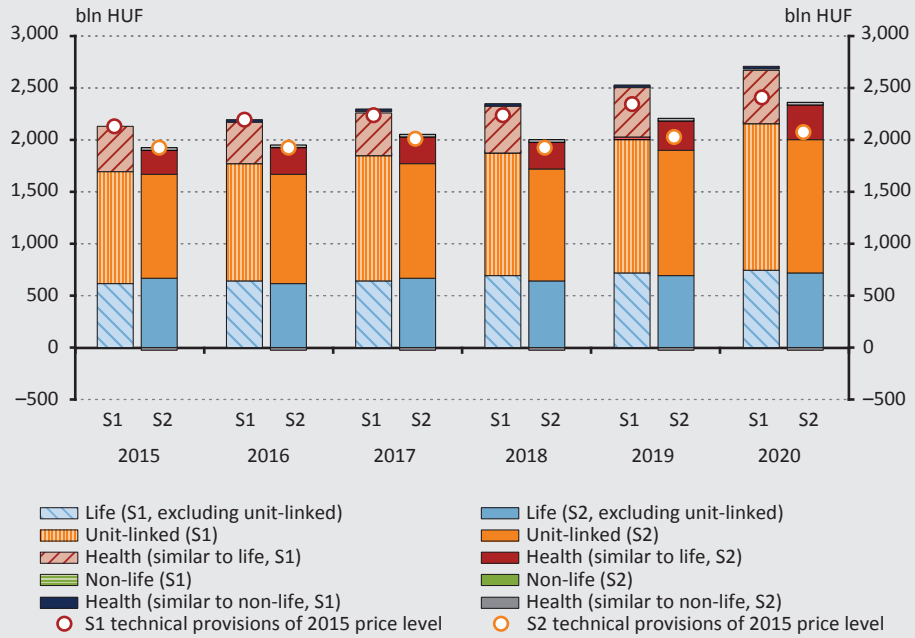
Source: EIOPA

2.2. Technical provisions

At the end of 2020, technical provisions valued in accordance with S2 amounted to HUF 2,319 billion, up by 22 per cent since the transition to the S2 framework. Growth can be observed even when adjusting for inflation: when the change in S2 provisions is examined at 2015 prices, an increase of 8 per cent can be seen between early 2016 and late 2020, due to the combined effect of several factors. In the non-life business, the rise in provisions was caused by the growth in the volume of the insurance portfolio and premiums. The slow expansion in life provisions was mainly related to unit-linked provisions: this was influenced by the increase in premium income and the average premium per contract, mainly concerning pension insurance, and to a lesser extent by yield performance. Although the latter mitigated the rise in provisions driven by premium income between the beginning of 2016 and the end of 2018, it was influenced positively by the investment yields of underlying assets in 2019–2020, except in the market turbulence in 2020 Q1. The growth in the provisions for traditional life insurance with saving elements, was negligible.

The ratio between statutory accounting and S2 technical provisions has been stable since early 2016 (87 per cent), and no major changes were seen in any individual business (*Figure 3*). The ratio of the S2 technical provisions for the life business to statutory accounting provisions was the highest, at 92–93 per cent, for the unit-linked portfolio, and around 97 per cent for non-linked life insurance. In the case of non-life insurance, the share of S2 provisions relative to accounting provisions varied around 61 per cent in the past year, resulting from discounting as well as from taking into account future profits; it is this low because of the risks that are covered with own fund rather than provisions under S2 (claims fluctuation, large claims).

Figure 3
Evolution of technical provisions between Day 1 S2 reporting and the end of 2020



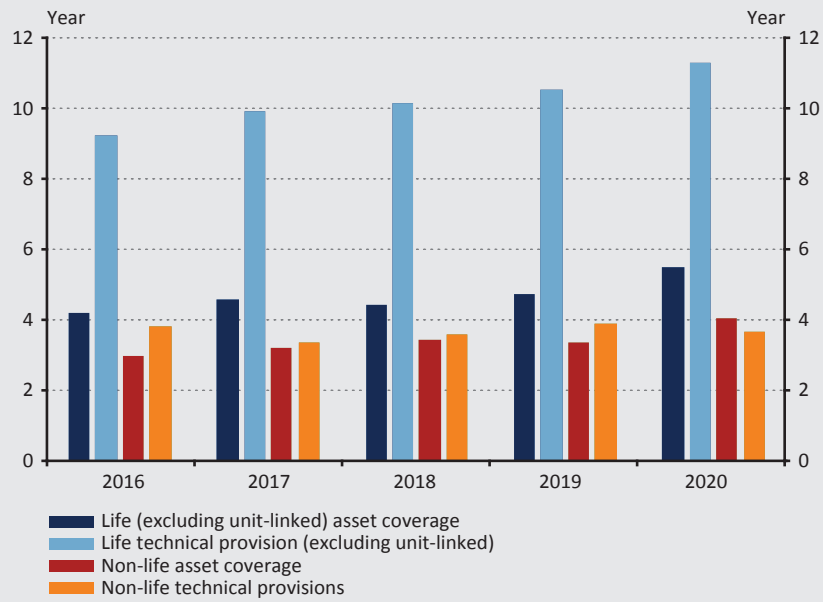
Note: 2015 = 100%, the data show the values as of 31 December.

Source: MNB data reporting

In the case of the traditional life portfolio which is not unit-linked, insurers need to manage the (reinvestment) risks arising from the maturity mismatch between assets and liabilities, and the (interest rate) risks arising from the unfavourable shifts in yield curves. The average duration of the liability side is high due to the long maturity of insurance contracts, which is contrasted with the shorter average duration of assets and the meagre yields offered in the low yield environment seen in the period under review. At the time of the transition to the S2 framework, the difference between the duration of life technical provisions with the exemption of unit-linked insurance policies and the duration of its underlying assets was almost 5 years, and the level it reached at the end of 2018 (5.7 years) has practically not changed since then (*Figure 4*). The stabilisation of the difference between the average duration of the asset and liability side cash flows was the result of the combined effect of several factors. The duration of non-linked life insurance liabilities has steadily increased since 2016, as the improved retention of insurance contracts and the popularity of pension insurance contracts lifted the average duration of the liabilities from 9.1 to 11.1 years between 2016 and 2020. In 2016–2018, the average maturity of the underlying assets for non-linked life insurance provisions fluctuated between 4.1 and 4.5 years, which rose to 4.7 years in 2019 because of the downward shift of the yield curve, with an average of 100 basis

points, and because the exposure of long-term securities increased between 2018 and end-2019. At the end of 2019, eleven Hungarian insurers had 20-year Hungarian government bonds issued in 2018 (ISIN/HU0000403555), totalling HUF 42.3 billion[4] (representing 4.8 per cent of the total non-unit-linked life assets), which meant that exposure doubled year-on-year. Besides the forint-denominated Hungarian government securities, three institutions had government bonds or credit institution bonds issued by foreign countries with a maturity of over 20 years (Italian, German, Swiss government securities and Dutch credit institution bonds) at the end of 2019, which represented a negligible share within the sector (0.32 per cent).

