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THE EU REGULATORY FRAMEWORK FOR MARKET RISK AND PRUDENT VALUATION: ARE THE RULES TOO PROCYCLICAL?

EVIDENCE FROM THE COVID-19 PANDEMIC AND THE 2022 GLOBAL ENERGY CRISIS

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ABSTRACT

The 2020 COVID-19 pandemic crisis and the 2022 global energy crisis consecutive to Russia's aggression against Ukraine have been unprecedented in several aspects.

In the European Union (EU), national governments, as well as European bodies put in place several relief measures to support the EU economy. However, the regulatory and supervisory responses in relation to prudential matters have been very different in these two crises.

In this paper, we first assess the impact of the two crises on the capital requirements related to traded risk and discuss the issue of procyclicality in the regulatory framework. We then analyse and compare the regulatory measures taken by the legislators and by the European Banking Authority (EBA). We finally identify how the regulatory framework is set to change to address the drawbacks that became evident during the recent crises.

KEYWORDS

Market risk; Prudent valuation; procyclicality; capital requirements; FRTB.

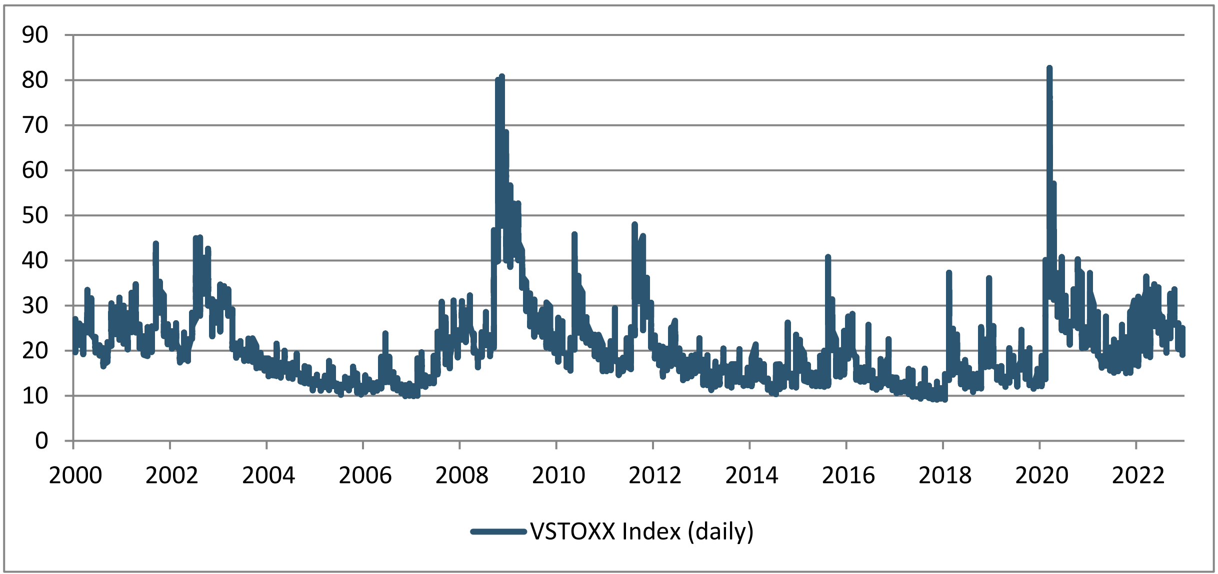
JEL CODES

G21; G28; G32; C00

1. Introduction

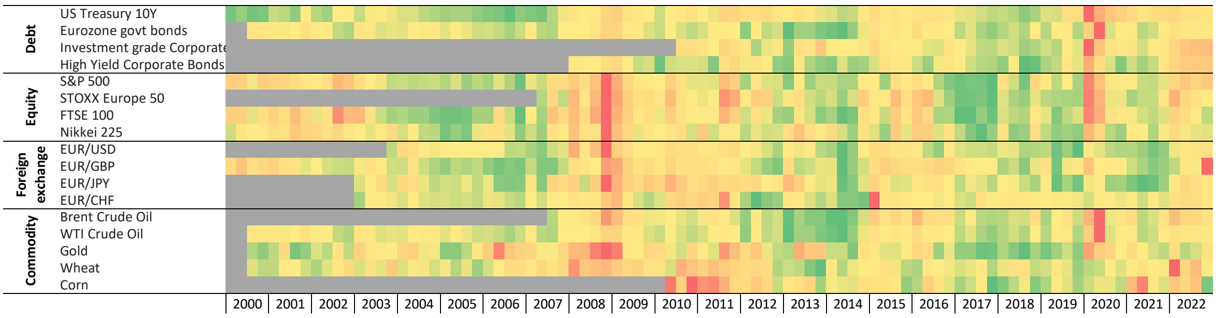
Following the Covid-19 pandemic, financial market volatility spiked in February 2020 and has remained relatively high until the end of 2020. The 2022 global energy crisis consecutive to Russia's aggression against Ukraine has triggered another period of heightened volatility in February 2022, particularly in the energy markets. Implied stock market volatility, as measured by the VSTOXX, provides a first overview of the magnitude of the two crises (Figure 1). The Covid-19 pandemic appears to be the second largest crisis after the global financial crisis in 2008, while the 2022 global energy crisis was much milder. At the same time, while realised market volatility increased in a range of asset classes during both crises, it was broader (in terms of affected asset classes) and more pronounced during the Covid-19 pandemic (Figure 2).

Figure 1: EURO STOXX 50 Volatility Index (VSTOXX), daily frequency, January 2000 – December 2022



Sources: Bloomberg.

Figure 2: Heat map of levels of volatility across major asset markets, January 2000 – December 2022



Sources: Yahoo Finance and authors calculations.

Notes: Volatility is estimated in each quarter as the standard deviation of daily returns from non-overlapping quarterly samples. A red, yellow and green colour code indicates, respectively, a high, medium and low volatility estimate compared with other periods in the respective asset market. The last observation is for 31 December 2022. Grey indicates non-availability of data.

From a prudential perspective, capital requirements linked to traded risks have generally increased during these stress periods. In particular, according to an analysis on 72 EU banks, capital requirements for market risk have increased on average by 16.5% in the Q1-2020 (COVID-19 pandemic) and by 16.3% in Q1-2022 (2022 global energy crisis).[1,2] Similarly, based on a sample of 90 EU banks, the requirements for prudent valuation have generally increased by 40.0% and 4.9% in Q1-2020 and Q1-2022, respectively.[3]

This sparked market participants and banking associations to call for regulatory action to smooth the procyclical impact of the capital requirement framework. Whether during a period of stress, capital requirements should increase or not has been a long-standing debate among the regulatory community. Some argue that this is exactly how a regulatory framework should work – banks should be ready to suffer more losses in crisis times compared to normal (i.e. non-crisis) times. Others instead argue that an increase in capital requirements can further exacerbate a crisis by, for example, reducing access to credit, or reducing the liquidity in the financial markets. We refer to the increase in the intensity of capital requirements in a period of stress as “procyclicality” of the regulatory framework.[4]

Among regulators, the debate became particularly prominent during these last two crises. The regulatory and supervisory community adopted several temporary relief measures following the Covid-19 pandemic[5], including some that aimed at reducing the procyclical components embedded in the regulatory framework. Instead, similar measures were not introduced in the context of the 2022 global energy crisis. Both experiences have therefore raised significant questions about the degree of procyclicality in the current framework, and about the circumstances under which a strong regulatory response, like the one adopted during the Covid-19 period, is warranted.

In this paper, we analyse the impact of the two crises on the capital requirements for market risk and the requirements linked to prudent valuation, with the objective of assessing the different approaches taken by regulators in response to these crises. To that end, we first define metrics to assess the intensity of the capital requirements, we then assess how the intensity in the capital requirements varies with the volatility in financial markets and based on the trends observed in those metrics we put into context the regulatory responses. Our analyses are based on supervisory data on market risk and prudent valuation for the biggest EU banks between Q4-2017 and Q4-2022.

Our motivation for this paper is twofold. First, we want to bring evidence on the dynamics of the regulatory framework in a crisis event by doing an ex-post assessment. We hope that this can serve as a basis for future policy discussions in case of another crisis event materialising. Second, we want to raise supervisory awareness on the functioning of the market risk and prudent valuation frameworks given the materiality of those two frameworks for some important players in the EU.

The remainder of the paper is structured as follows. Section 2 provides an overview of the market risk framework and analyses the impact of the two crises on market risk capital requirements. Section 3 looks at the prudent valuation adjustments in the EU and how they have been affected by the two crises. Section 4 concludes.

[1] The sample consists of all EU banks that have consistently reported good quality data on the market risk requirements between Q4-2017 and Q4-2022.

[2] To note that 2022 global energy crisis coincided with the introduction of the EBA Guidelines on structural FX (EBA, 2020a) in January 2022, which are expected to have a significant impact on market risk capital requirements. In fact, the foreign exchange risk under the standardised approach was the main driver of the total impact in the first quarter of 2022, accounting for more than half of the impact (8.3%).

[3] The sample consists of all EU banks that have consistently reported good quality data on the requirements for prudent valuation between 2018-Q4 and 2022-Q4.

[4] The term “procyclicality” has been widely used to describe the phenomenon in rather negative terms. In this paper, we use the term instead in a neutral manner. Furthermore, in some cases, the term procyclicality has been used to refer to the effect of a measure on the economic cycle (EBA, 2016). In this paper, we use the term in a simpler fashion to refer to the increase in capital requirements when a period of stress kicks-in.

[5] For example, the EBA put forward an extensive set of measures to address and mitigate the adverse systemic economic impact of COVID-19 on the EU banking sector: https://www.eba.europa.eu/coronavirus

2. The market risk framework

2.1 Market risk framework in the EU

During the global financial crisis, many banks experienced significant losses from their trading book positions. These positions were exposed to the risk of losses arising from adverse movements in market prices (e.g. for instruments such as bonds, shares or currencies), commonly known as market risk.

In July 2009, the Basel Committee of Banking Standards (BCBS) published the Basel 2.5 framework, which materially enhanced the capitalisation of market risk (BCBS, 2009). The reforms introduced a stressed value-at-risk requirement as well as an incremental risk capital charge to cover for default risk and migration risk of unsecuritised credit products. Basel 2.5 also removed most securitisation exposures from internal models and, instead, required such exposures to be capitalised as if held in the banking book (i.e. using credit risk rules).

However, Basel 2.5 did not address all the structural shortcomings within the market risk framework. As a result, in January 2019, BCBS published the final standards for market risk framework (BCBS, 2019), known as the Fundamental Review of the Trading Book (FRTB).[6] The core elements of the standards include a revised trading book/banking book boundary, a new more risk-sensitive standardised approach and a new internal model approach that relies on an expected shortfall measure and sets out separate capital requirements for the so-called non-modellable risk factors.

In the EU, under the Capital Requirements Regulation (CRR), which is still based on Basel 2.5[7] for market risk capital requirements, banks are required to compute capital requirements for equity and interest rate risk for their positions in the trading book, and for foreign-exchange and commodity risk for all their positions, regardless of whether these are held in the trading book or in the banking book (EU, 2013; EU, 2019).

To calculate the capital requirements, banks can either use the standardised approach or the internal model approach. Banks may actually use both methods, by employing internal models for some risk classes, and the standardised approach for the remaining ones. Finally, there could be banks using their internal models for all risk classes, but still allowed, or even required, to compute the risk related to some positions by means of the standardised approach. For example, the specific risk linked to funds for which the bank cannot identify the constituents (i.e. it cannot look-through), or positions in securitisations, have to be capitalised in any case under the standardised approach.

The framework also provides for a derogation for banks that have a small trading book business, allowing them to calculate the market risk capital requirements for their trading book business using the credit risk rules.

2.2 Overview of market risk capital requirements

As of Q4-2022, 1086 out of 2806 EU banks in the sample reported positive market risk total risk exposure amount (TREA).[8] Most of the on- and off- balance sheet business subject to market risk is held in the trading book (95.3%), while the remaining 4.6% and 0.1% is related to positions subject to FX risk and commodity risk held in the banking book. On average, the share of market risk TREA to total TREA is small (3.7%), although some banks have a share well above 10% of their total TREA and up to almost 40%.

[6] The 2019 FRTB replaces an earlier version of the standards as published in January 2016 (BCBS, 2016)
[7] The CRR currently incorporates FRTB only as a reporting requirement.
[8] The total risk exposure amount under market risk is the result of the multiplication of the own funds requirements for market risk by 12.5 as set out in Article 92(3) and 92(4) CRR.

As shown in Table 1, the majority of the banks (95.9%) use exclusively the standardised approach (hereafter refer to as ‘ SA banks’), while the remaining banks use a combination of the standardised and internal model approach (hereafter refer to as ‘IMA banks’). Even though only a few banks use the internal model approach, TREA calculated under the internal model covers 53.3% of the total market risk TREA in the EU and 71.5% of the total market risk TREA of IMA banks.

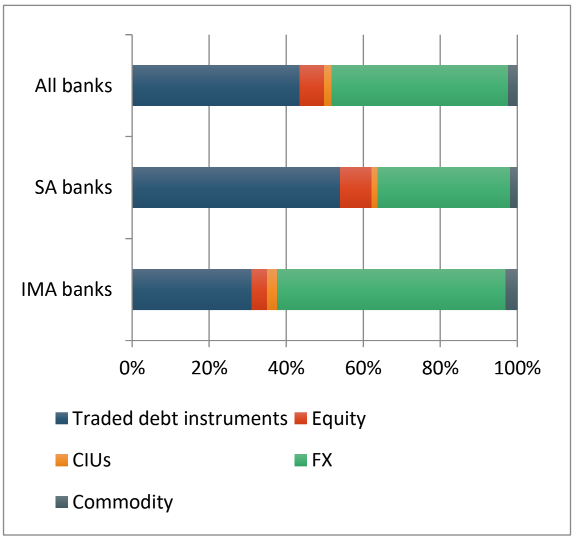
Table 1 Market risk capital requirement, by approach, Q4-2022

	Number of banks	Market risk TREA (EUR bn)	of which: under IMA (EUR bn)	of which: under SA (EUR bn)
IMA banks	45	294.9	210.8	84.1
SA banks	1,041	100.4	-	100.4
Total	1,086	395.4	210.8	184.6

Sources: EBA supervisory data and authors calculations.

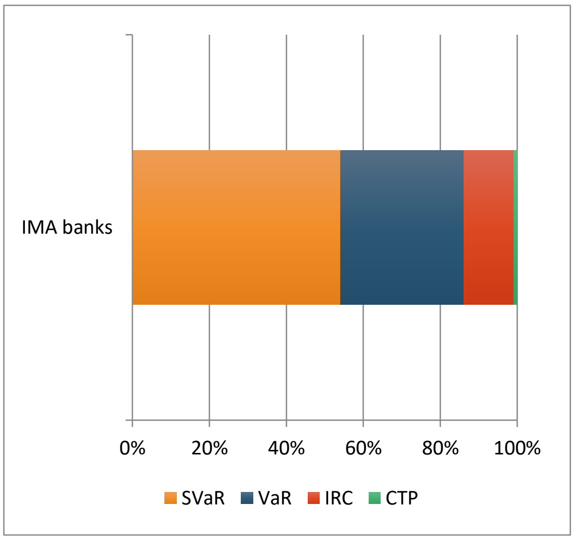
Focusing on the standardised approach, we observe that, on average, a big share of total SA TREA of all banks is related to foreign exchange (45.7%) and traded debt instruments (43.5%), while the remaining risk categories contribute only marginally to the total (Figure 3). A similar pattern is observed for SA and IMA banks, although traded debt instruments are more relevant for SA banks compared to FX, while the opposite is true for IMA banks. Turning to the internal model approach (Figure 4), we observe that the main contributor to total IMA TREA is SVaR (54.1%), followed by VaR (32.0%), IRC (13.1%) and CTP (0.8%).

Figure 3: Breakdown of market risk SA TREA by risk category, Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: CIUs stands for collective investment undertakings

Figure 4 Breakdown of market risk IMA TREA by component, Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: IRC stands for Incremental default and migration risk capital risk charge; CTP stands for all price risks capital charge for correlation trading portfolio

As the regulatory framework significantly differs depending on whether the market risk capital requirements are computed with the standardised or the internal model approach, we discuss the two separately.