Figure 4
Duration of non-linked liabilities and the corresponding collateral



Note: The data show the values as of 31 December.

Source: MNB data reporting

Out of the collateral for the non-unit-linked life insurance provisions, government securities worth HUF 67 billion (ISIN/HU0000402235) matured in November 2020, and in 2022–2023 another HUF 137 billion will mature (ISIN/HU0000402383, ISIN/HU0000402524), therefore Hungarian insurers seek to extend the average duration on the assets side when reinvesting. By the end of 2020, 20-year government securities holdings (ISIN/HU0000404165, ISIN/HU0000403555) had increased to

[4] At the end of 2019, insurers held HUF 7 billion and HUF 3 billion from the 20-year Hungarian government bond series ISIN/HU0000403555 in the non-life business and the unit-linked portfolio, respectively. Furthermore, one insurer reported another HUF 370 million in own assets for end-2019.

HUF 89 billion, which was held by the insurers affected by the largest refund of the surplus yield based on mathematical provisions. Such insurers typically cover for long-term insurance liabilities offering a guaranteed yield through government securities held until maturity.

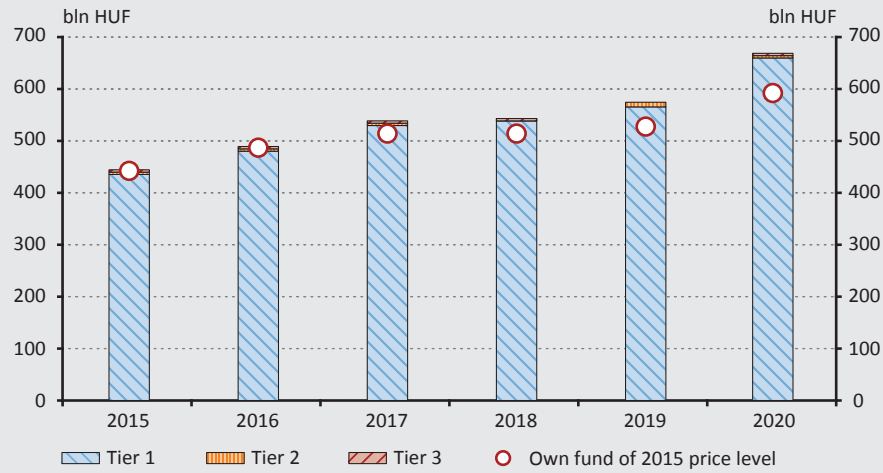
Due to the short run-off of non-life liabilities, the difference in the maturity structure of the asset and liability side does not pose much of a risk, as there is no major difference in the maturity and yield structure of assets and liabilities. The duration was stable in 2016–2020, fluctuating between 3.3 and 3.8 years. However, the average duration of the collateral exceeded the average duration of liabilities in all years but 2016, coming close to 4 years by the end of 2020.

2.3. Own funds

Insurers' S2 own funds are comprised of basic own funds and ancillary own funds. Basic own funds consist of the excess of assets over liabilities plus subordinated liabilities, less the amount of own shares held by the insurer. Ancillary own funds consist of items other than basic own funds which can be called up to absorb losses (e.g. unpaid share capital or initial funds that have not been called up, letters of credit and guarantees as well as any other legally binding commitments received by insurance and reinsurance undertakings). The amount of ancillary own-fund items to be taken into account when determining own funds is subject to supervisory approval (*EP 2009; EU 2014*). Hungarian insurers practically cover their entire capital requirement with basic own funds: in 2020 only one institution requested ancillary own funds to be taken into account, amounting to a negligible 0.004 per cent of the sector-wide own funds.

According to Day 1 reporting for 1 January 2016, own funds amounted to HUF 438 billion and increased steadily in 2016–2020, reaching HUF 662 billion by the end of 2020. This growth was significant in nominal terms (51 per cent) and in real terms (34 per cent at 2015 prices) (*Figure 5*). The largest year-on-year expansion occurred between 2019 and 2020 (16 per cent), mainly as a result of the MNB's executive circular on dividend payments issued in October 2020. In the circular, the MNB called on insurers to postpone the dividend payments planned for 2020 until 2021, when the risks caused by the pandemic had been forecast to be reduced, to maintain their resilience to crises and improve their shock-resistance. The MNB also expressed an expectation that dividends should only be paid if institutions' solvency ratio reached or exceeded the average Hungarian capital adequacy (205–243 per cent) even after the payment was made (*MNB 2020b*).

Figure 5
Evolution and distribution of own funds between Day 1 S2 reporting and the end of 2020



Note: 2015 = 100%, the data show the values as of 31 December.
Source: MNB data reporting

Own-fund items can be classified into a three-tiered system, depending on whether the individual capital elements are part of basic own funds or ancillary own funds, and whether they have permanent availability,[5] subordination[6] and sufficient duration[7] for this (*EP 2009; EU 2014*). With respect to the capital position of the Hungarian insurance sector, it is positive that basically the sector's entire own-fund holdings comprise Tier 1 items with unlimited availability, representing around 99 per cent of total own funds in 2016–2020. Accordingly, Hungary is among the leaders in the EU, as besides it only Cyprus, Estonia, Spain, Sweden, Croatia and Slovakia had 99 per cent or higher unlimited Tier 1 items at the end of 2020. In the same period, the lowest share of unlimited Tier 1 capital items was recorded in Norway (82 per cent) and Belgium (83 per cent). According to an EIOPA survey, non-life insurers have the highest Tier 1 ratio (95 per cent) in the European Union, while the average for composite insurers is around 89 per cent (*EIOPA 2021a*). Tier 1 items with limited access were only observed at the beginning of 2016, in negligible amounts (0.4 per cent of sector-wide own funds), mainly due to the uncertainties surrounding the transition to S2.

[5] The item is available, or can be called up on demand, to fully absorb losses on a going-concern basis, as well as in the case of winding-up (*EP 2009*).
[6] In the case of winding-up, the total amount of the item is available to absorb losses and the repayment of the item is refused to its holder until all other obligations, including insurance and reinsurance obligations towards policy holders and beneficiaries of insurance and reinsurance contracts, have been met (*EP 2009*).
[7] When assessing the extent to which own-fund items possess the characteristics of permanent availability and subordination, due consideration should be given to the duration and maturity of the items (*EP 2009*).

With respect to Tier 2 subordinated liabilities provided by an insurer's owner or group members, there was only one institution in the sector in 2016–2020 where the ratio of subordinated liabilities and own funds was around 10 per cent. As the capital adequacy ratio of that insurer was over 200 per cent since the end of 2016, with the exception of the S2 transition, the existence of subordinated liabilities did not pose a risk in the access to capital. Loans were taken out from the parent company by one institution in 2019 and another one in 2020 due to solvency ratio considerations. At the end of 2020, the former insurer's capital adequacy ratio rose to over 200 per cent due to the subordinated liabilities and the MNB's circular on postponing dividend payments. For the other institution, the MNB prescribed a capital add-on of HUF 500 million and at the same time authorised the borrowing of ancillary own-fund items worth HUF 500 million. By the end of 2020, Tier 2 capital items amounted to HUF 6.6 billion at these three institutions, representing merely 1 per cent of sector-wide own funds.

The volume of Tier 3 capital items was the largest at the beginning of 2016, with three institutions reporting deferred tax liabilities totalling HUF 297 million. It remained below 4 per cent of own funds at all institutions, and its sector-wide share was negligible (0.1 per cent). At the end of 2020, only one institution reported deferred tax liabilities (HUF 23 million), which is insignificant for both the institution and the sector (0.004 per cent). In Hungary, Tier 2 and Tier 3 capital items are typically held by smaller, non-composite insurers. As the overwhelming majority of Hungarian insurers are part of a foreign group, and they usually represent a small share within the group, the well-capitalised owners can quickly provide capital, which is typically of insignificant amount relative to the group's assets, and therefore Tier 2 and Tier 3 capital items do not need to be involved.

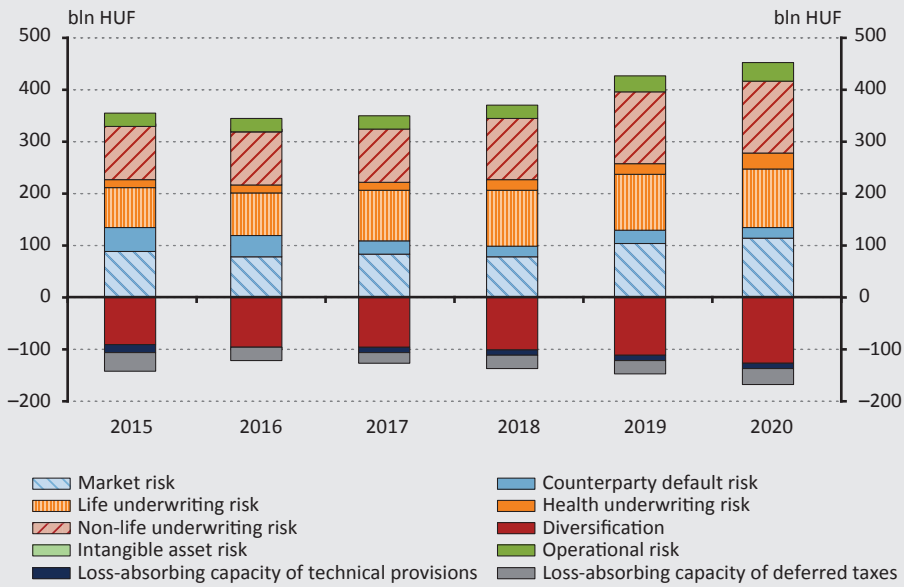
2.4. Solvency Capital Requirement

Under the S2 framework, the SCR should be calibrated so as to ensure that all quantifiable risks to which an insurer is exposed are taken into account. This calculation can be performed on the basis of the standard formula stipulated by law or with an internal model. Hungarian insurers calculate their SCR based on the standard formula, with the exception of one institution that uses a partial internal model to quantify the capital requirement for non-life risks. The number of internal models used in Hungary may seem low, but EIOPA's data suggests that this is not unique: at the end of 2020, 189 European insurers used an internal model, representing merely 7 per cent of the total sample (2,675 institutions from 31 countries).[8] Eleven countries have a higher share than the 4.5 per cent in Hungary, and in 15 countries no insurer uses internal models (*EIOPA 2021d*).

[8] The standard formula is used by 88.5 per cent of institutions, and there is no available data on the capital requirement calculation method in 4.5 per cent of the cases.

The (net) SCR calculated on the basis of the standard formula is the sum of the basic SCR and the capital requirement for operational risk, adjusted for the loss-absorbing capacity of technical provisions and deferred taxes (*Figure 6*).

Figure 6
Distribution of the SCR by risk modules, and the adjustment for the loss-absorbing capacity of technical provisions and deferred taxes



Note: The columns in the figure add up to the net SCR, but the SCR of the individual risk modules is the gross amount. The data show the values as of 31 December.

Source: MNB data reporting

Between early 2016 and end-2018, the net SCR steadily increased (5 per cent), primarily due to growth in life and non-life risk exposure. There was a 13-per cent rise between 2018 and 2019, amounting to close to HUF 280 billion, resulting from the combined effect of several factors. Owing to the growth in the volume of non-life portfolio and insurance premiums, premium and reserve risks increased within non-life risk. Moreover, the interest rate risk exposure, which had risen on account of the increase in equity risk exposure and the major downward shift in the yield curve, lifted the capital requirement for market risk between 2018 and 2019 across the sector. Although the growth rate of net own funds was lower between 2019 and 2020 (7 per cent), net own funds amounted to HUF 300 billion by the end of

2020, mainly attributable to the contraction in long-term yields and the increase in spread risk and concentration risk[9] (*EP 2009*). In addition, life and health insurance risk exposure increased due to the coronavirus pandemic. The capital requirement for health insurance risk (HUF 28 billion at the end of 2020) is still not significant compared to large risk modules, although the risk exposure grew by 26 per cent between 2019 and 2020.