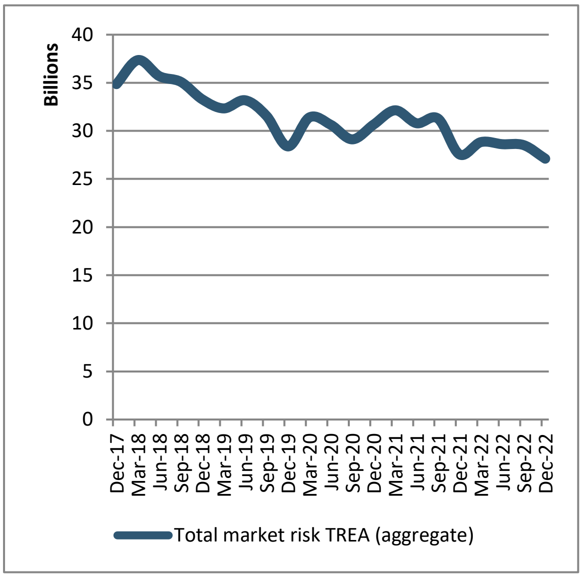
2.3 Standardised approach banks

Banks using the standardised approach calculate capital requirements by applying prescribed methodologies and predefined risk-weights. Those risk-weights are fixed – hence, they do not change with market conditions, i.e. they are independent of whether markets are going through a period of financial stress.

However, a period of financial stress can still have an impact on banks' positions, and accordingly on capital requirements. For example, high-volatility in financial markets may lead banks' hedging techniques to be less effective – less hedged positions naturally trigger higher capital requirements. Or again, a period of financial stress may be accompanied by a liquidity crisis – difficulties for banks in hedging their positions could lead the hedging costs to be higher than the cost of capital, thus, banks may opt for maintaining an overall riskier position and be subject to higher capital requirements. Those changes cannot however be primarily attributed to the functioning of the regulatory framework and, overall, they are not expected to generate a significant and sudden impact in terms of own funds requirements.

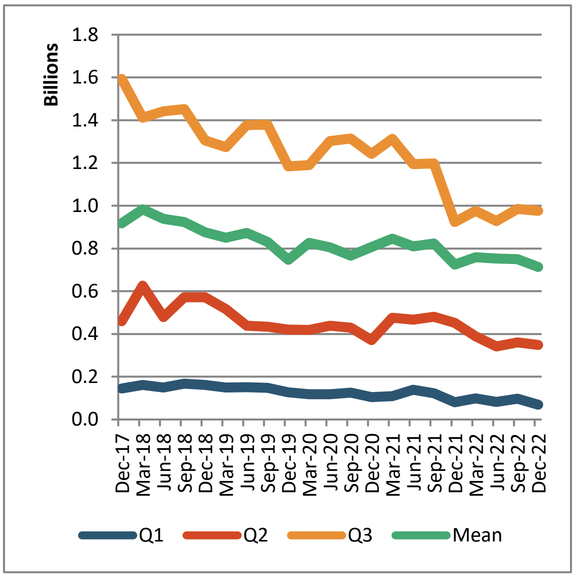
Figure 5 shows the evolution of the aggregate market risk SA TREA from Q1-2017 to Q4-2022 for a sample of 38 SA banks.[9] In Figure 6, we report the distribution of the market risk SA TREA for the same sample of SA banks.

Figure 5: Total market risk TREA (aggregate), SA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: SA only banks use solely the standardised approach to calculate market risk capital requirements.

Figure 6 Distribution of total market risk TREA, SA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: SA only banks use solely the standardised approach to calculate market risk capital requirements.

The aggregated level of market risk TREA for SA banks is far from being a perfect metric to assess the impact of a stress period. In particular, this metric depends on the scope of positions on which it is calculated, i.e. banks' portfolios, that by definition are very dynamic. While acknowledging this, it is worth noting that Figure 5 does not hint to any specific "anomaly" resulting from the Covid-19 pandemic or from the 2022 global energy crisis.

[9] The number of SA banks considered in Figure 5 is significantly lower than the ones presented in Table 1 because we consider a constant sample of banks between Q1-2017 to Q4-2022, which have consistently reported good quality data for market risk during the entire period. We do this to ensure that any changes in TREA are not driven by changes in the sample. Prior to Q4-2020, the EBA did not receive data for most of the medium-sized and small EU banks, which are included in the analysis of Table 1, but are excluded from Figure 5 as no data for the full period considered is available for those. As of Q4-2022, the sample represented 27.0% of the SA TREA of the total population.

In particular, the relative quarter-to-quarter change in Q1-2020, and Q2-2022 is comparable to changes occurred in other quarters from 2017 to 2022.

Naturally, results are even more stable when looking at the median bank (red line in Figure 6), as the measure is less affected by significant changes characterising only a few banks in the sample. More interestingly, we see that both the relative change in Q1-2020, and in Q2-2022 are negative.

To further support our analysis, we investigate the introduction of a metric that would allow us to reduce some of the drawbacks identified by the previous metric, i.e. the level of market risk TREA computed with a standardised approach. In particular, we normalise the latter by the size of the business subject to market risk. In this way, we reduce the impact on the metric related to changes in banks' portfolios, and we can isolate, to a certain extent, the impact on own funds requirements that is due to an increase in financial markets' volatility due to the COVID-19 pandemic or due to the 2022 global energy crisis. In formulas, we introduce the metric:

$$\lambda^{MKT} = \frac{\text{TREA for market risk}}{\text{Size of business subject to market risk}}$$

The metric λ^{MKT} corresponds to the TREA for market risk for one euro of business subject to market risk; in other words, it represents an intensity measure of the TREA for market risk and we denote it with λ – such letter is indeed commonly used to describe parameters that are linked to the intensity of a phenomenon (e.g. intensity function of counting process, decay rates of radioactive elements). Furthermore, since we are interested in its evolution, we make explicit its dependence on time:

$$\lambda^{MKT}(t) = \frac{TREA_{\mathrm{MR}}(t)}{S(t)}$$

where $TREA_{\mathrm{MR}}(t)$ and $S(t)$ denotes the TREA for market risk and the size of business subject to market risk, at time t, respectively.

The metric λ^{MKT} does not allow us to perfectly assess the impact that may be attributed to a hike in financial markets' volatility. Indeed, two portfolios of the same size are typically not subject to the same level of TREA as the latter does not just depend on the size of the portfolio but also on the level of risk taken by the bank owning that portfolio. As a result, a bank that changes its risk strategy over time by moving, for example, to riskier businesses, will automatically see a change in the intensity metric – even without a change in financial markets' volatility. However, significant changes in the risk-appetite are not expected to be that frequent or that fast – hence, quarter-to-quarter changes in the intensity rate λ^{MKT} can be assumed not to be driven by changes in risk appetites.

In accordance with Article 325a of the CRR2 (EU, 2019), the size of the business subject to market risk $S(t)$ is computed by summing up three components: (i) $S_{\mathrm{TB}}(t)$, the sum of the absolute values of long and short positions in the trading book, (ii) $FX_{\mathrm{BB}}(t)$, the net open position in foreign currencies positions in the banking book, to be calculated as prescribed in Article 352 of the CRR, and (iii) $COM_{\mathrm{BB}}(t)$, the commodity risk position in the banking book, to be calculated as prescribed in Articles 357 and 358:

$$S\,(t) = S_{\mathrm{TB}}(t) + FX_{\mathrm{BB}}(t) + COM_{\mathrm{BB}}\,(t)$$

Summing the absolute value of long and short positions does not recognise the hedging effects that may be present between different positions. Such effect is however recognised in the own funds requirements for market risk. Thus, a larger size of business subject to market risk in the sense of CRR2 does not necessarily imply a greater market risk. However, size and risk are in general correlated – and that is why the measure is used to determine whether banks should in the future be allowed to keep using the current Basel II standardised approach (called simplified standardised approach in CRR3 proposal), instead of the new FRTB standardised approach (EC, 2012). While being mindful of its limitations, we employ the CRR2 definition for the purposes of our analysis due its simplicity, given that other ways of measuring the size of the business subject to market risk would also present similar drawbacks.

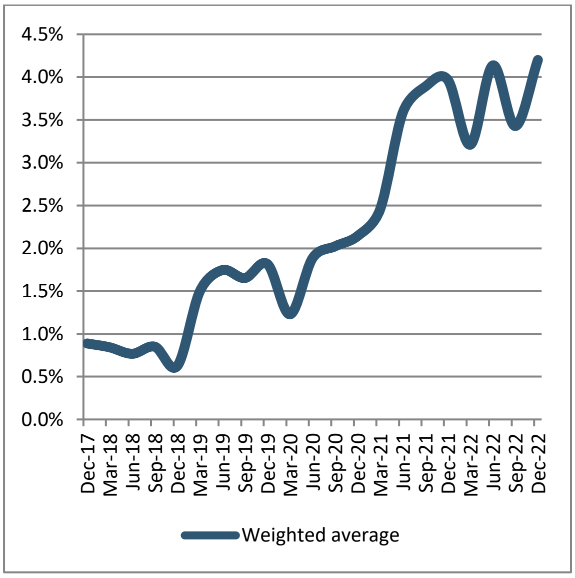
Retrieving the figures corresponding to the TREA for market risk is rather trivial since the data are reported by EU banks via COREP C 02.00. However, since the definition of the business subject to market risk was introduced only via CRR2, the three components (described above) to calculate its size were reported by EU banks only from Q3-2021. Hence, we introduce simplifications and find proxies to finally obtain a measure resembling the size of business subject to market risk over the period of our analysis.

In particular, we set:

$$COM_{\mathrm{BB}}\ (t) = 0$$

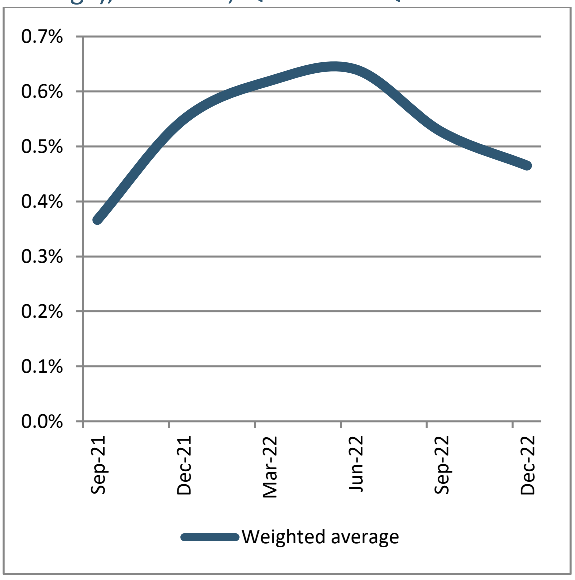
This choice has been made considering that EU banks are generally not exposed to commodity risk, regardless of whether it is held in the trading book or in the banking book. In Figure 7, we show that for SA banks the market risk TREA due to commodities represents an almost negligible share (i.e. around 1-2%) of the total market risk TREA. Moreover, in Figure 8 we show the size of commodity positions held in the banking book as reported from Q3-2021 under the new CRR2 requirements – the figures further confirm that commodity risk in the banking book is negligible.

Figure 7: Share of market risk TREA due to commodities to total market risk TREA (weighted average), SA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: SA only banks use solely the standardised approach to calculate market risk capital requirements.

Figure 8: Share of banking book positions subject to commodity risk to on- and off- balance sheet business subject to market risk (weighted average), SA banks, Q3-2021 – Q4-2022



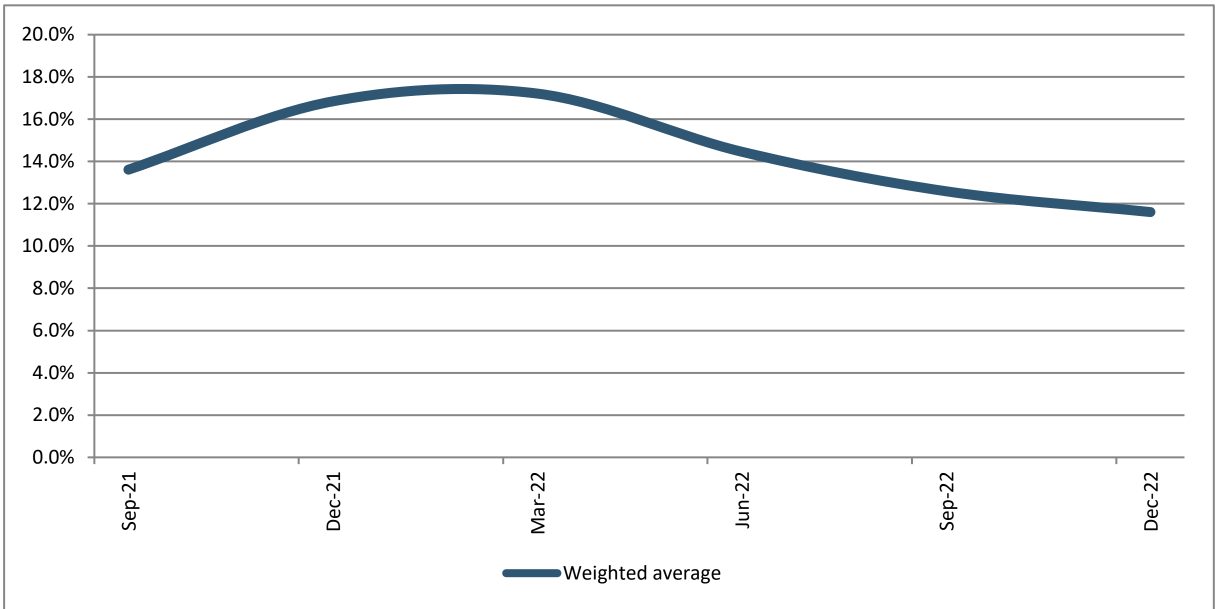
Sources: EBA supervisory data and authors calculations.
Notes: SA only banks use solely the standardised approach to calculate market risk capital requirements.

FX in the banking book is usually material for EU banks, in particular for cross-border groups, providing credit in various currencies. That is why in 2020, the EBA published its final Guidelines on the treatment of Structural FX positions under Article 352(2) of the CRR2 (EBA, 2020a). Those guidelines were published following evidence of a non-harmonised calculation of the FX net open position across EU banks, and consequently, an uneven application of the structural FX provision that specifically targets the FX risk associated to banking book positions. However, standardised approach banks are on average small and medium sized banks, and in most of the cases, they are not cross-border groups. In Figure 9, we show the size of the FX position in the banking book under the new CRR2 reporting requirements, and considering last available data (that are not affected by low data quality issues that are generally present in the newly created reporting requirements), we see that FX in the banking book contributes to around 13% of the size of business subject to market risk. Accordingly, considering that the contribution of FX in the banking book is not particularly material, and that are there are no ways for identifying such contribution before Q3-2021, we decide to set:

$$FX_{\mathrm{BB}}\,(t) = 0$$

This simplification leads to an overestimation of $\lambda^{MKT}(t)$. Nevertheless, we expect that because of this simplification we are not losing much information when analysing the changes in $\lambda^{MKT}(t)$ from quarter to quarter. In particular, as it can be seen from the heat map in Figure 2, the FX risk class was the least volatile among the risk classes in the two quarters that are in our focus. Hence, when assessing whether the volatility observed during the COVID-19 period or the 2022 global energy crisis affected $\lambda^{MKT}(t)$, we do not expect FX risk to be a major driver of those potential changes.

Figure 9: Share of banking book positions subject to foreign exchange risk to on- and off- balance sheet business subject to market risk (weighted average), SA banks, Q3-2021 – Q4-2022



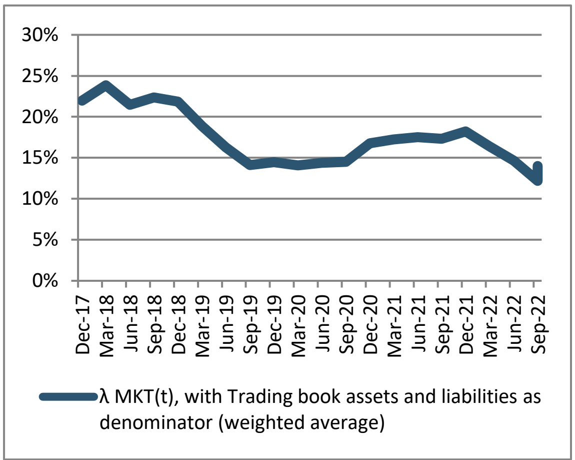
Sources: EBA supervisory data and authors calculations.