The composition of the basic SCR was stable in 2016–2020, there was no significant change in the share of risk modules. The most important risk modules remained non-life (23–25 per cent), life (18–21 per cent) and market risk (16–18 per cent).[10] Across Europe, insurance (life, non-life) risk is followed by market risk. At the end of 2020, its share within the basic SCR varied between 25 and 70 per cent, which puts Hungary among the countries with the lowest market risk exposure. This is attributable to the previously described conservative investment strategy. The diversification characteristic in the Hungarian insurance sector accounts for a large share, close to 30 per cent, of the basic SCR, which is the highest in Europe, as this value varies between 15 and 25 per cent in other EU Member States. Diversification is low in the countries with a mature capital market where market risk is extremely high (*EIOPA 2021a*).

2.5. Solvency ratio

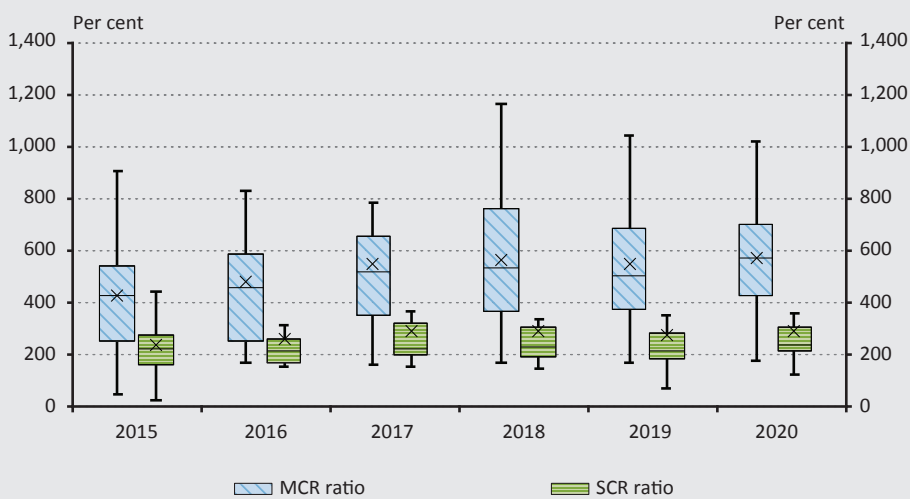
Under the S2 framework, the regulation differentiates between two types of capital requirement: the SCR comprising risk modules as described in the previous section and the MCR necessary for the operation of institutions. The capital requirement to be taken into account for capital adequacy is equivalent the maximum amount of these; therefore, the solvency ratio, otherwise known as the capital adequacy ratio, is the eligible own funds[11] divided by maximum SCR-MCR. Below, unless indicated otherwise, capital requirement is understood to mean this maximum amount, and that is used for determining solvency ratio.

The different definitions lead to considerable variation between MCR and SCR capital adequacy (*Figure 7*). While the average of the former fluctuated between 400 and 560 per cent in 2016–2020, the latter varied in a much narrower range, between 200 and 220 per cent. Looking at it in more detail, it can be clearly seen that the 25th percentile of the SCR capital adequacy ratio gradually climbed to over 200 per cent, considerably influenced by the VCB Recommendation published in 2016. In the European Union, Hungary had the highest value at the end of 2020

[9] Pursuant to the transitional measure in Article 308b (12) of Directive 2009/138/EC of the European Parliament and of the Council, as of 2018 the government bonds not issued in the domestic currency of a Member State cannot be considered 100 per cent risk-free, therefore they should be taken into account at 20, 50 and 100 per cent in 2018, 2019 and 2020, respectively while calculating interest rate spread and concentration risks.
[10] Considering the effect of diversification.
[11] It matters whether MCR or SCR is used for dividing own funds, as the eligible capital items differ.

with a 25th percentile over 200 per cent, with only Denmark and Germany having similarly high percentiles (*EIOPA 2021a*). However, the interquartile range of SCR capital adequacy is quite small in Hungary, and it continued to shrink in 2016–2020. The widest interquartile range was seen at the end of 2017 (125 percentage points), which declined to 75 per cent by 2020. It is interesting to note that the median value of the SCR capital adequacy has been stable since the end of 2017 (215–225 per cent, which is high by EU standards) and close to the 25th percentile, which suggests that the distribution stretches far to the right. This is supported by the position of the average value. According to a report by EIOPA published in 2021 (*EIOPA 2021a*), the SCR capital adequacy ratio had a skewed distribution to the left and a distribution stretching far to the right in EU Member States at the end of 2020.

Figure 7
Distribution of the capital adequacy ratio calculated on the basis of the SCR and the MCR



Note: The data show the values as of 31 December.
Source: MNB data reporting

Based on the Day 1 reporting, the distribution of SCR capital adequacy was almost symmetrical, due to the low capital adequacy of a crisis-managed institution that fell far short of the regulatory minimum. Solvency ratios below 100 per cent were rarely seen in the period under review, and the next time it was observed in 2019. With respect to the SCR capital adequacy, outliers are the smaller institutions where the capital requirement is determined by the MCR rather than the risk-based SCR. At the time of the Day 1 reporting, the interquartile range of the SCR comprised

14 institutions. This figure fell to twelve insurers by the end of 2020, due to the number of institutions that ceased operation in those five years on the one hand, and the smaller differences between individual institutions regarding the capital adequacy ratio on the other. It has to be noted though that in 2016 the figures often changed due to the calculation uncertainties caused by the transition.

However, the distribution of the MCR capital adequacy ratio has been almost symmetrical since the introduction of S2. Its median value has been steadily over 400 per cent in 2016–2020, peaking at the end of 2020 (at 564 per cent), but this still puts Hungary in the average of the EU. At the end of 2020, there were 14 EU Member States with higher median values of MCR capital adequacy than in Hungary, with Finland boasting the highest value (824 per cent) (*EIOPA 2021a*).

During the transition to S2, the MCR capital adequacy ratio of only one institution (34 per cent) violated the legally stipulated value. Other than that, the minimum MCR capitalisation was stable in the period between 2016 and end-2020, fluctuating between 150 and 160 per cent. The MCR capital adequacy ratio varies in a much wider range than SCR, which is clearly shown by the double or triple difference between the total and interquartile ranges. This is because the MCR stipulated by law results in a high capital adequacy ratio, often over 500–1,000 per cent, at large insurers due to the massive level of own funds. Since 2016, the interquartile range of the MCR capital adequacy has continuously narrowed and shifted downwards. By the end of 2020, the 25th percentile was close to 440 per cent, while the 75th percentile was below 700 per cent, similar to the end of 2017 and 2019. Since the end of 2016, out of the five largest (composite) insurers based on premium income, two had an MCR capital adequacy below the median.

During the transition to the S2 framework, the capital adequacy ratio was determined by the MCR stipulated by law in the case of 7 out of the 28 institutions. At the end of 2020, the same figure was 4, while the total number of institutions declined to 22. Therefore, the distribution of capital adequacy is similar to the distribution of SCR capital levels: skewed to the left, stretching far to the right, as the median is lower than the average (*Figure 8*). Between 2016 and 2020, the distribution became increasingly peaked, as the interquartile range narrowed: at the end of 2020, the difference between the 25th and the 75th percentile was merely 61 percentage points. The interquartile range shifted upwards over the years in this case, too, with even the bottom quartile (207 per cent) and the median (221 per cent) being over 200 per cent by the end of 2020. In addition, extremely high capitalisation levels also declined, which indicates a contraction in the total range of the capital adequacy ratio.

Figure 8
Distribution of the capital adequacy ratio

Note: Taking into account whether institutions' capital requirement is determined by the SCR or the MCR. The data show the values as of 31 December.

Source: MNB data reporting

Interestingly, the capital adequacy ratio at three out of the five largest insurers was steadily below the median in 2016–2020, and capital adequacy was also not consistently higher than the median value at the other two insurers. While in early 2016 the capital adequacy ratio of all TOP5 insurers was within the interquartile range, three of them were outside the range at the end of 2020, which suggests that the top insurers in the market sought to minimise the capital held and also comply with the VCB Recommendation. This is supported by the insurers' own risk and solvency assessment (ORSA) reports: in 2015[12] three quarters of the target capital adequacy values determined by the institutions were below 150 per cent. In 2017 this was observed only at a quarter of insurers, and in 2020 the capital adequacy target was above 150 per cent at all institutions. As *Balogh* (*2017*) describes, there are several considerations in the case of capital allocation, and the change in insurers' target capital adequacy ratio definitely shows the orienting role of the VCB recommendation.

[12] Preparatory ORSA reports, so-called FLAOR reports

All in all, the capital adequacy ratio of the Hungarian sector has been stable since 2016, partly due to the VCB Recommendation, and there is also no significant change in the distribution. However, the interquartile range is quite small, and it continued to shrink in 2016–2020. By the end of 2020, the 25th percentile of the capital adequacy ratio had gradually moved to over 200 per cent, which exceeds the European Union average (*EIOPA 2021b*). The sector-wide capital adequacy ratio was over 200 per cent in 2016–2020 and following a temporary slump in 2019 (204 per cent at the end of 2019), it was 220 per cent at the end of 2020.

3. Empirical analysis of the volatility capital buffer

After the presentation of the most important sector-wide developments, the volatility of the capital position is examined in detail. This is because the five years that passed since the VCB Recommendation was published provide an opportunity for empirical analysis.

The impact assessments prepared in preparation for the new framework (*MNB 2015; Bora et al. 2015; Bora et al. 2016a; Bora et al. 2016b; Lencsés 2015*) suggest that the new methodology could entail volatility in the capital position. Accordingly, the MNB expects insurers to hold a volatility capital buffer from 1 July 2016 to ensure continuous capital adequacy. In practice, this means that if insurers do not wish to determine the size of the buffer based on their own calculations,[13] an additional buffer amounting to 50 per cent of the last reported SCR should be held as a buffer (*MNB 2016*), which helps avoid unexpected capital losses over a one-year horizon.

The authors aim to explore the volatility of the system since its introduction, analysing data from 27 insurers between the Day 1 and end-2020 reporting. This means 21 data points for each insurer, or a total of 511 capital adequacy ratio data points, if quarterly disclosures are also taken into account. Out of the 27 insurers, 22 are still operating, while 5 ceased operation in the meantime, but they are treated separately in the analysis. 28 insurers participated in the transition to the new framework, but supervisory action was taken against one of them, and therefore no consistent reporting of sufficient amount was received from it.

[13] Pursuant to Section 2 of the VCB Recommendation, the volatility capital buffer is determined by insurers in a way that ensures that it provides at least 90-per cent protection against unexpected capital losses over a one-year horizon.

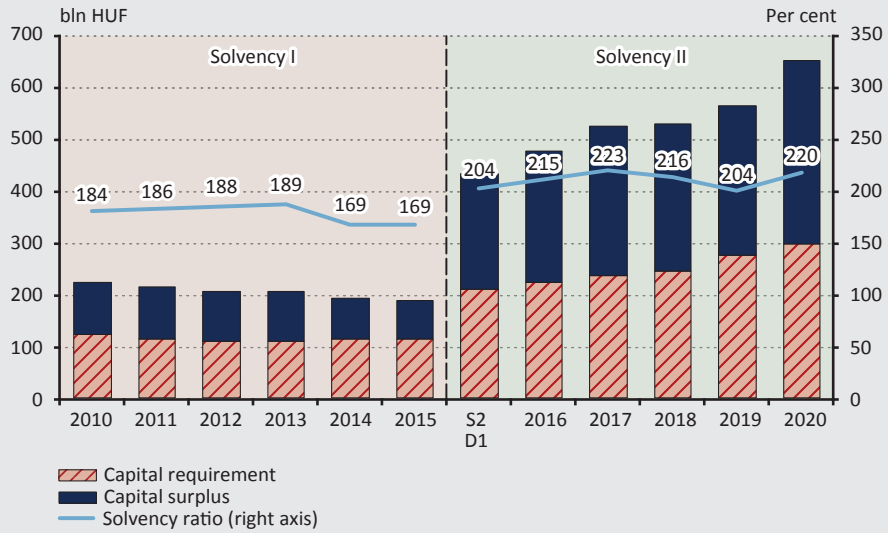
3.1. Methodological limits to the analysis

The concept of a volatility capital buffer emerged because the S2 regulation expects continuous capital adequacy; however, insurers are only required to perform a comprehensive capital requirement calculation annually, or if the risk profile changes considerably (*Zubor 2016*). This means that the interim, quarterly reports do not necessarily show accurate capital adequacy ratios, as only the available capital is required to be determined at such intervals. Since the introduction of S2, nine institutions have used the option provided by law to show the capital requirement values reported for the previous year in the quarterly reports of the subsequent year. Currently six insurers do this, and two of them use the MCR as a basis, which means that this is not relevant to them. The practices of the other insurers do not necessarily reflect the actual capital requirement values during the year, but since they recalculate at least certain risk modules in every quarter, a more accurate picture can be gained about their capital adequacy ratio. If the intra-year values were disregarded, only six datapoints would remain for each insurer; therefore, these interim period indicators were used several times during the analysis to ensure an adequate sample size. The intra-year values may skew the final result due to the heterogeneous methodologies used by the insurers, but this was always indicated.