Regarding $S_{TB}(t)$, while the definition of trading book in prudential terms (under Article 325a CRR) is not the one used in the accounting context, the two frameworks generally lead to very similar results in terms of instruments' allocation to the relevant book. We can thus proxy the size of the prudential trading book, $S_{TB}(t)$, with the size of the accounting trading book as reported under FINREP. In particular, in templates F01.01 and F01.02, banks report respectively the amount of assets and liabilities held for trading. We indicate with $S_{TB}^{ACC}(t)$ the size of the accounting trading book. As a result, we set:

$$\lambda^{MKT}(t) = \frac{TREA_{\mathrm{MR}}(t)}{S_{TB}^{ACC}(t)}$$

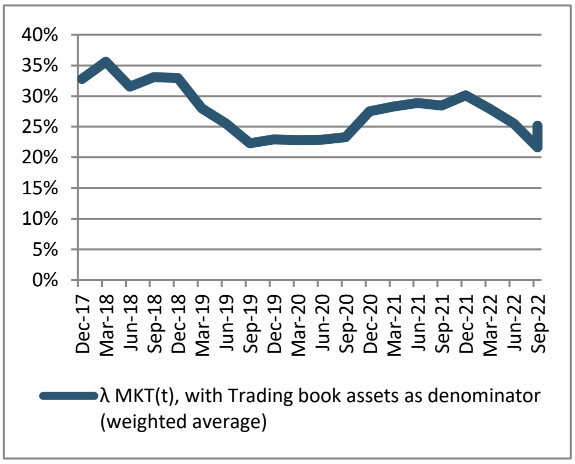
In Figure 10, we show the evolution of $\lambda^{MKT}(t)$ over time for SA banks. As highlighted above, we focus on the changes affecting $\lambda^{MKT}(t)$ over a short period, i.e. quarter by quarter. Similarly to what we observed when considering the level of market risk TREA, we see that $\lambda^{MKT}(t)$ is stable between Q4-2019 and Q1-2020, and even decreases between Q4-2021 and Q1-2022. For completeness, Figure 11 shows the evolution of $\lambda^{MKT}(t)$, where instead only the assets held in the trading book are used as the denominator for the intensity measure, and we observe a similar pattern.

Figure 10: $\lambda^{MKT}(t)$ considering total assets and liabilities held for trading as the denominator (weighted average), SA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

Figure 11: $\lambda^{MKT}(t)$ considering total assets held for trading as the denominator (weighted average), SA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

As mentioned above, the design of the regulatory framework for the standardized approach is such that banks are not expected to see significant changes when moving from a period of "calm" to a period of stress. The results shown clearly corroborate, from an empirical perspective, what was expected from a theoretical point of view.

The fact that regulators decided to not introduce any specific measure in relation to the standardized approach, neither in the context of the COVID-19 pandemic, nor following the 2022 global energy crisis does not come therefore as a surprise. On the contrary, the ex-post figures reported above show that any relief measure that regulators could have introduced would have been de-facto unjustified.

It should be noted that, although the standardised approach under the FRTB framework is very different when compared to the Basel II framework, the same overarching principles apply. In particular, a set of risk factors and corresponding risk weights is provided, and no significant changes are expected in the capital requirements when a stress period kicks-in. In other words, the new standardised approach under FRTB framework is not expected to be more procyclical than the current framework and to behave differently under a period of stress.

2.4 Internal model approach banks

The own funds requirements for positions under an internal model approach are expressed as follows (Article 364 CRR):[10]

$$\mathrm{OFR_{MR}(t)} = \max\left(\mathrm{VaR_{t-1}};\, \mathrm{m_c}\cdot \mathrm{VaR_{avg_t}}\right) + \max\left(\mathrm{sVaR_{t-1}};\, \mathrm{m_s}\cdot \mathrm{sVaR_{avg_t}}\right) + \mathrm{IRC} + \mathrm{CTP}$$

Where:

[10] As an example, let $\mathrm{VaR_{t-1}} = \mathrm{EUR\ 20\ million}$, $\mathrm{VaR_{avg}} = \mathrm{EUR\ 25\ million}$, $\mathrm{m_c} = 4$, $\mathrm{sVaR_{t-1}} = \mathrm{EUR\ 50\ million}$, $\mathrm{sVaR_{avg}} = \mathrm{EUR\ 55\ million}$, $\mathrm{m_s} = 4$, IRC = EUR 50 million and CTP = 0. The $\mathrm{OFR_{MR}(t)} = \max(20; 4*25) + \max(50; 4*55) + 50 + 0 = 100 + 220 + 50 = \mathrm{EUR\ 375\ million}$.

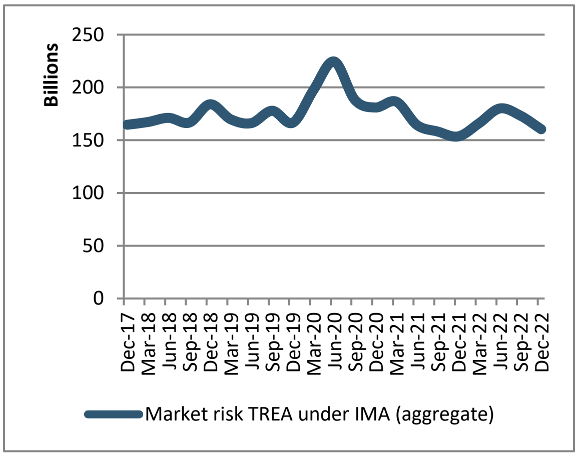
- VaR_{t-1} is the value-at-risk at the previous day calibrated over the last twelve months period[11] over a 1-day horizon and with a 99% confidence level,
- $sVaR_{t-1}$ is the stressed value-at-risk at the previous day, i.e. the value-at-risk calibrated on a period of financial stress, over a 1 day horizon and with a 99% confidence level,
- VaR_{avg_t} and $sVaR_{avg_t}$ their averages over the previous sixty business days,
- m_c and m_s are multipliers floored at 3. They can be expressed as $3 + m_{qualitative} + m_{quantitative}$, being $m_{qualitative}$ an add-on imposed by the competent authority in case of deficiencies in the model, $m_{quantitative}$ an add-on determined on the basis of the number of overshootings observed when performing the backtesting of the actual and hypothetical P&Ls[12] figures against VaR_{t-1}. $m_{qualitative}$ can differ for m_c and m_s, $m_{quantitative}$ is instead the same;
- IRC is the incremental risk charge capturing default risk in the trading book;
- CTP are the own funds requirements for the correlation trading portfolio.

In this paper we focus on the first two terms, i.e. those not relating to the incremental risk charge and the correlation trading portfolio, and we especially highlight that the first term requires a calibration on the last twelve months period, and the second term requires instead a stress period calibration.

In Figure 12, we show the level of market risk TREA calculated with the internal model approach by IMA banks. The level shows an increase of around 35% in Q2-2020, and an increase of around 17% in Q2-2022.

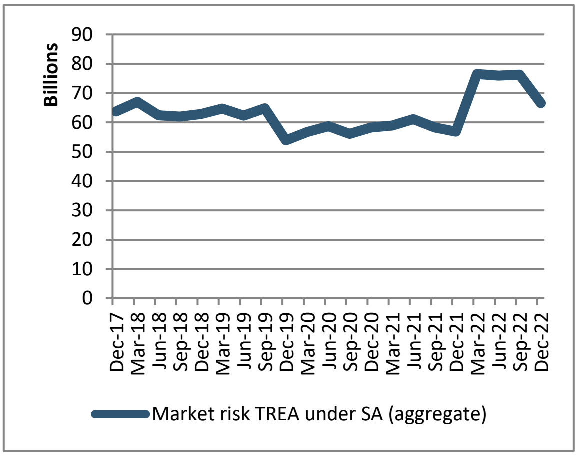
Some banks have the permission to use their internal models only in the context of some risk classes. In addition, as mentioned before, even if the bank uses the internal models for all risk classes, it may still be allowed, or even required, to compute the risk related to some positions by means of the standardised approach. In Figure 13 we report the level of market risk TREA computed with the standardised approach by IMA banks. As expected on the basis of the arguments and figures presented in the previous section dealing specifically with SA banks, the level of market risk TREA computed with a standardised approach for IMA banks is rather stable in Q1-2020.

Figure 12: Market risk TREA under IMA (aggregate), IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

Figure 13 Market risk TREA under SA (aggregate), IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

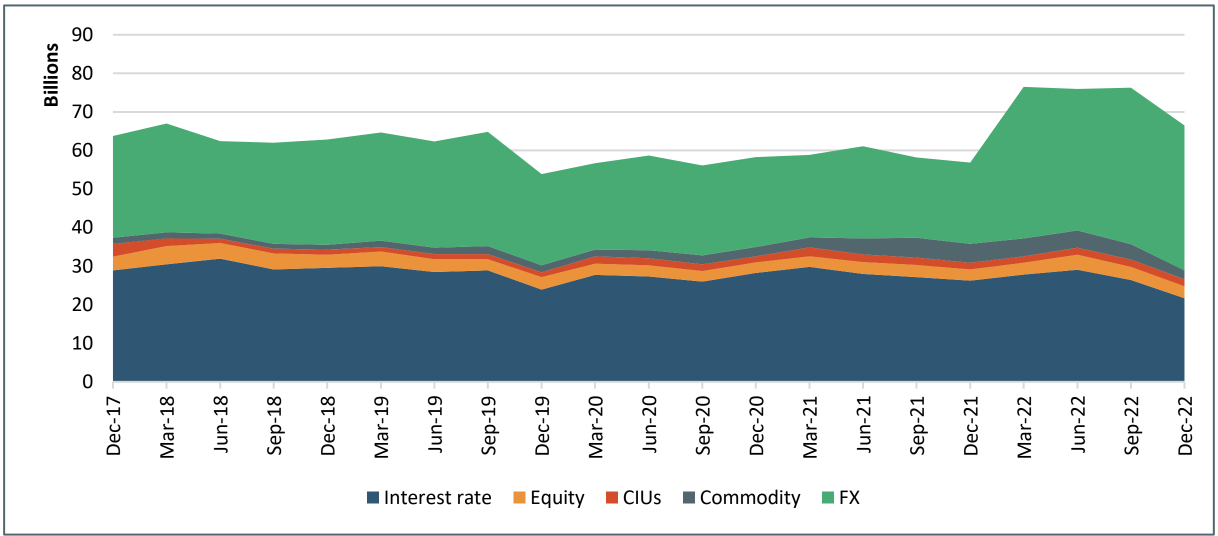
However, an important increase is observed in Q1-2022. Nevertheless, that increase is not resulting from the 2022 global energy crisis, but from the entry into application of the EBA Guidelines on Structural FX under Article

[11] To note that there must be an effective 1-year period – hence, weighting schemes de-facto shortening the effective calibration period are not allowed.

[12] Respectively, the P&L including intra-day trading, and the P&L assuming the portfolio frozen, i.e. where changes in the portfolio's value are only due to changes in market data.

252(2) (EBA, 2020a). This is evident in **Error! Not a valid bookmark self-reference.**, where we show that the increase in Q1-2020 is only driven by the FX risk class. It should be noted that such an important increase was not observed for SA banks (see Figure 5), as typically the structural FX provisions is mostly relevant for cross-border banks that in most of the cases are IMA banks.

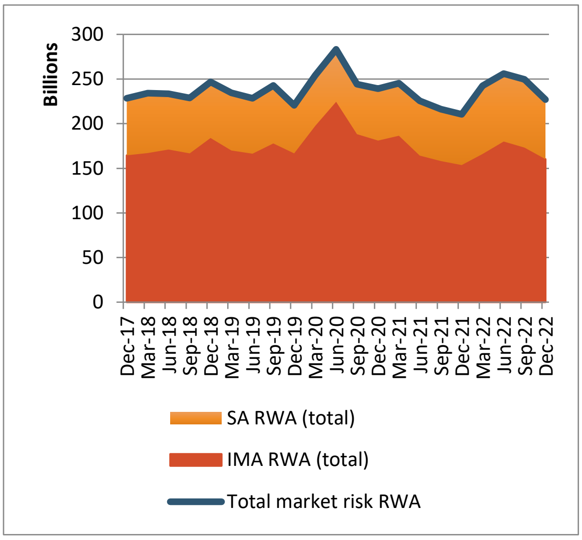
Figure 14 Market risk TREA (aggregate) under the standardised approach broken down by risk category, IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

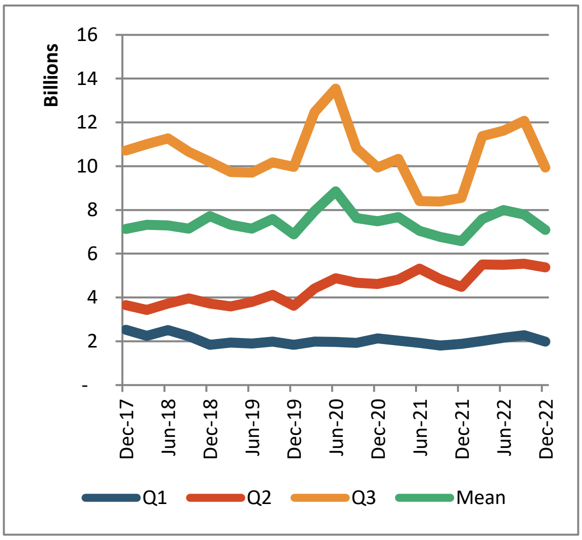
For completeness, in Figure 15 and Figure 16, we report the aggregated level of the total market risk TREA for IMA banks, as well as the distribution across banks. The aggregate level resembles the pattern observed for the market risk TREA calculated with the internal model approach.

Figure 15: Total market risk TREA broken down by approach, IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

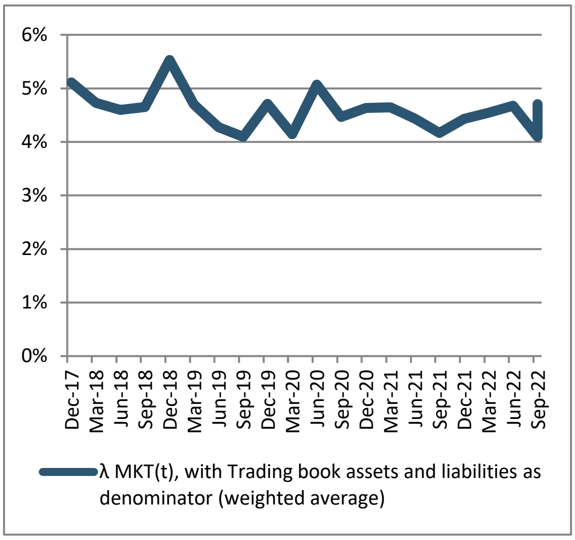
Figure 16 Distribution of total market risk TREA, IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

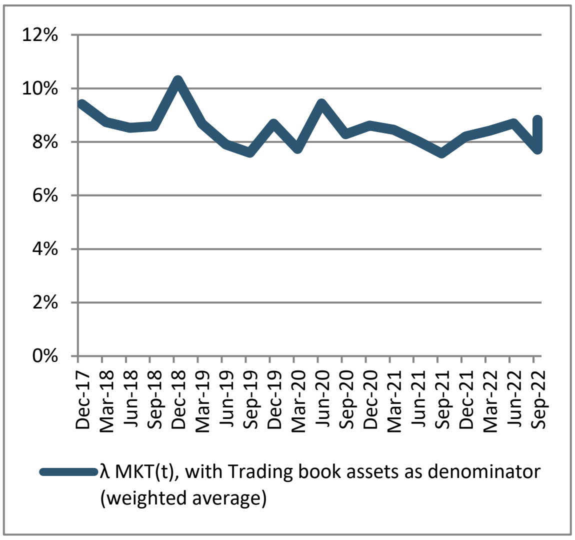
In principle, we could make again an assessment of the procyclicality based on $\lambda^{MKT}(t) = \lambda^{MKT}(t) = \frac{OFR_{\mathrm{MR}}(t)}{S_{TB}^{ACC}(t)} = \frac{IMA(t)+SA(t)}{S_{TB}^{ACC}(t)}$ as defined in the previous section – we report its value over time in Figure 17 and Figure 18 for IMA banks.

Figure 17: $\lambda^{MKT}(t)$ considering total assets and liabilities held for trading as the denominator (weighted average), IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

Figure 18: $\lambda^{MKT}(t)$ considering total assets held for trading as the denominator (weighted average), IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

However, for IMA banks, $S_{TB}^{ACC}(t)$ includes both positions capitalised with the internal model approach and positions capitalised with the standardised approach, and our objective is to analyse the effect of the internal model approach only. Furthermore, as we have seen, for IMA banks, the size of FX risk in the non-trading book is material, i.e. we cannot conclude that $FX_{\mathrm{BB}}(t) = 0$.

We therefore introduce two alternative measures to assess the potential procyclicality in the internal model framework. The first measure is defined as follows:

$$\lambda^{IMA}(t) = \frac{VaR_{t-1}}{sVaR_{t-1}},$$

The $sVaR_{t-1}$ is the VaR calibrated on the period maximising the VaR itself – such period is therefore a period of stress. Typically, it is a period between 2007 and 2008 catering for the volatility observed during the global financial crisis. Banks are required to update that stress period at least on a yearly basis, and even when updated, the new stress period usually varies only for some days or weeks from the previous one[13]. We can therefore assume that changes in $sVaR_{t-1}$ are only due to changes in the underlying portfolio. Instead, VaR_{t-1} reflects the changes in the underlying portfolio as well as the changes in the calibration period that is rolling (i.e. the last 12 months period). Given that VaR_{t-1} and $sVaR_{t-1}$ are based on the same portfolio, we can think of $\lambda^{IMA}(t)$ as a metric informing us on the intensity of the current period (i.e. the last 12 months period) compared to the stress period.

[13] This was particularly true before the COVID-19 pandemic. After the COVID-19 pandemic, the stress period identified by banks may either be that covering the global financial crisis or, although more rarely, the COVID-19 pandemic – hence, the period can vary from one update to the other.

In addition, considering that the VaR_{t-1} and $sVaR_{t-1}$ contribute to the capital charge as follows: $\max\left(\mathrm{VaR}_{t-1}; \mathrm{m_c} \cdot \mathrm{VaR}_{\mathrm{avg}_t}\right) + \max\left(\mathrm{sVaR}_{t-1}; \mathrm{m_s} \cdot \mathrm{sVaR}_{\mathrm{avg}_t}\right)$ and that usually, due to the multipliers $\mathrm{m_c}$ and $\mathrm{m_s}$, the terms corresponding to the maximum are respectively $\mathrm{m_c} \cdot \mathrm{VaR}_{\mathrm{avg}_t}$, and $\mathrm{m_s} \cdot \mathrm{sVaR}_{\mathrm{avg}_t}$, we also consider a second measure as follows:

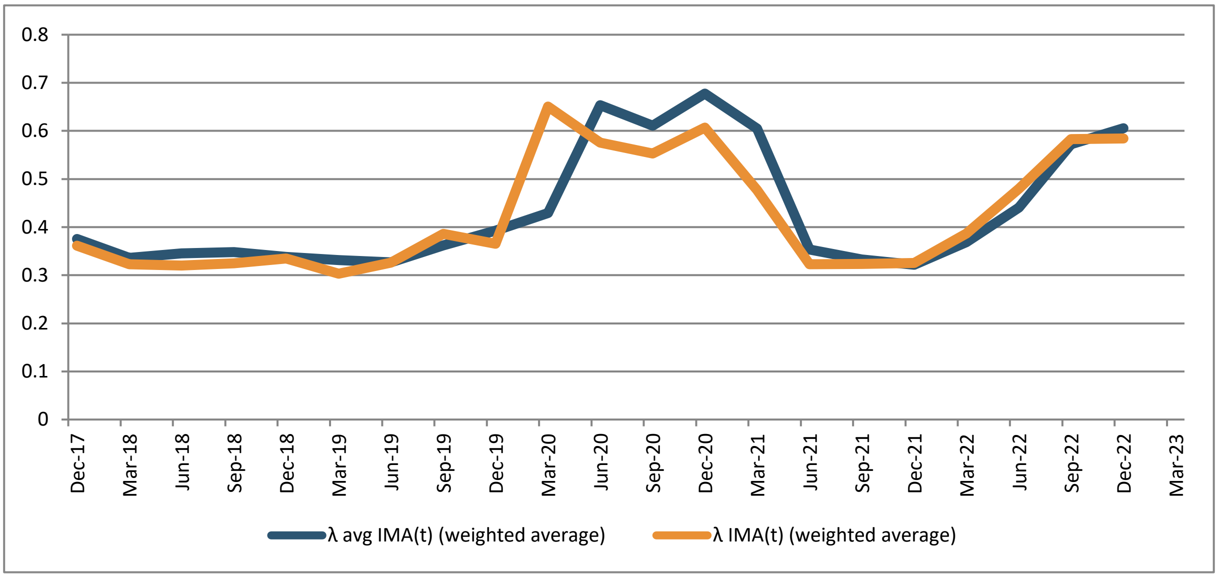
$$\lambda_{avg}^{IMA}(t) = \frac{VaR_{avg_t}}{sVaR_{avg_t}}$$

Having introduced these two measures, we first look at their trends and compare the shape of the measures during the COVID-19 period and the 2022 global energy crisis, and then put into context the extraordinary regulatory measures that were taken by EU bodies.

In Figure 19, we show the level of $\lambda^{IMA}(t)$ and $\lambda_{avg}^{IMA}(t)$ over time, while in Figure 20 and Figure 21, the decomposition of each by its numerator and denominator. As explained above, VaR_{t-1} is calibrated on the last twelve months period. When a period of stress kicks in, like the one observed during the COVID-19 crisis, the time series that are used to calibrate the shocks applicable to the risk factors in VaR begin to gradually include observations that are reflective of the turbulence in the financial markets. As a result, with some delays with respect to the start of that turbulence, a significant increase in the value of VaR_{t-1} is expected to be observed. As a direct consequence, a significant increase in the value of VaR_{avg} is also observed with an additional delay compared to the increase in VaR_{t-1}, as the former is an average over the previous sixty business days of the latter.

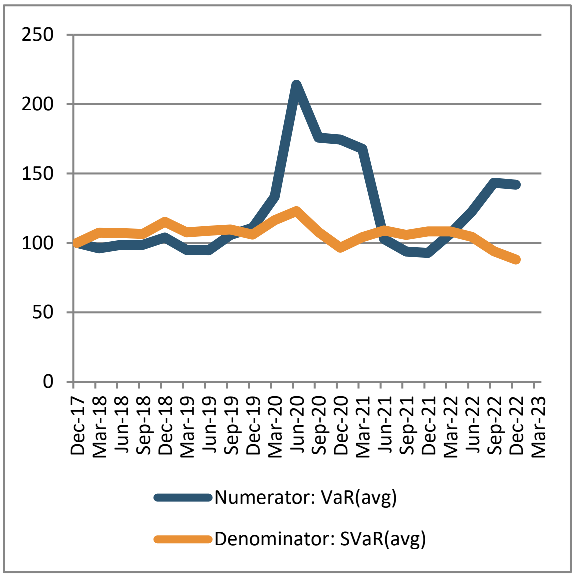
Accordingly, as expected, we see that when a period of financial stress kicks in $\lambda^{IMA}(t)$ and $\lambda_{avg}^{IMA}(t)$ increase. Furthermore, $\lambda_{avg}^{IMA}(t)$ does so with a delay compared to $\lambda^{IMA}(t)$, given that the latter is a one point in time measure, and the former instead is an average on past days. Naturally, also the peak of capital requirements is reached with a delay compared to the peak in VaR – as it can be seen observed in Figure 12 and Figure 19 jointly.

Figure 19: $\lambda^{IMA}(t)$ and $\lambda_{avg}^{IMA}(t)$ (weighted average), IMA banks, Q4-2017 – Q4-2022



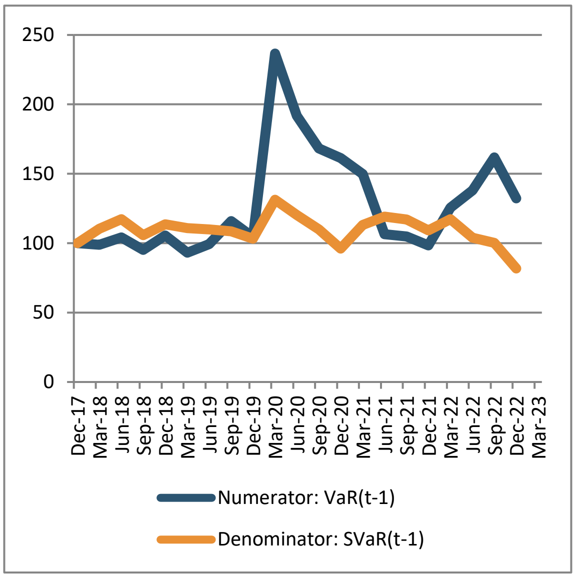
Sources: EBA supervisory data and authors calculations.

Figure 20: Numerator and denominator of $\lambda^{IMA}(t)$ (index: Q4-2017 = 100), IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

Figure 21: Numerator and denominator of $\lambda_{avg}^{IMA}(t)$ (index: Q4-2017 = 100), IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

The positive relation between our intensity measures and the volatility in the financial markets is also confirmed by looking at their correlation with the VSTOXX. Over the period Q4-2017 to Q4-2022, the (quarterly average) correlation of the VSTOXX with $\lambda^{IMA}(t)$ and $\lambda_{avg}^{IMA}(t)$ was statistically significant standing at 0.76 and 0.64, respectively.[14]

While the intensity measures reach a similar level in 2020 and in 2022, the speed at which that level is reached is very different. During COVID-19, the peak is reached in a single quarter. Instead, the curve is much smoother in 2022. The speed at which a period of stress kicks-in has important consequences in terms of capital requirements. In particular, as mentioned, banks must determine the multiplier $m_{quantitative}$ by comparing a 1-day P&L against the Value-at-risk calculated on the previous day (VaR_{t-1}): the more times the losses exceed the VaR, the higher is $m_{quantitative}$. However, the 1-day P&L captures immediately any new stress in the market. Instead, the VaR measure does so gradually, being a measure calibrated on 1-year data.

More concretely, when a stress period kicks-in at a very fast pace, the VaR reflects an old market regime (i.e. that previous to the stress). Instead, the P&Ls fully reflect the new market conditions without any delay. Accordingly, the bank suffers of overshootings that are not due to model deficiencies, but rather due to the design of the regulatory framework. This is exactly what happened at the outbreak of the COVID-19 pandemic – European banks saw losses exceeding their VaR[15] for several days due to a change in regime. As a result, banks saw a sudden increase in the multiplier $m_{quantitative}$ from one quarter to the other.

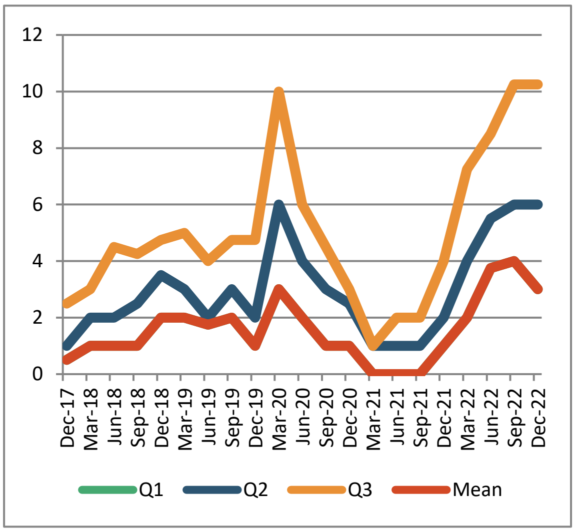
Hence, the argument that the overshootings were not due to model deficiencies was valid, given the speed at which the stress period kicked in, and that is why in June 2020, the legislators decided to introduce a targeted and temporary measure known as "quick fix" allowing banks, subject to competent authority's permission, to

[14] Statistical significance was assessed using the t-statistic $t = \rho \times \sqrt{n-2}/\sqrt{1-\rho^2}$, where ρ is the correlation coefficient and n the number of observations.
[15] Overshooting were observed both when comparing the VaR against the actual and against the hypothetical changes.

exclude overshootings that occurred between 1 January 2020 and 31 December 2021 that were not due to model deficiencies (Figure 22). [16,17]

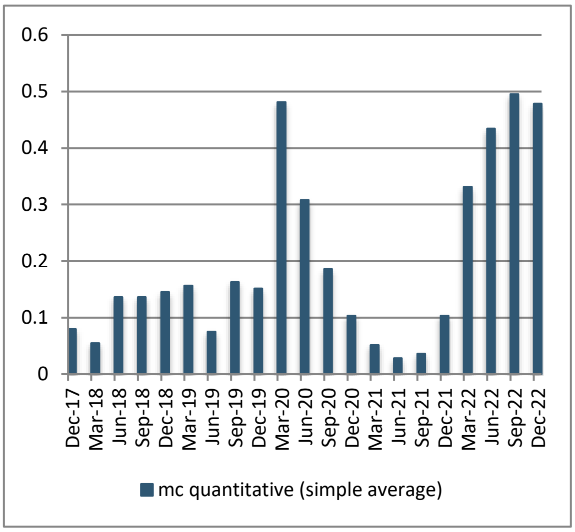
In Figure 23, we show the trend of the quantitative add-on $\mathrm{m}_{\mathrm{quantitative}}$ resulting from back-testing. We see an important increase between Q4-2019 and Q1-2021, as well as the effect of the targeted relief from Q2-2020. Without such regulatory measure, we expect that the add-on would have been even higher in Q2-2020 than it was in Q1-2020.

Figure 22: Distribution of number of overshootings, IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

Figure 23: $m_{quantitative}$, simple average, IMA banks, Q4-2017 – Q4-2022

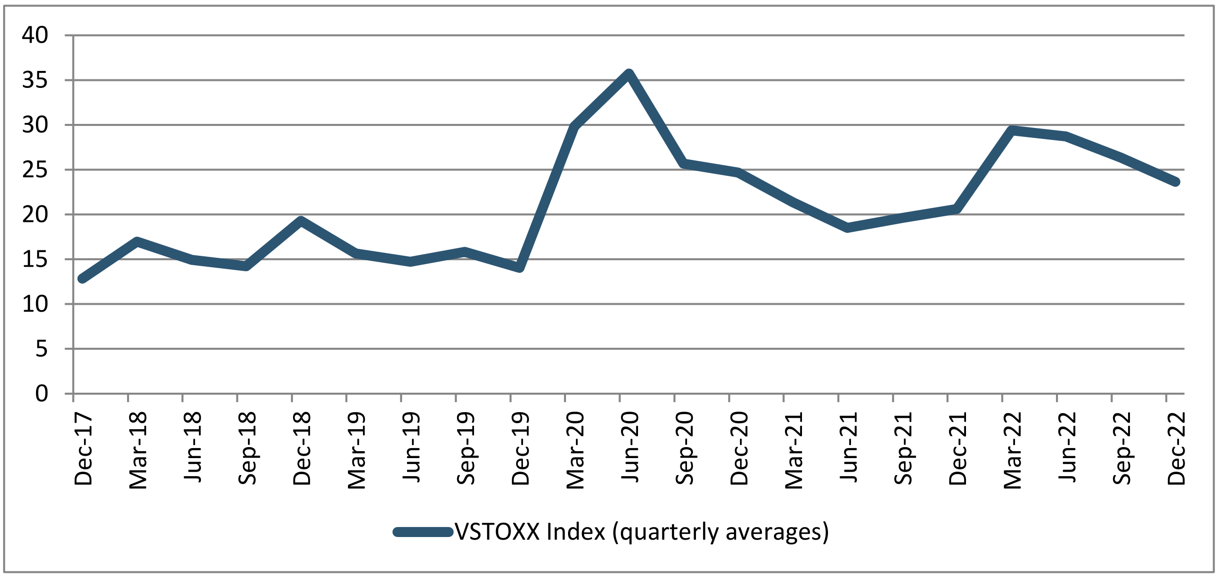


Sources: EBA supervisory data and authors calculations.