3.2. Volatility of capital adequacy

Section 2.5 described in detail the evolution of sector-wide S2 capital adequacy. If the time series is expanded to include earlier, S1 data, the differences between the two regimes become clear: the introduction of S2 considerably increased the capital requirement and surplus capital, resulting in a roughly 30-percentage point higher capital adequacy ratio across the sector (*Figure 9*). Nonetheless, no significant variation can be observed within the sector for the institutions under review, with the exception of the contraction in 2019. This change was triggered by the combined effect of several factors, resulting in the rise of the capital requirement: the change in the yield curve, the incorporation of the insurance tax into the MTPL premiums as well as the legal amendment to the calculation of non-life catastrophe risk. The expected volatility (*Kočović et al. 2017*; *Richard 2020*) based on quantitative impact studies and market consistent valuation has not appeared at the market level.

Figure 9
Sector-wide solvency ratio under S1 and S2



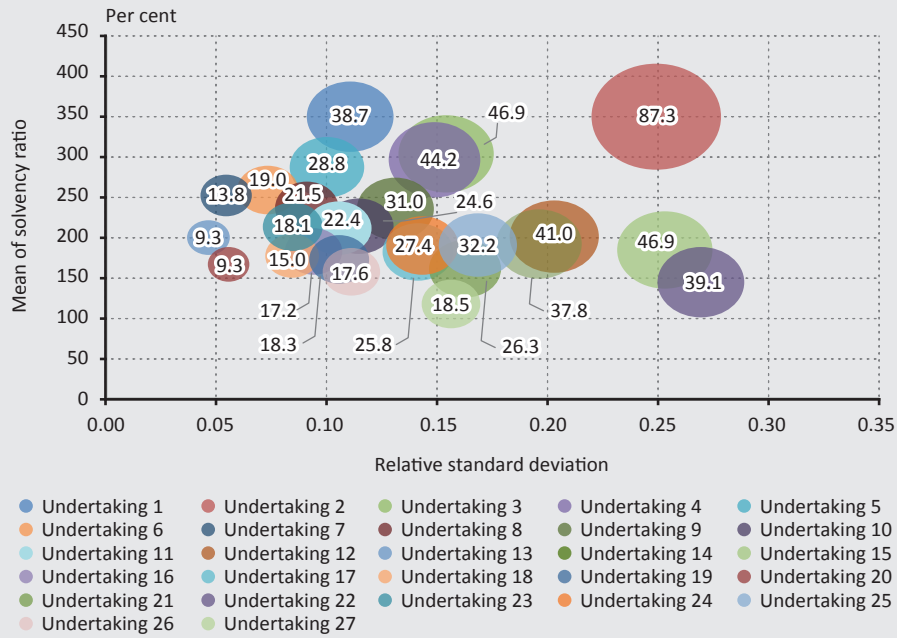
Source: MNB data reporting

In other words, capital adequacy has been stable across the sector, even if Hungarian institutions made only scarce use of the instruments for mitigating volatility permitted by the regulation. Such long-term guarantees measures (LTGs) include volatility and matching adjustment, which exert their effect by adjusting the risk-free interest rate term structure (*EIOPA 2021c*). Taking into account the so-called transitional measures, the use of LTGs has a significant effect on the SCR capital adequacy ratio in the EU, as without them the capital adequacy ratio would drop from the 259 per cent measured at the end of 2019 to 231 per cent. By contrast, the SCR capital adequacy would remain unchanged in Hungary (*EIOPA 2020*).

Still, the volatility of the capital position should mainly be examined at the institution level, as sector-wide aggregations may conceal individual outliers. This is confirmed by *JPMorgan* (*2019*), which, although it only examined volatility between 2016 and 2017, found that the solvency ratio increased by at least 50 percentage points for 10 per cent of European life and composite insurers, while it declined by 20 percentage points for another 10 per cent in one year. Meanwhile, the capital adequacy ratio rose from 229 per cent to 239 per cent in Europe as a whole (*EIOPA 2021d*). At the institution level, the dispersion indicators were examined first, during which the solvency ratios determined in quarterly reports were also taken into account. As already seen in the theoretical calibration document (*Zubor 2016*), a possible indicator for measuring volatility is relative standard deviation. Based

on the data from the insurers participating in the preliminary impact assessments, their S1 relative standard deviation was 0.179, while it was 0.260 in S2, which shows that capital adequacy is more volatile in the new regime. The practical data are summarised in *Figure 10,* where the average, the standard deviation and the relative standard deviation derived from their ratio is shown for each insurer.

Figure 10
Average and standard deviation of capital adequacy ratios



Note: The size of bubbles reflects the standard deviation.

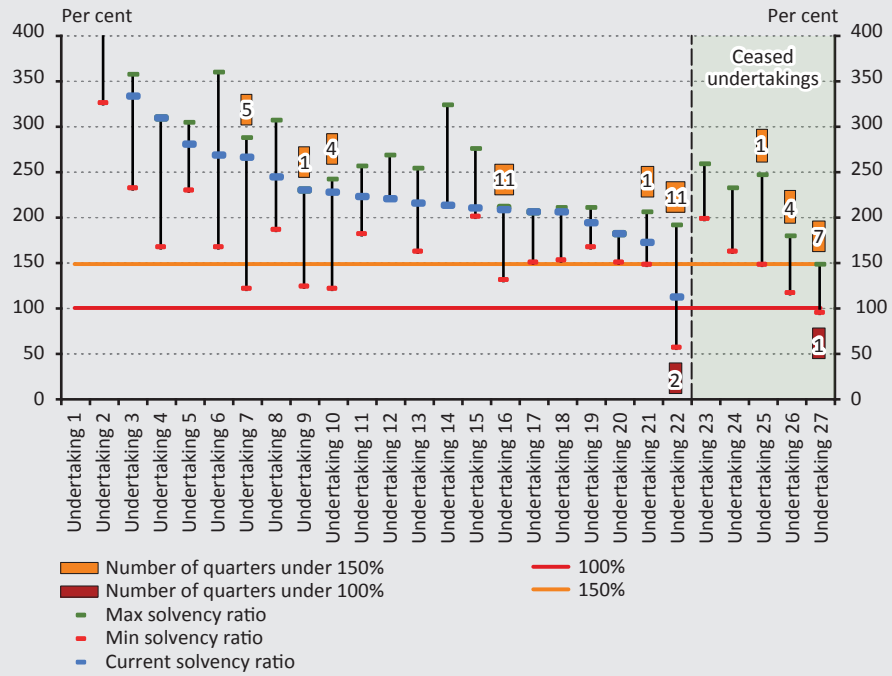
Source: MNB data reporting

It can be seen that the average capitalisation of the 13 currently operating insurers is in, or close to, the range of 150–200 per cent, and a standard deviation of over 30 per cent can be observed in the case of several insurers. Overall, this yields a relative standard deviation of over 0.2[14] in these cases. This illustrates the point that higher volatility can occur even in the case of insurers without a particularly high level of capital adequacy. The average relative standard deviation of functioning institutions is 0.13, or 0.11 when the first year is disregarded. However, standard deviation may not be the best indicator to be used in analysis, as it takes into account not only the volatility arising from the contraction.

[14] Due to the different coverages, this is not fully comparable to the values calculated based on the impact assessments.

Figure 11 also took into account the capital adequacy ratios determined in the quarterly reports: it shows the range of capital adequacy ratios ranked by the values measured at the end of 2020. The figure also points out which insurers crossed the 150 per cent and 100 per cent capital adequacy thresholds and for how many quarters.

Figure 11
Range of capital adequacy since the introduction of S2



Note: Undertaking 1 solvency ratio: min: 446%; max: 552%; current: 521%. Undertaking 2 solvency ratio: max: 581%; current: 461%.

Source: MNB data reporting

The average range was 103 per cent, with the lowest extending for a range of 32 per cent, and the largest spanning a range of 254 per cent. It can be seen that the capital adequacy ratios of six currently functioning insurers dipped below 150 per cent, which typically lasted for several quarters. Out of these, one insurer even breached the 100 per cent threshold.

3.3. Significant contractions in the capital adequacy ratio

Below, the contractions in the capital adequacy ratio are presented over a one-year horizon. Based on the VCB Recommendation, the analysis focused on the number of cases with a drop of over, or close to, 50 percentage points within a year.

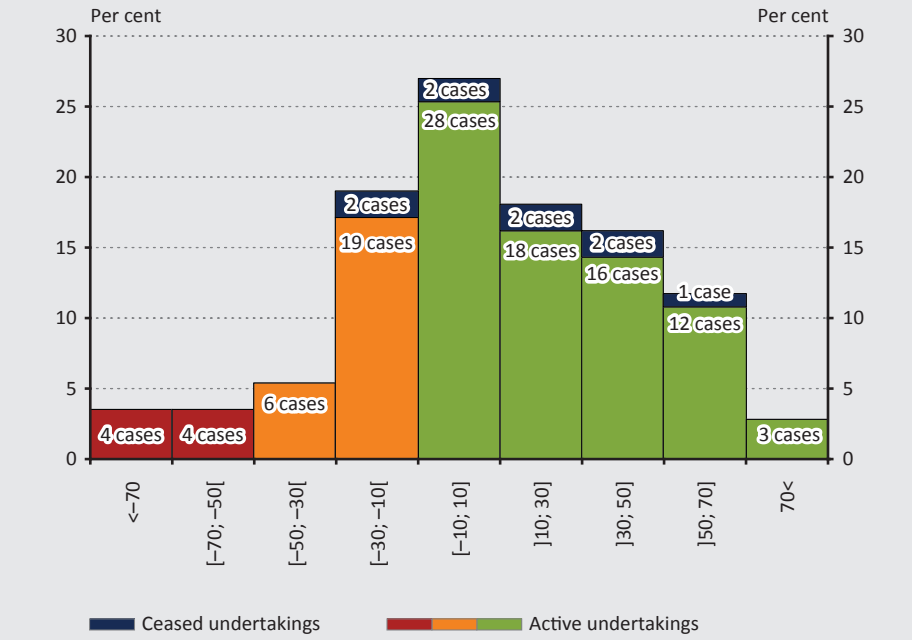
It should be noted that the capital adequacy ratio is also influenced by dividend payments. Insurers subtract the expected dividends for the next 12 months from the surplus of assets in excess of liabilities, and therefore the capital adequacy ratio already shows the situation after the expected dividend payments. If the actual dividends differ from the anticipated value, capital adequacy declines with higher payments and increases with lower payments. However, the contractions detailed below are not related to this, because insurers typically do not deviate much from the planned values. As mentioned in Section 2.3, the MNB's executive circular had a positive effect on the capital adequacy ratio for 2020.

The percentage point drop was analysed at the different insurers since the introduction of the S2 regime over a horizon of no more than 1 year. When determining this, the quarterly capital adequacy ratios were taken into account here as well. The maximum contraction values show the maximum decline over a 1-year horizon, regardless of whether there was any growth in the interim periods. If the time periods of the two maximum contractions overlapped, the larger one was taken into account, and the continued decline was determined on the part not covered by the other. Therefore, every contraction was taken into account, and thus the whole period was covered for all insurers.

Contraction of over 50 percentage points occurred in 19 cases, which is 14 per cent of 139 observations, at the currently functioning insurers, of which five occurred in the first year. These massive reductions affected 13 insurers, but it has to be added that this decline typically did not lead to a violation of the 150 per cent threshold, because it occurred at insurers with high capital adequacy. There were a large number of contractions (43 cases which is 31 per cent of all observations) in the 20–50 per cent range, which also illustrates the volatility of capital adequacy.

The changes on a 1-year time horizon were also analysed using another approach, based on annual data reporting. The results are shown in *Figure 12* which presents the distribution of the change in the capital adequacy ratio, i.e. the percentage point difference from the previous year-end value. These were classified into symmetrical, 20-percentage point ranges, illustrating the percentage changes in capital adequacy ratios in the given ranges within all the annual changes recorded so far. For clarity, the actual number of cases is also shown in the figure, and the insurers that ceased operation are denoted separately.

Figure 12
Distribution of the annual change in the capital adequacy ratio



Source: MNB data reporting

Based on the annual disclosures, there were eight contractions of over 50 percentage points, and it can also be seen that the currently operating insurers experienced even larger growth in 15 cases, which also illustrates the volatility of the system. A more detailed analysis revealed that outliers were more likely to be observed in the year of introduction. It is argued that this is because the calculation methodology and model calibration had not been solidified in the first period of the transition, and those were gradually developed by the insurers. In the first year, seven of the 27 insurers experienced a change of over 50 percentage points (with three cases of decline), while this occurred in 17 of the 92 cases after the first year, of which only five were cases of decline.