Instead, the increase in $\lambda^{IMA}(t)$ is much less abrupt in 2022 compared to 2021 (see Figure 19). This is consistent with the information that we obtain observing the VSTOXX over the two periods. We also note that by computing the average of the VSTOXX value in a given quarter (see Figure 24), the levels observed during 2020 and 2022, while being different, are not so distant – however, as it can be seen by the daily values reported in Figure 1, their distribution is very different, with the Covid-19 period presenting peaks that can only be found back in the global financial crisis. The argument that over-shootings observed in 2022 are not due to model deficiencies is therefore weaker given that the VaR and the P&Ls against which the VaR is back-tested do not reflect two completely different market regimes. Accordingly, also the argument that during that period, the regulatory framework was triggering effects that were excessively procyclical was weaker as de-facto the framework worked as intended. The decision therefore to not introduce temporary relief measures equivalent to those adopted during the COVID-19 crisis appears to be sound and risk-based, and it signalled that supervisors were overall satisfied with a framework characterised by some embedded procyclicality, as long as this was not undue from a mathematical point of view - or in the wording used so far, excessive.

[16] The temporary measure has been introduced as part of a package of targeted amendments to the capital requirement regulation, known as CRR quick fix (EU, 2020b).
[17] On 22 April 2020, the EBA also noted this issue and noted that supervisors could reduce the qualitative add-on (EBA, 2020b).

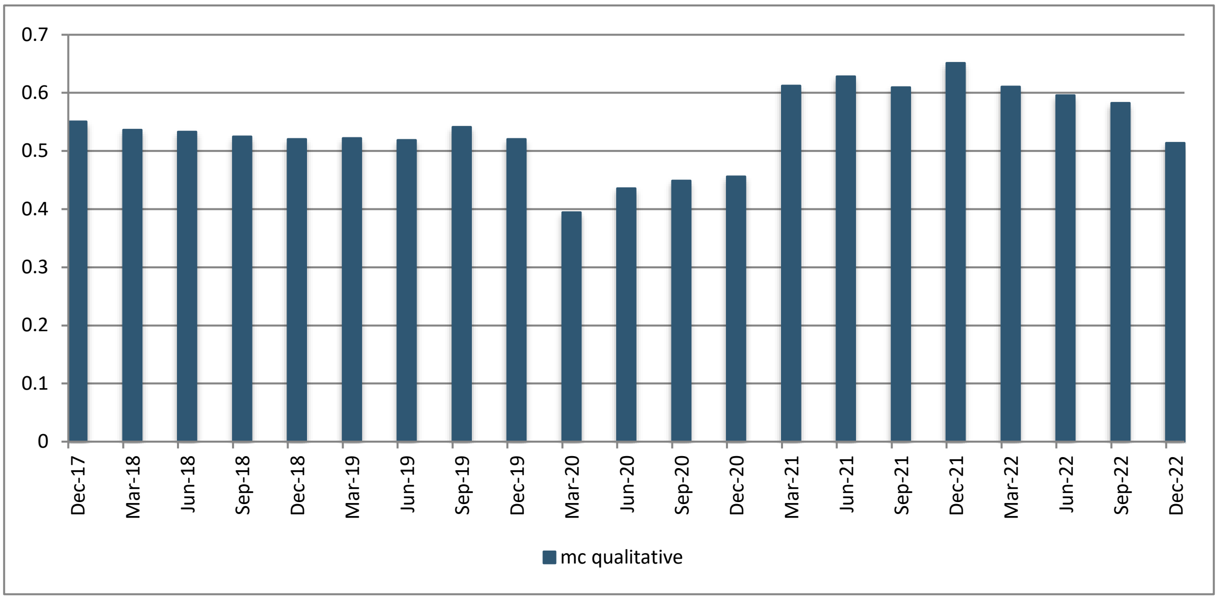
Figure 24 EURO STOXX 50 Volatility Index (VSTOXX), quarterly frequency, January 2000 – December 2022



Sources: Bloomberg and authors calculations.

While the regulatory responses, as shown, have been adequate and risk-based, some lessons learnt should lead to an improvement in the functioning and the effectiveness of the regulatory framework. First, in a crisis, the timing dimension is of utmost importance. It took around four months for introducing the targeted measures in CRR – an extremely short timeframe for those familiar with the average duration of the EU legislative process. The circumstances would have justified, however, an even quicker response. In the absence of those targeted amendments, competent authorities had to fully use the limited space of maneuver that they were left with – for example, from Figure 25, it appears that competent authorities decided to reduce $\mathrm{m_{qualitative}}$ to the minimum observed over the years. However, such relief was only possible for banks with positive $\mathrm{m_{qualitative}}$, i.e. only those presenting deficiencies. In other words, banks not presenting deficiencies and hence characterised by a $\mathrm{m_{qualitative}} = 0$ could not benefit from this measure, leading to concerns about the level playing field across EU banks. Looking at Figure 25, it is also clear that competent authorities re-increased the level $\mathrm{m_{qualitative}}$ once the targeted amendments to the capital regulation were adopted. Second, while the provision to discard overshootings removed an element of excessive procyclicality, the capital requirements still increased as a result of the financial stress, simply because the VaR increased. This signaled that the regulators allowed the relaxation of the capital requirements only to the extent that the regulatory framework could not be considered to function as designed.

Figure 25: mc qualitative, IMA banks, Q4-2017 – Q4-2022



Sources: EBA supervisory data and authors calculations.

EU legislators made a crucial step towards structurally solving the above issues as part of the on-going legislative process amending the capital requirement regulation (known as the CRR3 proposal). As regards the first issue, in implementing the Basel III reforms, and more specifically, the FRTB rules, the legislators suggest that competent authorities be empowered to discard an overshooting resulting from back-testing, should extraordinary circumstances – like those observed during the Covid-19 crisis – occur. Having this power directly included in Union law ensures that, should similar circumstances occur again, the supervisory response can be quick and effective, without the need of legislative changes. In relation to the second issue, it should be noted that, under the FRTB rules, own funds requirements are de-facto calibrated on a stress period directly. Accordingly, the multiplier resulting from back-testing ($\mathrm{m}_{\mathrm{quantitative}}$) will multiply a stressed risk-measure that is therefore expected to be rather stable to changes in current market volatility. Having a risk-measure directly calibrated on a stress ensures that banks hold sufficient capital in a crisis time, while at the same time it does not create a situation where banks see an increase in capital costs in times of crisis.

As a result, the main elements of procyclicality in the current regulatory framework will be removed following the Basel III implementation, making the capital requirements less sensitive to sudden changes in market regimes.

3. Prudent valuation adjustments

3.1 Prudent valuation framework in the EU

The global financial crisis has shown that the accounting values of financial instruments, especially for illiquid positions, embed a significant degree of uncertainty. Banks are therefore exposed to the risk of incurring losses when the fair value estimates for their assets are higher than the "true" price they would obtain if they were to sell those assets. This potential source of risk due a difference between the fair value and the "true" tradeable price is known as valuation risk.

Valuation risk can arise in a number of market conditions unrelated to stressed periods, for example in markets with low trading levels where daily prices are difficult to obtain. It can also be affected by the characteristics of the financial instruments being valued (e.g. complexity of payoffs, absence of readily available market prices that can guide valuation), the trading environment (e.g. the market's depth and breadth) and the characteristics of the holder of the financial instruments (e.g. where the holder has a significant share of overall open market position) or of the counterparties of such financial instruments (e.g. CVA).

As a result, in its June 2004 Basel II framework, BCBS provided banks with guidance on prudent valuation for positions in the trading book (BCBS, 2004). This included a set of requirements in terms of systems and controls, valuation methodologies and valuation adjustments or reserves. In July 2009, in the wake of the 2007/2008 crisis, the BCBS extended the scope of its prudent valuation guidance to all positions subject to fair value accounting. It also opened the way for regulators to require additional valuation adjustments (AVAs) to the current accounting values, particularly where there is uncertainty in the valuation of a position due to illiquidity (BCBS, 2009) .

In the EU, the CRR and the Commission Delegated Regulation (EU) No 2016/101 with regards to regulatory technical standards for prudent valuation under Article 105(14) (EU, 2015) – hereafter referred to as the 'RTS on Prudent Valuation' – provides a framework for the application of the prudent valuation standards to institutions.[18] The requirements set out in these regulations go beyond those established by the BCBS, providing a detailed methodology on how to estimate AVAs and how these are to be translated into deductions from capital (see Figure 44 in the Annex for a summary).

Under this framework, all fair-valued positions, regardless of whether they are held in the trading book or non-trading (banking) book, are subject to prudent valuation requirements.[19] Specifically, institutions should calculate AVAs to adjust the fair value of their positions to a 'prudent' value, which achieves '*…an appropriate degree of certainty having regard to the dynamic nature of trading book positions, the demands of prudential soundness and the mode of operation and purpose of capital requirements in respect of trading book positions'* (Article 105 of the CRR). The amount of these AVAs should then be deducted from Common Equity Tier 1 (CET1) capital (Article 34 of the CRR).

The framework consists of two approaches for calculating individual and aggregated AVAs:

[18] These regulations build on to the EBA's work on prudent valuation. In November 2012, the EBA has published a Discussion Paper (DP) to gather stakeholders' opinions at an early stage on the development of the regulatory technical standards (RTS) on prudent valuation adjustments. In July 2013, the EBA published a Consultation Paper (CP) taking into account the responses received during the DP. The CP was also accompanied by a Quantitative Impact Study (QIS) to assess the impact of the draft RTS. The final draft RTS were published in March 2014 and updated in January 2015.

[19] Fair-valued assets and liabilities for which a change in accounting valuation has a partial or zero impact on CET1 capital, are included in the scope of the prudent valuation requirements only in proportion to the impact of the relevant valuation change on CET1 capital.

- **Simplified approach**: This approach is optional for institutions with smaller fair value portfolios. Article 4 of the RTS on Prudent Valuation sets out an eligibility threshold of EUR 15 billion on the sum of the absolute value of fair-valued assets and liabilities, below which an institution is allowed, but not obliged, to use this approach.[20,21] The calculation of AVAs under the simplified approach is performed as 0.1% of the eligibility threshold amount.
- **Core approach**: This is the default approach and is commonly used by institutions with larger fair value portfolios. The calculation of AVAs is first performed at category level for nine different categories of valuation adjustments: market price uncertainty, close-out costs, unearned credit spread, investing and funding costs, concentrated positions, future administrative costs, early termination, operational risk (Articles 9 to 17 of the RTS on Prudent Valuation). Within each category, individual AVAs are calculated as the excess of valuation adjustments required to achieve the prudent value over any fair value adjustments. The prudent value should be based on market data (Article 3 of the RTS on Prudent Valuation). Where sufficient data exists, a fully quantitative approach should be used, while, where those are insufficient, an expert-based approach may be used. In both cases, a 90% level of certainty needs to be achieved. These AVAs are then aggregated at category level based on a simple sum, except for certain categories (market price uncertainty, close-outs costs, unearned credit spread), where some diversification benefits may be recognised (Articles 9(6), 10(7) and 11(6) of the RTS on Prudent Valuation).[22] The calculation of AVAs at aggregated level is finally obtained as a simple sum of the category level AVAs. Where for certain positions the calculation of individual AVAs based on the application of Articles 9 to 17 of the RTS on Prudent Valuation is not possible, the core approach provides for a 'fall-back' approach, which considers the unrealised profit and the notional amount of the financial instruments related to these positions (Article 7(2)(b) of the RTS on Prudent Valuation).

3.2 Overview of requirements due to prudent valuation

This section provides an overview of the scope of prudent valuation adjustments and the corresponding AVAs for EU banks. The analysis is based on a sample of 833 banking groups and stand-alone banks reporting at the highest level of EEA consolidation with good quality data.

As of Q4-2022, around EUR 9.1 trillion of fair-valued assets and liabilities are subject to prudent valuation adjustments (Figure 26).[23] This accounts for 91.8% of the total fair-valued assets and liabilities held by EU banks (EUR 9.9 trillion), with the remaining positions excluded because of zero or partial impact on CET1 capital. The excluded positions are mainly related to exactly matching, offsetting fair-valued assets and liabilities (EUR 566.5 billion), followed by hedge accounting (EUR 152.2 billion) and positions subject to other adjustments (EUR 72.6 billion). On the other hand, the prudential filters play only a minor role for excluding fair-valued assets and liabilities from the scope of prudent valuation adjustments (EUR 20.0 billion).

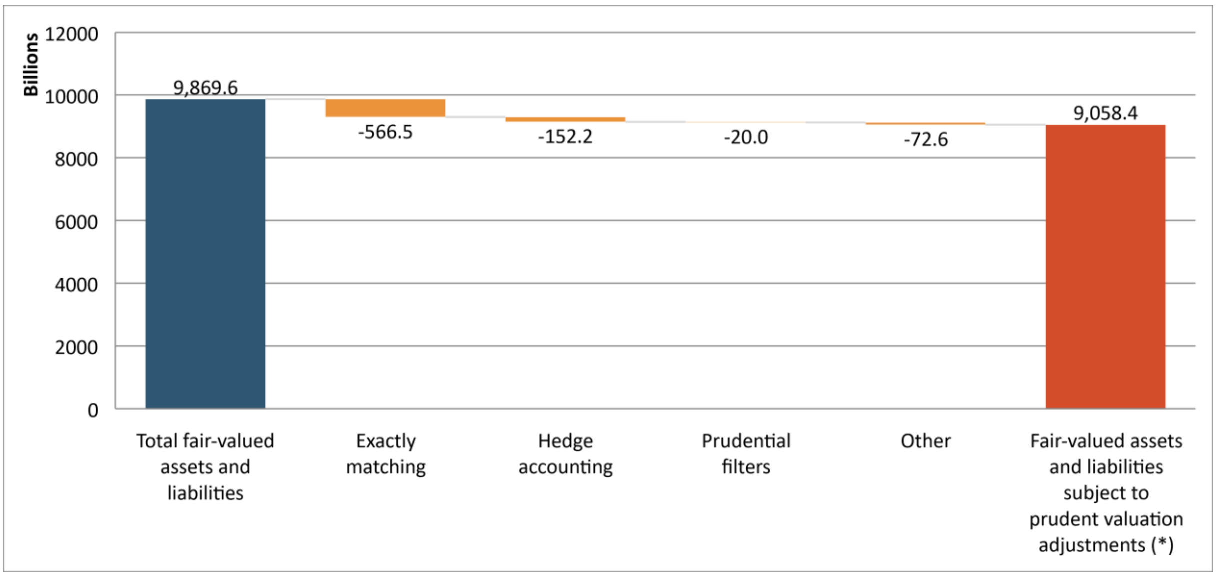
[20] Exactly matching, offsetting fair-valued assets and liabilities are excluded from the calculation of the eligibility threshold. For fair-valued assets and liabilities for which a change in accounting valuation has a partial or zero impact on CET1 capital, their values shall only be included in proportion to the impact of the relevant valuation change on CET1 capital.

[21] The threshold shall apply on an individual and consolidated basis. Where the threshold is breached on a consolidated basis, the core approach shall be applied to all entities included in the consolidation.

[22] The diversification benefits are set at 50%. During the period between Q2-2020 to Q4-2020, the RTS on PVA were amended by the EBA to increase the diversification benefits to 66% on the grounds of extreme levels of volatility triggered by the COVID-19 pandemic, which had had a disproportionate impact on aggregated AVAs amounts compared to their levels in normal market conditions (EU, 2020a)

[23] This refers to the fair-valued assets and liabilities included in the eligibility threshold specified in Article 4 of the RTS on Prudent Valuation.

Figure 26 Total fair-valued assets and liabilities and fair-valued assets and liabilities subject to prudent valuation adjustments (EUR billion), Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: (*) Fair-valued assets and liabilities included in the eligibility threshold specified in Article 4 of the RTS on Prudent Valuation.

The vast number of EU banks (92.8% of total) use the simplified approach to calculate AVAs (Table 2). However, the absolute value of fair-valued assets and liabilities subject to prudent valuation adjustments held by these banks covers only a fraction of the total amount held by EU banks (EUR 0.5 trillion out of a total of EUR 9.1 trillion, or 5.9%), with banks using the core approach holding most of it (EUR 8.5 trillion out of a total of EUR 9.1 trillion, or 94.1%). The same holds true for the corresponding AVAs, where a large amount of the total AVAs in EU is associated with the banks using the core approach (EUR 15.9 billion out of a total of EUR 16.4 billion, or 96.7%).