The identified large capital adequacy ratio reductions of over 50 percentage points were typically triggered by an external shock, which suddenly increased the SCR and/or reduced the available capital. These shocks can be classified into the following categories:

1. *Growth in SCR with unchanged available capital, typically attributable to two reasons:*

   – *A major increase in holdings:* The growth in holdings generates an SCR, the sudden surge of which is not followed by a rise in the available capital. This was typically caused by the dynamic expansion of the non-life portfolio.

   – *Realignment of the investment portfolio:* As mentioned in Section 2.1 in connection with the investment portfolio, sector-wide asset composition did not change much, but there were several significant shifts at the individual institution level. In the case of a few insurers, the share of corporate bonds and investment fund shares, which are riskier assets than government securities, increased, even if only temporarily, which was attributable to diversification considerations as well as the low yield environment. However, the riskier exposures entailed a higher SCR, which reduced the capital adequacy ratio. Similar consequences ensued in several cases when the amount from the government securities investments maturing right before the end of the reporting period (quarter) was not immediately reinvested but instead kept on the bank account of the insurers. This is because according to the regulations, Hungarian forint-denominated government securities are free from counterparty risk, while provisions need to be provided for the amounts held on bank accounts. Further considerable volatility can be caused by changes in the yield curve and the regulation, such as in the case of natural catastrophe risks.

2. *Growth in SCR with declining available capital:* As mentioned in the previous point, the growth in holdings entails a rise in the capital requirement. In the case of non-life insurance, this has a limited effect on the value of own funds, unlike in the case of life insurance for saving purposes. This is because selling these products entails heavy costs, mainly an outflow of commissions. The payment of sales commissions appears immediately on the S2 balance sheet, as the collateral of the paid amount disappears from assets. Therefore, capital adequacy may come under pressure from both directions, from own funds as well as the SCR. In the period under review, this happened at one of the Hungarian insurers. The impact was exacerbated by the fact that the institutions' acquisitions were well over the expected amount, and therefore capital adequacy eroded quickly for several quarters.

3. *Change in economic circumstances/assumptions* (*e.g. impact of Covid-19*)*:* The sudden changes in the external environment may have an enormous impact on insurers' capital position, including through their effect on business planning, the market value of assets and the assumptions used for calculating technical provisions. A typical example is capital market turbulence and the quick change in the yield environment. However, these are typically short-term effects, which may

abate after one or two quarters. The pandemic that started in 2020 will be felt for longer, because even though the position of the Hungarian insurance sector remained stable (*MNB 2021*), the profitability of certain businesses changed considerably relative to earlier periods, which exerted a huge impact at the insurers specialising in such businesses.

However, the events causing a contraction of over 50 per cent in capital adequacy typically did not pose a problem, because the capital adequacy of insurers was still well over 150 per cent, with the exception of two cases. In one of those cases, the capital adequacy ratio dropped to below 150 per cent, and in the other case the 100 per cent threshold was even breached, but capital adequacy was restored in the meantime. Even so, it can be argued based on empirical data that as a result of the market-consistent assessment and risk-based capital requirement calculation stipulated by S2, a change in the environment or its development diverging from expectations makes the capital position volatile, which may jeopardise continuous capital adequacy.

4. Summary

Since the transition to the S2 framework, the Hungarian insurance sector's position has been stable and ranked highly in several respects by European standards. In 2016–2020, the average capital adequacy ratio was steadily over 200 per cent. No major change can be observed in the distribution of capital adequacy, the interquartile range is quite small, and it continued to shrink in 2016–2020, partly owing to the VCB Recommendation. By the end of 2020, the 25th percentile of the capital adequacy ratio had gradually moved to over 200 per cent, which is the highest value in Europe. Since 2016, the capital requirement of 75–80 per cent of institutions is determined on the basis of the SCR, the composition of which can be considered stable: within the sector insurance risk is still followed by market risk exposure. Compliance with the capital requirement is facilitated by the fact that the own funds of the Hungarian sector comprise almost exclusively Tier 1 capital items with unlimited access, which has been an exceptionally high value among European Union countries since the introduction of S2.

There was no significant change in the composition of assets held by insurers in 2016–2020, as the Hungarian insurance sector continues to be characterised by a conservative investment strategy. Almost 80 per cent of the collateral of non-linked insurance comprise government securities, which continues to be an outstanding share by international standards. In the case of the non-linked, traditional life insurance portfolio, the difference between the average duration of assets and liabilities side cash flows stabilised in 2018–2020, on account of the growing share of long-term government securities in collateral, and the improving retention of

insurance contracts and the popularity of pension insurance on the liabilities side. Since 2016, technical provisions have been slowly expanding, due to the growing premium income from unit-linked products, mainly pension insurance products, in the life business, as well as growth in the non-life portfolio and insurance premiums.

Based on the impact assessments prepared before the introduction of market-consistent assessment and risk-based capital requirement calculation in 2016, the capital adequacy ratio was expected to be volatile under the new regime. The paper examined this hypothesis while reviewing the capital adequacy ratios of insurers at the institution level in the period until now, with a special attention to the impact of the recommendation on the volatility capital buffer from 2016. While exploring this, the capital adequacy ratios reported on a quarterly basis were also taken into account, and the data available at year-end were analysed separately.

All in all, empirical data also confirm the volatility of the S2 framework, as high standard deviation was seen in the capital adequacy ratios of several insurers, which fluctuated in a wide range. This occurred even in the case of insurers whose average capital adequacy was not particularly high in the past period; in other words, volatility affects not only the insurers with high capital adequacy. Furthermore, the examination of major contractions showed that a decline of over 50 percentage points occurred in the capital adequacy ratio at 13 insurers over a 1-year horizon, and six insurers had capital adequacy levels below 150 per cent, of which one insurer's capital adequacy dipped below 100 per cent. Based on the experiences so far, the capital buffer has served its purpose well: the sector has proven to be resilient to external shocks, while without it capital shortfalls or situations close to that could have emerged in several cases.

Due to the short time series, the data available at the time of writing were insufficient to conduct more comprehensive analyses. Nevertheless, the examination should be repeated later, when more year-end data are available, to gain a more accurate picture of the volatility of the S2 framework and the justification for the volatility capital buffer in practical use.

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