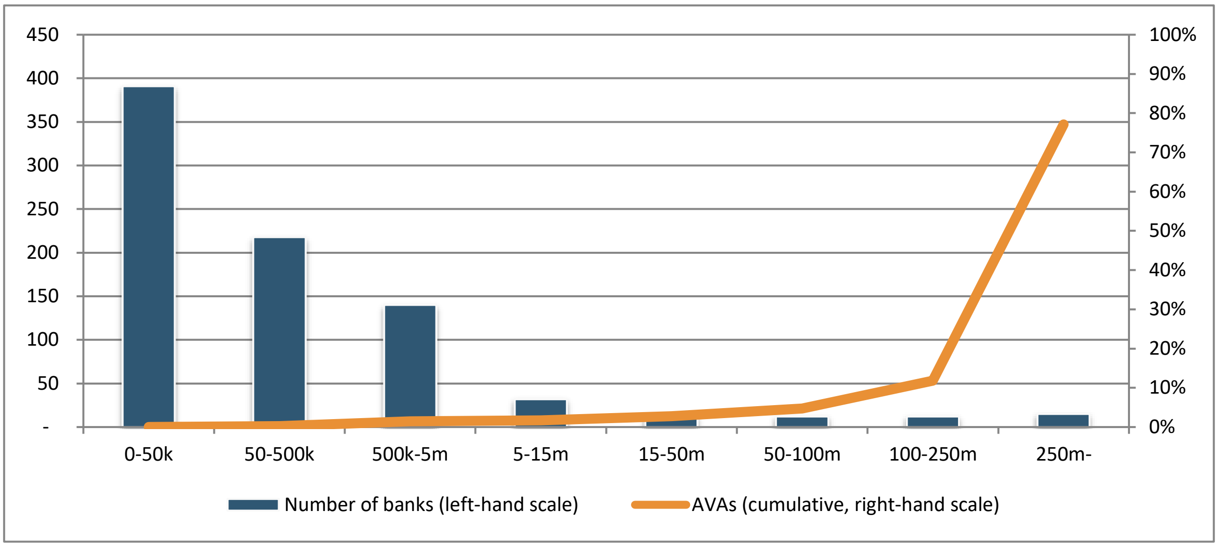
Table 2 Total fair-valued assets and liabilities, fair-valued assets and liabilities subject to prudent valuation adjustments and AVAs (EUR billion) by regulatory approach, Q4-2022

	Number of banks	**Fair-valued assets and liabilities (EUR bn)**	**of which: subject to prudent valuation adjustments (EUR bn)(*)**	**AVAs (EUR bn)**
Core approach	60	9,193.5	8,519.9	15.9
Simplified approach	773	676.1	538.5	0.5
Total	**833**	**9,869.6**	**9,058.4**	**16.4**

Sources: EBA supervisory data and authors calculations.
Notes: (*) Fair-valued assets and liabilities included in the threshold specified in Article 4 of the RTS on Prudent Valuation.

In fact, most of the AVAs are concentrated in a small number of banks, with 15 banks covering almost 80% of the total AVAs in EU (Figure 27). These correspond to some of the larger EU banks in terms of total assets and consists of banks only using the core approach for the calculation of AVAs.

Figure 27 Distribution of EEA banks by size of AVAs, Q4-2022



Sources: EBA supervisory data and authors calculations.

3.3 Core approach banks

This section focuses on the AVAs calculated under the core approach. The analysis is based on a sample of 60 banks using the core approach at the highest level of EU consolidation reporting good quality data.

As explained in the previous sections, AVAs under the core approach are calculated at category level based on Articles 9 to 17 of the RTS on Prudent Valuation or, where this is not possible for certain positions, using a 'fall-back' approach. On aggregate, for almost all the fair-valued assets and liabilities subject to prudent valuation under the core approach in the EU (99.8% of the total) Articles 9 to 17 of the RTS on Prudent Valuation are used for the calculation of AVAs (Figure 28).[24] However, the corresponding AVAs for these positions account for a relatively lower share (80.4%) of the total AVAs calculated under the core approach in the EU (Figure 29). The remaining 19.6% are calculated using the 'fall-back' approach, suggesting that this approach is much more conservative, even though is only being used for the calculation of a very small share of fair-valued assets and liabilities subject to prudent valuation under the core approach (0.2% of the total).

[24] The low usage of the 'fall-back approach is also evident when looking at the number of banks making use of this approach, which corresponds to 20.4% of the sample.

Figure 28: Fair-valued assets and liabilities subject to prudent valuation adjustments under the core approach by calculation method (Articles 9 to 17 of the RTS on Prudent Valuation vs 'fall-back' approach), Q4-2022

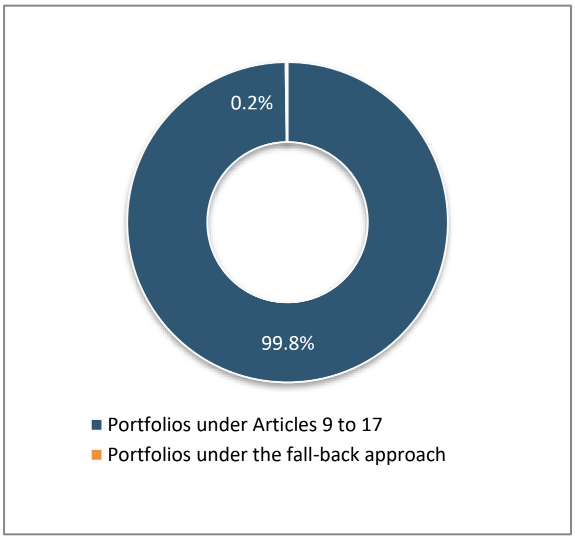
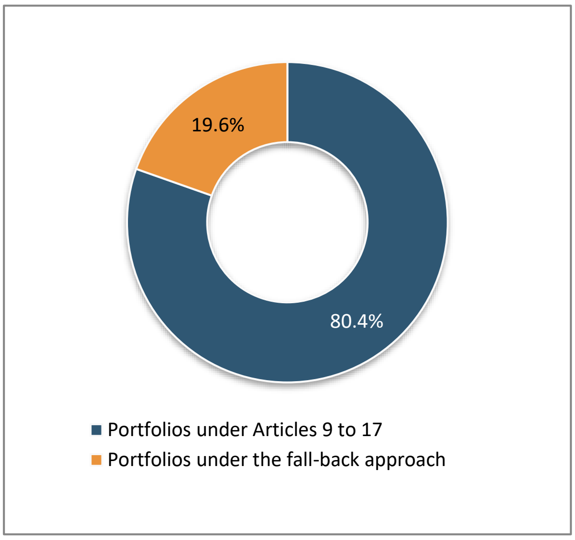


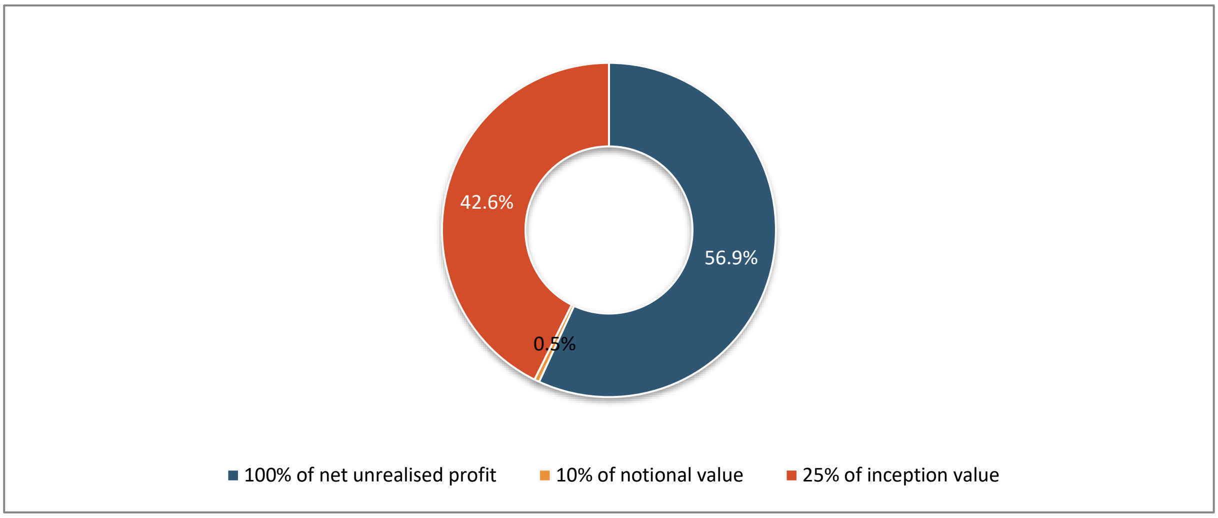
Figure 29: AVAs under the core approach by calculation method (Articles 9 to 17 of the RTS on Prudent Valuation vs 'fall-back' approach), Q4-2022



Sources: EBA supervisory data and authors calculations

Focusing on the 'fall-back approach', AVAs are calculated as the sum of a) 100% of the net unrealised profit on the related financial instruments (100% of net unrealised profit); b) 10% of the notional value of the related financial instruments in the case of derivatives (10% of notional value); c) 25% of the absolute value of the difference between the fair value and the unrealised profit, as determined in the first point (25% of inception value). Figure 30 shows that the largest share of AVAs for portfolios under the 'fall-back' approach in EU is attributed primarily to 100% of the net unrealised profits (56.9%) and by 25% of inception price (42.6%).

Figure 30: AVAs for portfolios under the 'fall-back' approach (Article 7(2)(b) of RTS on Prudent Valuation) by contributing factor, Q4-2022



Sources: EBA supervisory data and authors calculations.

Turning to AVAs calculated at category level under Articles 9 to 17 of the RTS on Prudent Valuation, AVAs are calculated for nine different valuation adjustment categories. As shown in Figure 31, market price uncertainty accounts for 37.7% of the total AVAs in EU, followed by close-out costs (20.5%), concentrated positions (19.4%), model risk (12.4%), future administrative costs (5.6%), operational risk (3.0%) and early termination (1.4%).

For the remaining two categories of AVAs (unearned credit spreads, investing and funding costs), banks shall include the element of the AVA relating to market price uncertainty, close-out costs uncertainty and model risk within the respective AVA category. Unearned credit spreads AVAs contribute by 34.2% to the model risk AVA category but by a much lower share to the market price uncertainty (4.7%) and close-out costs (5.0%) AVA category (Figure 32). On the other hand, investing and funding costs AVAs contribute by 3.2% to the market price uncertainty, 2.1% to the close-out costs and 5.4% to the model risk AVA category.

Figure 31: AVAs for portfolios under Articles 9 to 17 of the RTS on Prudent Valuation by valuation adjustment category, Q4-2022

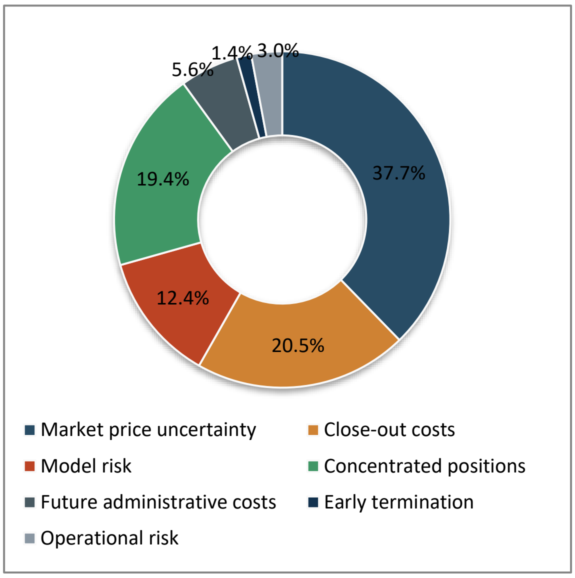
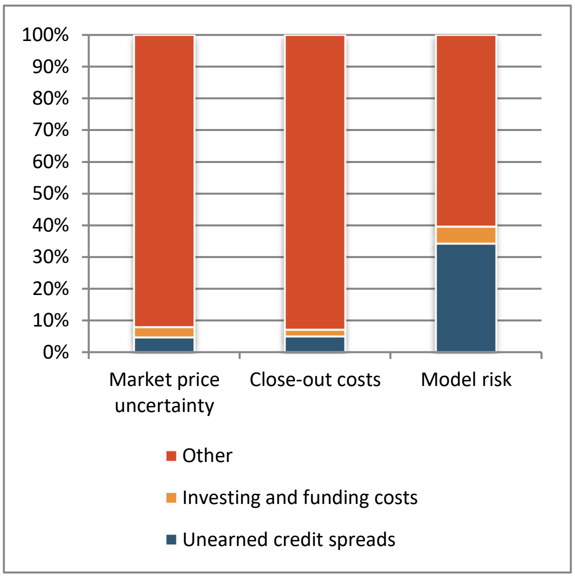


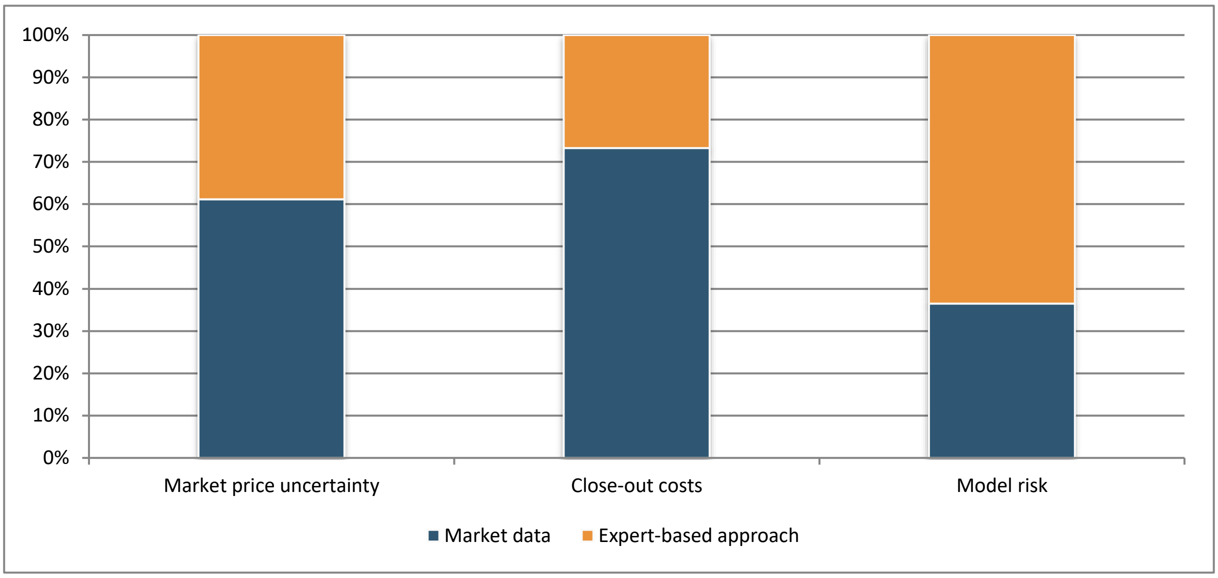
Figure 32: AVAs for market price uncertainty, close-out costs and model risk by source of uncertainty, Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: In Figure 32, AVAs do not take into account any diversification benefits (i.e. pre-diversification AVAs) due to data availability.

The AVAs relating to market price uncertainty, close-out costs uncertainty and model risk are calculated, where sufficient data exists, using a fully quantitative approach, or where this is not possible on an expert-based approach. On aggregate, a fully quantitative approach is used for the calculation of 61.1% of market price uncertainty AVAs, 73.3% of close-out costs AVAs and 36.5% of model risk AVAs.

Figure 33: AVAs for market price uncertainty, close-out costs and model risk by calculation approach (quantitative vs expert-based approach), Q4-2022



Sources: EBA supervisory data and authors calculations.

The RTS on Prudent Valuation allows the recognition of some diversification benefits when aggregating individual AVAs at category-level for the market price uncertainty, close-out costs and model risk categories. This is to account for expected overlaps among individual AVAs computed at the level of valuation exposures that occur in the aggregation of those categories of AVAs.

The RTS on Prudent Valuation provides two methods for doing so (Method 1 and Method 2). Under Method 1, the total category AVAs are calculated as 50% of the sum of individual AVAs within each category. Under Method 2, the total category AVAs are calculated as the difference between the sum of individual AVAs within each category and 50% of the aggregated difference between the expected value and the prudent value of the valuation exposure.

Diversification benefits account for 50.6% of the total pre-diversification AVAs for market price uncertainty, close-out costs and model risk, which is very close to the aggregation factor of 50%. Most of the diversification benefits are calculated using Method 1 (66.6%), although a considerable share is calculated based on Method 2 (33.4%).

Figure 34: AVAs for market price uncertainty, close-out costs and model risk pre- and post-diversification (index: pre-diversification level = 100), Q4-2022

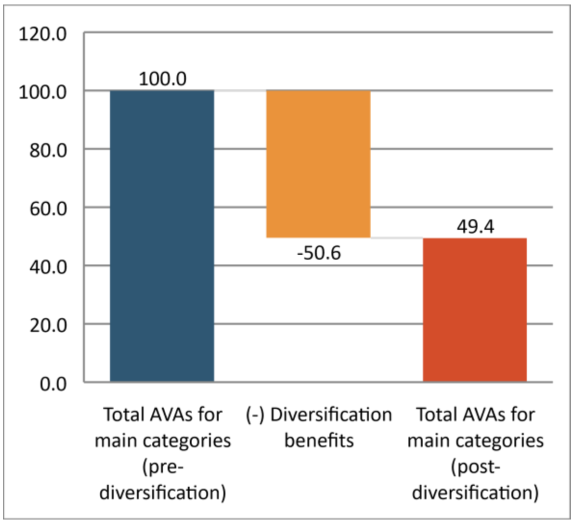
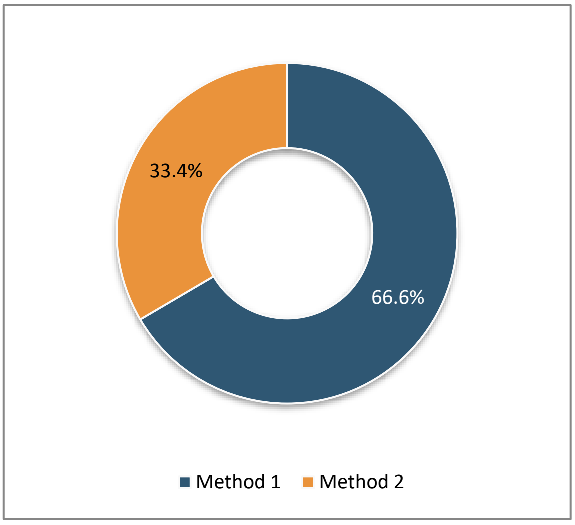


Figure 35: Diversification benefits for market price uncertainty, close-out costs and model risk AVAs by diversification method, Q4-2022



Sources: EBA supervisory data and authors calculations.
Notes: AVAs for Market price uncertainty, Close-out costs and Model risk have been indexed to pre-diversification levels.

3.4 Impact of COVID-19 pandemic and 2022 global energy crisis and regulatory response

The COVID-19 pandemic has triggered levels of extraordinary volatility throughout financial markets worldwide affecting multiple asset classes. This has generated exceptional increases in asset price dispersion and bid-offer spreads, increasing individual AVAs in comparison with their levels in normal times.

The cyclical adjustment of individual AVAs to new market conditions is a normal process and a desirable property of the prudent valuation framework, which considers the valuation uncertainty observed at a given point in time with a forward-looking perspective. However, the unprecedent systemic shock caused by the COVID-19 pandemic had a disproportionate impact on individual AVAs and, as a result, on aggregated AVAs.

The EBA therefore decided to temporarily revise the rules for prudent valuation between June 2020 and December 2020, which was, at the time, the expected duration of the extreme market volatility and the systemic shock caused by the COVID-19 pandemic. More specifically, Commission RTS on Prudent Valuation Delegated Regulation (EU) 2020/866 (EU, 2020a) provided, from its entry into force on 26 June 2020 until 31 December 2020 (i.e. for COREP reporting data produced for prudent valuation for Q2, Q3 and Q4 2020), for a higher aggregation factor of 66% (compared to 50% aggregation factor under normal market conditions), when recognising diversification benefits for market price uncertainty, close-out costs and model risk.

To assess the impact of COVID-19 on AVAs for EU banks and the subsequent regulatory response, we construct the following metric on a quarterly basis:

$$\lambda^{PVA}(t) = \frac{\text{Total AVAs (t)}}{\text{Fair} - \text{valued assets and liabilities subject to prudent valuation adjustments (t)}(*)}$$

(*) Fair-valued assets and liabilities included in the eligibility threshold specified in Article 4 of the RTS on Prudent Valuation

This metric follows the same philosophy as the intensity metric $\lambda^{MKT}(t)$ discussed in the previous chapter. It corresponds to the average AVAs associated with one euro of fair-valued assets and liabilities subject to prudent valuation; in other words, it represents an intensity measure of AVAs.

For banks using the simplified approach the metric remains constant over time due to AVAs being calculated under that approach as a fixed share (0.1%) of the fair-valued assets and liabilities included within the threshold. Using that metric as a measure of procyclicality, we therefore argue that the decision taken both during the COVID-19 pandemic, as well as during the 2022 global energy crisis to not introduce any temporary relief for banks operating under the simplified approach is sound. Accordingly, in what follows, we calculate the above metric only for EU banks using the core approach. The sample covers 37 banks using the core approach at the highest level of EU consolidation, which consistently reported good quality data during the analysis' period (Q4-2018 to Q4-2022).[25]

The intensity metric $\lambda^{PVA}(t)$ was stable prior to the start of the COVID-19 pandemic (Q4-2018 – Q4-2019), hovering around 0.13% on average (Figure 36). However, with the beginning of the COVID-19 pandemic in Q3-2020, the average $\lambda^{PVA}(t)$ spiked to 0.17% before coming down to the pre-pandemic levels between Q2-2020 and Q4-2020 when the emergency regulatory measures on prudent valuation came into force. After the elapse of the measures, average $\lambda^{PVA}(t)$ has started to increase again and exceeded the COVID-19 levels in Q4-2022, reaching 0.18%. The distribution of $\lambda^{PVA}(t)$ followed the same pattern, suggesting that most banks have experienced a similar variation over time.

Figure 36: Distribution of $\lambda^{PVA}(t)$, Q4-2018 – Q4-2022

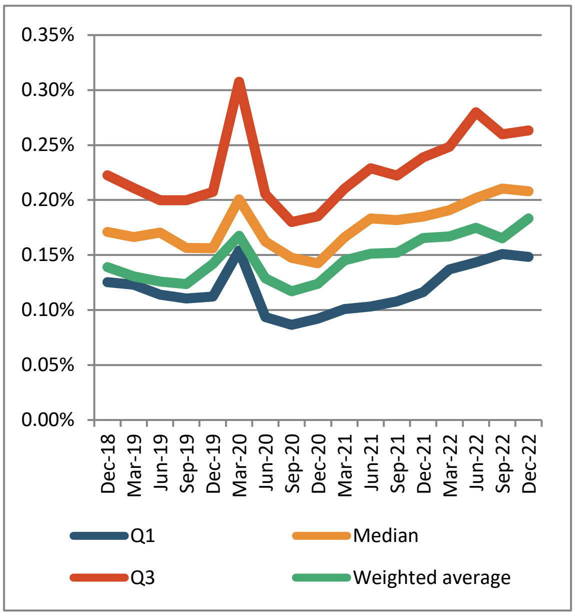
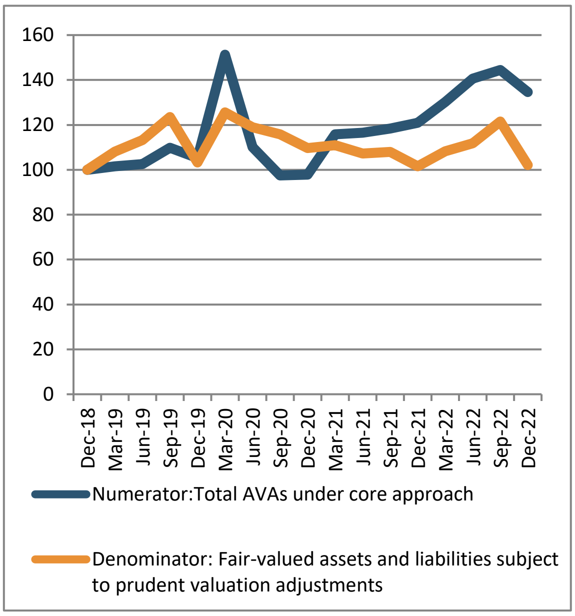


Figure 37: Numerator and denominator of $\lambda^{PVA}(t)$ (index: December 2018 = 100), Q4-2018 – Q4-2022



Sources: EBA supervisory data and authors calculations.

The positive relation between $\lambda^{PVA}(t)$ and volatility is also confirmed by the correlation coefficient with the VSTOXX (quarterly averages). The correlation coefficient was calculated over the Q4-2018 to Q4-2022 excluding

[25] The consistent sample accounts for 68.9% of the total fair-valued assets and liabilities subject to prudent valuation and 73.5% of the total AVAs under the core approach.

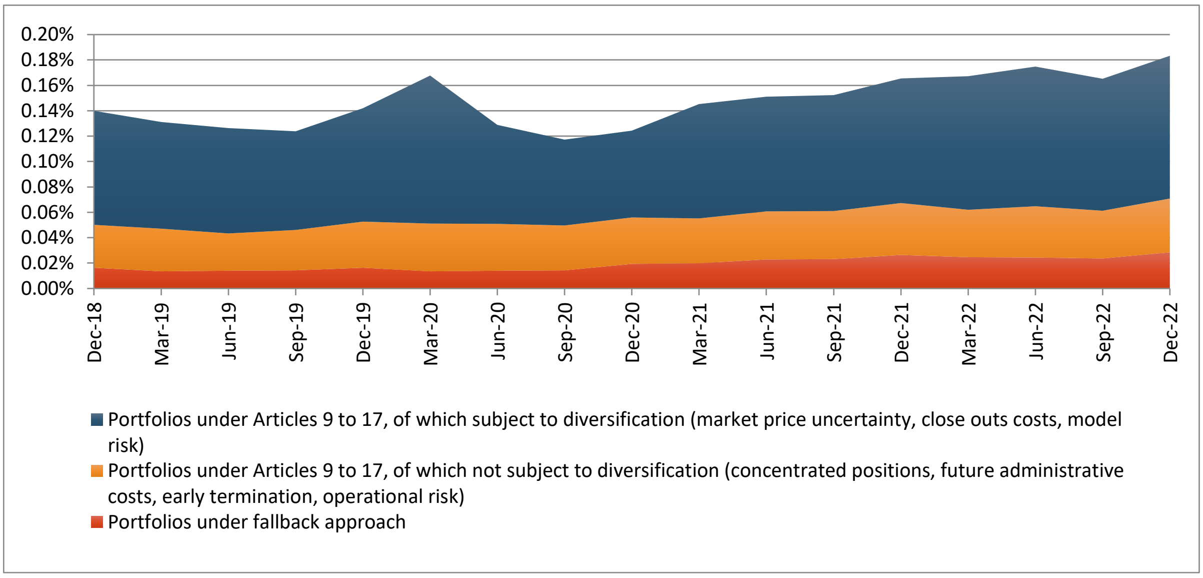
observations between Q2-2020 to Q4-2020 to avoid contaminating it with the effect of the emergency regulatory measures. The correlation coefficient was 0.82 and statistically significant.[26]

Decomposing $\lambda^{PVA}(t)$ into its numerator and denominator, we observe that the main driver behind its increase between Q4-2019 and Q1-2020 was the dramatic increase in total AVAs relative to the increase of the fair-value assets and liabilities subject to prudent valuation adjustments in that period (Figure 37). On the other hand, the increases observed during the period 2021 and Q4-2022 are partly driven by a decrease in the fair-value assets and liabilities subject to prudent valuation adjustments.

When breaking down $\lambda^{PVA}(t)$ for the different AVA calculation methods, we see that the contribution of AVAs for the portfolios under the 'fall-back' approach is rather stable over time (Figure 38). The same holds true for the contribution of AVAs for portfolios under Article 9 to 17 for selected valuation adjustment categories not subject to diversification (concentrated positions, future administrative costs, early termination and operational risk). On the other hand, AVAs for portfolios under Article 9 to 17 for market price uncertainty, close-out costs and model risk drive the evolution of $\lambda^{PVA}(t)$. Similarly to $\lambda^{PVA}(t)$ we observe a large increase in the contribution in Q1-2020 at the start of the COVID-19 pandemic, followed by a sudden drop between Q2-2020 and Q4-2020 with the introduction of the temporary regulatory measures on prudent valuation, which had an effect only on those valuation adjustment categories. After the elapse of the measures, the contribution started to increase again, reaching a new peak in Q4-2022.

The differences in the levels of $\lambda^{PVA}(t)$ observed in Q4-2022 compared to Q1-2020 can be explained by the contribution of the portfolios under the 'fall-back' approach, which is 0.02% higher in Q4-2022 and overcompensates for the small deduction (-0.01%) in the contribution for portfolios under Article 9 to 17 (subject to diversification).

Figure 38: $\lambda^{PVA}(t)$ by calculation method and valuation adjustment category, Q4-2018 – Q4-2022



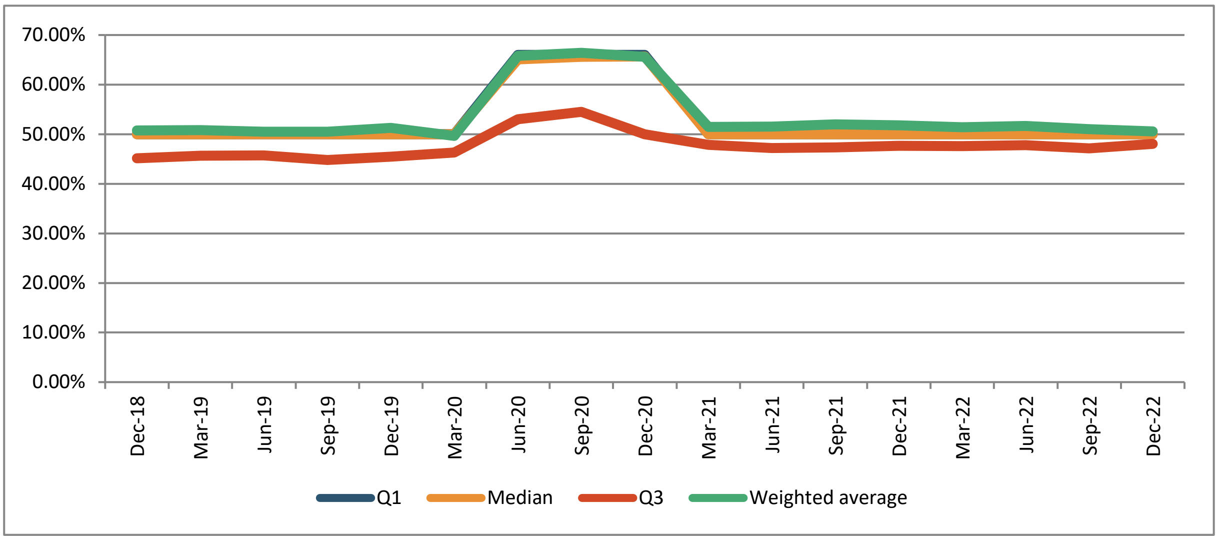
Sources: EBA supervisory data and authors calculations.

To assess the impact of the regulatory response, we run a hypothetical scenario analysis where we assume that the share of diversification benefits for the market price uncertainty, close-out costs and model risk AVAs to the pre-diversification AVAs for the respective categories between Q2-2020 and Q4-2020 is equal to the average

[26] Statistical significance was assessed using the t-statistic $t = \rho \times \sqrt{n-2}/\sqrt{1-\rho^2}$, where ρ is the correlation coefficient and n the number of observations.

share calculated over Q4-2018 to Q1-2020 (i.e. the period prior to regulatory measures).[27] In other words, the increased share observed during Q3-2020 and Q4-2020 (around 65.9%) as a result of the higher aggregation factor (66%) was reduced to around 50.6% to reflect the pre-pandemic levels, which are based on the 55% aggregation factor under normal market conditions (Figure 39).

Figure 39: Share of diversification benefits for the market price uncertainty, close-out costs and model risk AVAs to the pre-diversification AVAs for the respective categories, Q4-2018 – Q4-2022



Sources: EBA supervisory data and authors calculations.

Based on this assumption, the extra AVAs that would not have been diversified out are calculated and added back to the actual total AVAs observed during that period. As can be seen on Figure 40, the hypothetical $\lambda^{PVA}(t)$ under a scenario where no regulatory measures were taken (i.e. after reintegrating the extra AVAs) would have remained at much higher levels compared to the pre-pandemic period (around 0.15%), despite a slight decrease from its peak in Q1-2020.

Given that AVAs are directly deducted from CET1 capital, this would have resulted in a decrease in the actual CET1 ratio by around 4bps on average, and up to 64bps for certain banks (Figure 41). Instead, the regulatory measures have saved EU banks on average EUR 2.3 billion.

[27] The results remain robust when we use the median share between December 2018 to March 2020 or the point-in-time share observed in March 2020.

Figure 40: Actual and hypothetical $\lambda^{PVA}(t)$ in the absence of temporary regulatory measures taken as a response to the COVID-19 pandemic, Q4-2018 – Q4-2022

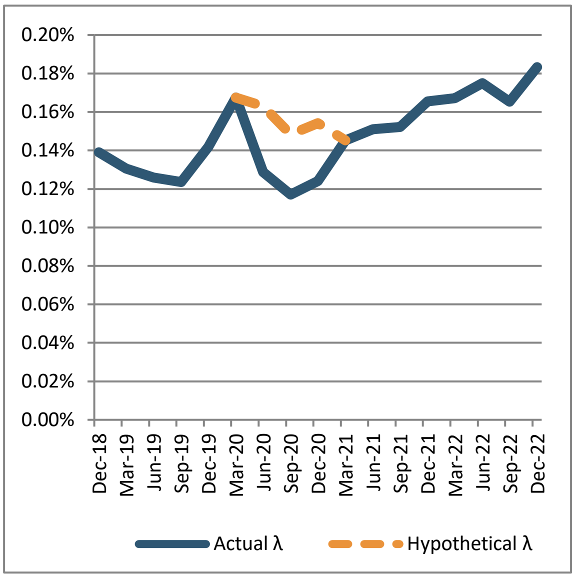
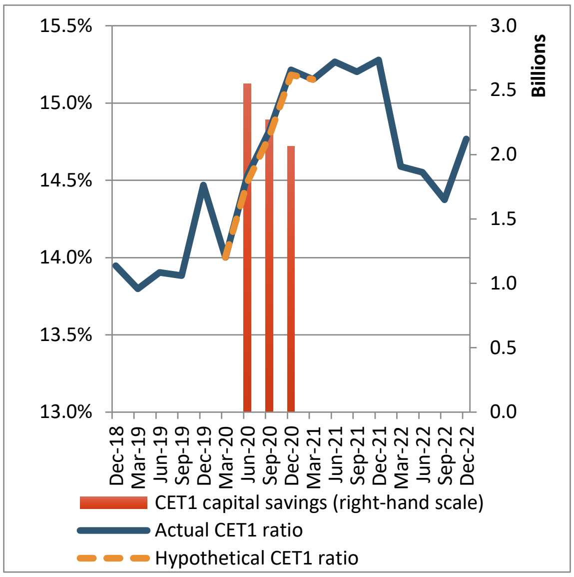


Figure 41: Actual CET1 ratio, hypothetical CET1 ratio and corresponding CET1 capital savings in the absence of temporary regulatory measures taken as a response to the COVID-19 pandemic, Q4-2018 – Q4-2022



Sources: EBA supervisory data and authors calculations.

Notes: The hypothetical λ and CET1 ratio are calculated by assuming that the share of diversification benefits for the market price uncertainty, close-out costs and model risk AVAs to the pre-diversification AVAs for the respective categories between June 2020 and December 2020 is equal to the average share calculated over December 2018 to March 2020 (i.e. the period prior to regulatory measures providing for a higher aggregation factor).

On the contrary, no regulatory measures were taken after the 2022 global energy crisis, despite the fact that the intensity measures reached similar levels in Q1-2020 and in Q1-2022. The main difference between the two crises as discussed in the previous section dealing with the market risk framework, is the speed at which the crisis manifested. In the case of COVID-19, the turbulence in financial markets materialised suddenly. The prudent valuation framework mostly relies on one point time forward looking measures which are calibrated on data of that day or alternatively, when data are not available, by means of an expert-based approach. That is the case for example of the AVAs linked to market price uncertainty and to close-out costs, where banks are required to target a 90% confidence level, regardless of whether data are available, or an expert-based approach is used. As shown in Figure 1 , volatility in the financial market in the aftermath of the first COVID-19 cases in Europe was extreme. In case of extreme uncertainty in financial markets, the prudent valuation framework as designed may lead to some unintended consequences: first, where the market turbulence results in significant intraday changes, the AVA calculation on a given day may significantly differ depending on the time of the day at which the calculation is performed; second, as the framework relies both on a data-based approach, and on an expert based-approach, the heightened sudden volatility may exacerbate differences in the AVA results across banks, leading to excessive variability in the final results that do not reflect necessary differences in the underlying uncertainty in the valuation. The market turbulence relating to the 2022 global energy crisis as discussed, materialised much more gradually. Hence, those unintended consequences are expected to be much less pronounced.

The actual impact of the two crises, as assessed by our intensity metric is consistent with the qualitative discussion in the previous paragraph. First, the intensity metric peaked at a fast pace during the COVID-19 crisis, and instead gradually increased after 2022 global energy crisis. Another main difference is the magnitude of the change in the interquartile range of the intensity measure that is more pronounced during the COVID-19 period, highlighting the increased variability across banks' results following the crisis. In particular, Figure 34 suggests that, in relative terms, the "3rd quartile bank" is dramatically affected by the stress in financial market linked to COVID-19 pandemic when compared the "1st quartile" and the "median" bank. The three lines in the same figure do not diverge as much in the aftermath of the 2022 global energy crisis. In Figure 42 and Figure 43, we directly report the change in the interquartile range in $\lambda^{PVA}(t)$, also normalised by the median.[28]

It should also be noticed that in the case of the 2022 global energy crisis, the higher level in the intensity measure was the result of a steady increase that started well before the crisis. This suggests that the increase cannot be attributed solely on the extraordinary conditions caused by the 2022 global energy crisis, but may be the result of several other factors, e.g. changes in banks' portfolios, remedial actions taken by supervisors to address weaknesses in banks' management of valuation risk, etc.[29]

All these differences between the two crises justify in our view the different response taken from a regulatory perspective. The temporary relief introduced during COVID-19 by increasing the diversification factor, reduced the abovementioned unintended consequences that can manifest when a stress period kicks-in suddenly, and reduced the variability of the impact of the crisis across banks which may not be directly attributable to the level of risk. One should however acknowledge that in the context of the internal model approach for market risk, it is much easier to assess the extent at which banks are unduly subject to an increase in capital requirements. That clarity in the dynamics, also allows to take a risk-sensitive response and discard only those overshootings that are not due to a model deficiency, while still requiring banks to pay for the weaknesses in their model. In the prudent valuation framework, considerations on the dynamics of the framework are more general, and it is not possible to easily identify an element of procyclicality that is clearly undue in some extraordinary circumstances. That is also why the regulatory response, i.e. the increase in the diversification factor, is less risk-sensitive, and de-facto treats all banks in the same way. That being said, Figure 34 clearly shows that the increase in the diversification (from 50% to 66%) was well calibrated, given that the increase de-facto brought $\lambda^{PVA}(t)$ to pre-crisis level.[30]

Figure 42: Interquartile range of $\lambda^{PVA}(t)$, Q4-2018 – Q4-2022

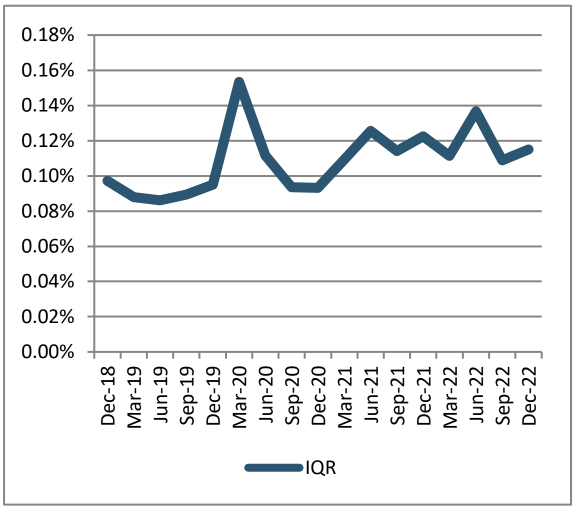
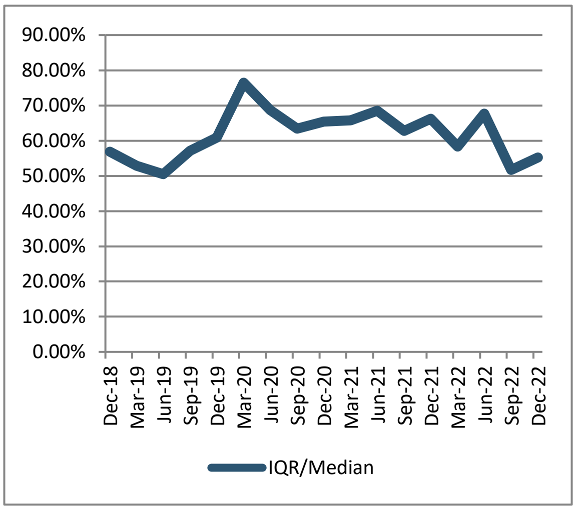


Figure 43: Interquartile range of $\lambda^{PVA}(t)$ over median $\lambda^{PVA}(t)$, Q4-2018 – Q4-2022



[28] Normalising by the median accounts for the fact that for higher levels of $\lambda^{PVA}(t)$, it is natural to have higher q-o-q absolute changes.
[29] The ECB launched a three-year on-site inspection campaign on valuation risk in 2019 and published its interim results in May 2021. The campaign has highlighted severe weaknesses in banks' internal valuation risk frameworks. Following the campaign, the Joint Supervisory Teams responsible for the inspected banks followed up closely and, where necessary, imposed remedial actions adapted to the severity of the findings (ECB, 2021).
[30] $\lambda^{PVA}(t)$ levels are aligned in Q4-2019 and Q2-2020.

4. Conclusions

In this paper we study the impact of the COVID-19 pandemic and the 2022 global energy crisis on capital requirements related to traded risk and discuss the different regulatory responses taken by the EBA and EU bodies. Using two novel intensity metrics, which aim to capture the procyclicality in the regulatory framework, we show that the rapid and significant increase in market volatility triggered by these crises had a very high impact on capital requirements for market risk and CET1 deductions under prudent valuation. In addition, we show that the impact materialised very quickly in the aftermath of the Covid-19 pandemic, while in the case of the 2022 global energy crisis the impact was more gradual and took more time to reach its peak.

We argue that some components in the current framework may not work as intended. For example, we identified that the automatic increase in the multipliers applied to market risk capital requirements resulting from back-testing overshootings that are not due to model deficiencies is an element that can be unduly procyclical in crisis time. We note that this is particularly the case when a new a period of stress kicks-in at a fast pace, given the delay in the 1-day VaR to reflect such new market regime compared to the P&Ls against which the VaR is compared which instead reflect the new regime without any delay. Likewise, in the prudent valuation framework, we note that when there is sudden change in market volatility, the framework may lead to undue dispersion in the final AVA computation that does not necessarily reflect the underlying uncertainty in the valuation. However, in this case, we did not identify a clear element of undue procyclicality. Finally, in line with the design of the regulatory framework, we did not identify any element that may lead to undue procyclicality or unintended consequences in the standardised approach for market risk and in the simplified approach under the prudent valuation framework.

On that basis, we consider that the temporary relief measures taken in the Covid-19 pandemic were appropriate. In particular, allowing the discarding of overshootings that were not due to model deficiencies was fully justified given that the shift in market regime was very sudden and material. Hence, the temporary measure de-facto removed an element of undue procyclicality. In relation to the prudent valuation framework, we note that the temporary relief introduced during COVID-19 reduced unintended consequences in the framework that can manifest when a stress period kicks-in suddenly, as well as reduced the variability of the impact of the crisis across banks. We also note that the temporary increase in the diversification was well calibrated given that it allowed the capital intensity to remain at pre-crisis level.

At the same time, the absence of any regulatory action in the case of the 2022 global energy crisis can be justified by the fact that the high levels in our intensity measures observed during that period were the result of a gradual increase, making the undue procyclicality argument weaker. More specifically, the fact that the increase in financial markets' volatility was not sudden did not lead to a situation where the calibration period used for VaR reflected a completely different regime than the P&Ls against which it was tested, making the case for granting temporary reliefs weaker. Furthermore, as regards prudent valuation, the crisis did not lead to an increased dispersion in the AVAs computed across banks. In addition, we note that the higher levels of AVAs in 2022 compared to 2021 is not just the result of the volatility in financial markets but rather the result of other factors, including remedial actions taken by supervisors to address weaknesses in banks' management of valuation risk, further weakening the point that a temporary relief in the prudent valuation framework was needed in that context.

In addition, the absence of any specific measure in relation to the standardised approach for market risk during both periods proved to be correct given that banks using this approach did not experience an excessive increase in market risk capital requirements, as expected from a theoretical point of view. The same holds true in the context of the simplified approach under the prudent valuation framework.

We note that while the introduction of the FRTB will reduce some of the procyclical elements of the current framework, as the capital requirements will be based on risk-measures that are mostly driven by a stress-period calibration, others will be kept, as the back-testing will still compare a VaR measure calibrated on the last 12 months period against a 1-day P&L.

Overall, our findings have relevant policy implications. They support the view that regulatory action is warranted in some cases to smooth any unintended effects that the regulatory framework may lead to during extraordinary circumstances. Accordingly, the findings empirically support the introduction of exceptional powers, as currently proposed in the on-going legislative process to amend CRR (known as CRR3 proposal), for the EBA or competent authorities to intervene and soften some regulatory requirements in the market risk and for prudent valuation framework under extraordinary circumstances.

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Annex

Figure 44 Summary of prudent valuation framework in the EU

Prudent valuation framework in the EU

PRUDENT VALUATION ADJUSTMENTS

VALUATION RISK
The risk of incurring losses when selling an asset or transferring a liability due to inaccuracies in the fair value estimates

- Fair value: The price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date, i.e. the exit price (IFRS13)
- Prudent value: The value that achieves an 'appropriate degree of certainty' in the exit price (Art. 105 CRR)
- Additional valuation adjustments (AVAs): The difference between the fair value and prudent value

CAPITAL REQUIREMENTS
Deductions from regulatory capital

- Total AVAs are fully deducted from Common Tier 1 (CET1) capital (Art. 34 CRR)

SCOPE

ASSETS AND LIABILITIES
All fair-valued assets and liabilities

- Both trading and non-trading (banking) book positions
- For positions for which a change in accounting valuation has a partial or zero impact on CET1 capital, their values are included in proportion to the impact of the relevant valuation change on CET1 capital (Art. 8 DR)

REGULATORY APPROACHES

SIMPLIFIED APPROACH
Eligible only for institutions with a small fair-valued portfolio

- Eligibility threshold: Sum of the absolute value of fair-valued assets and liabilities less than EUR 15bn (Art. 4 DR)
- Calculation of AVAs at aggregate level as 0.1% of the eligibility threshold (Art. 5 and 6 DR)

CORE APPROACH
Default approach for all institutions

- Calculation of AVAs at category level for 9 different categories: market price uncertainty, close-out costs, model risk, unearned credit spread, investing and funding costs, concentrated positions, future administrative costs, early termination, operational risk (Art. 9 to 17 DR)
- AVAs calculated as the excess of the prudent value over fair value
- Prudent value based on market data and a 90% target level of certainty or, where not possible, on expert-based approach with the same level of certainty
- Diversification benefits allowed in the aggregation of main AVAs categories: market price uncertainty, close-outs costs and unearned credit spread AVAs (Art. 9(6), 10(7) and 11(6) of the DR)
- A conservative 'fall-back' approach is provided, where individual AVAs based on Art. 9 to 17 DR cannot be estimated (Art. 7(2)(b) DR)

IFRS13: International Financial Reporting Standards 13 – Fair Value Measurement
CRR: Regulation (EU) No 575/2013 – Capital Requirements Regulation
DR: Commission Delegated Regulation (EU) No 2016/101 with regards to regulatory technical standards for prudent valuation under Article 105(14)

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