



European Securities and
Markets Authority

EMIR Review Report no.2

**Review on the efficiency of margining requirements to limit
procyclicality**

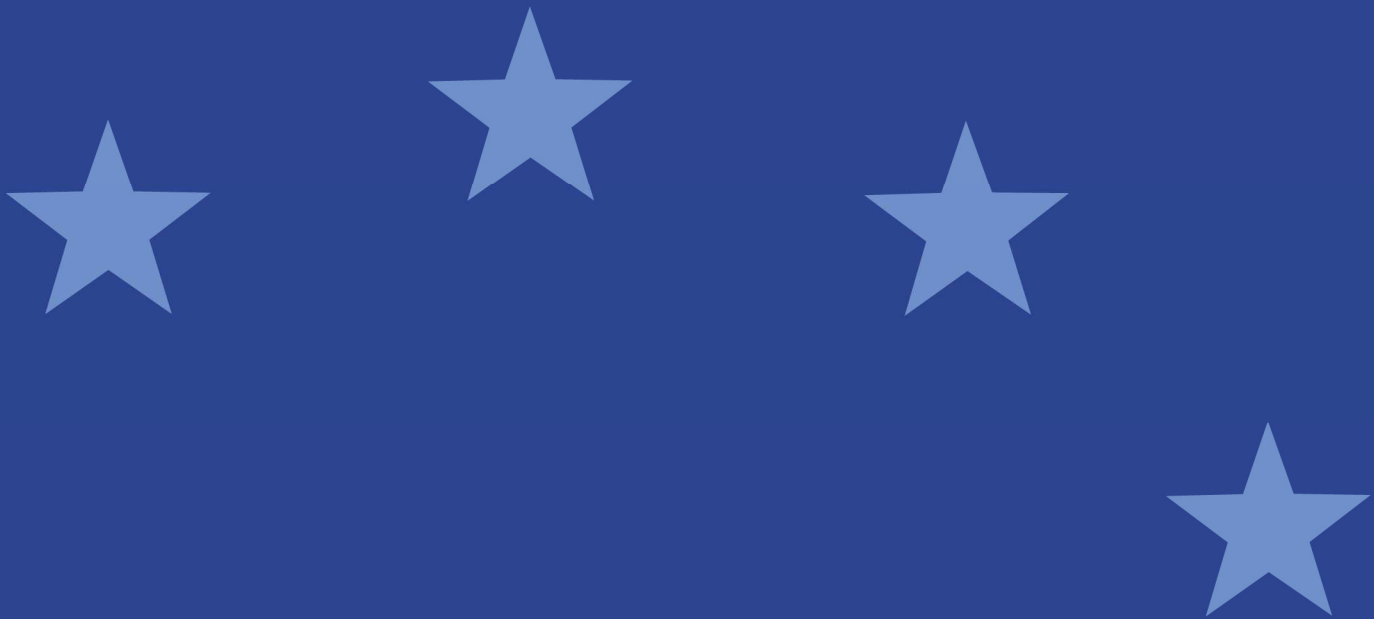


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Acronyms used

CCP	Central Counterparty
CPSS	Committee on Payment and Settlement Systems
EMIR	European Market Infrastructures Regulation – Regulation (EU) 648/2012 of the European Parliament and Council on OTC derivatives, central counterparties and trade repositories
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
ETD	Exchange Traded Derivatives
EWMA	Exponentially weighted moving average
FX	Foreign Exchange
HSVAR	Historical Simulation Value at Risk
IOSCO	International Organization of Securities Commissions
ITS	Implementing Technical Standards
OTC	Over-the-counter
RTS	Regulatory Technical Standards
RTS on CCP	Commission Delegated Regulation (EU) No 153/2013 on requirements for central counterparties (OJ L 52, 23.2.2013, p.41)

1 Executive Summary

Reasons for publication

The European Market Infrastructures Regulation (“EMIR”) entered into force in August 2012. EMIR constituted the main part of the European response to the commitment by G-20 leaders in September 2009 that: “All standardised OTC derivatives contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at latest. OTC derivatives contracts should be reported to trade repositories. Non-centrally cleared contracts should be subject to higher capital requirements”.

In accordance with Article 85(1) of EMIR, the Commission is required to prepare a general report on EMIR which shall be submitted to the European Parliament and the Council, together with any appropriate proposals. The Commission must in particular assess, in coordination with ESMA and the ESRB, the efficiency of margining requirements to limit procyclicality and the need to define additional intervention capacity in this area. The present report constitutes ESMA’s contribution to this assessment.

Content

Following an introduction including the background, the relevant definitions and the scope of the review, this report analyses in Section 3 the relevant regulatory provisions and discusses their efficiency to limit procyclical effects on margin requirements and collateral used to cover margin requirements. Section 4 sets out the recommendations on the basis of this analysis and Annex I provides an overview of the usage of the EMIR provided counter-cyclical tools by authorised central counterparties (CCPs).

Next steps

ESMA will submit the report to the European Commission so that the recommendations will inform the European Commission’s assessment when producing its final report.

2 Introduction

2.1 Background

1. Regulation (EC) 648/2012 entered into force on 16 August 2012 and started applying following the finalization of the Delegated Regulations (RTS/ITS) in 2013. EMIR introduced new prudential standards for CCPs including the obligation to monitor and, if necessary, revise the level of its margins to reflect current market conditions taking into account any potential procyclical effects of such revisions. The actual effects of the regulatory provisions on CCPs can only be assessed after their authorisation under EMIR, and the first CCP was authorised in March 2014.
2. Further, the European Commission shall, in line with EMIR provisions, review and prepare a general report on this Regulation by 17 August 2015 including the assessment, in cooperation with ESMA and ESRB, of the efficiency of margining requirements to limit procyclicality and the need to define additional intervention capacity in this area. The Commission has requested ESMA to provide input in writing covering its views on this topic. The present Report constitutes ESMA's response to this request and is based on ESMA's experience in the implementation of EMIR to date.

2.2 Definitions and Scope

3. Under the Principles for Financial Markets Infrastructures (CPSS/IOSCO, April 2012), the concept of procyclicality is discussed in reference to changes in risk-management practices that are positively correlated with market, business, or credit cycle fluctuations and that may cause or exacerbate financial instability. EMIR does not include an explicit definition of procyclicality. However, the objectives set by the RTS for the calculation and revision of margin, taking into account the need to prevent and control possible procyclical effects, provide that margining requirements shall be forward looking, stable and prudent. Furthermore, CCPs shall avoid when possible disruptive or big step changes and establish transparent and predictable procedures for adjusting margin requirements in response to changing market conditions. The concept of procyclicality is incorporated in these requirements and the efficiency of procyclicality treatment arrangements is discussed in the light of these requirements.
4. As a response to the EMIR mandate and the Commission's request, this report mainly focuses on the efficiency of the procyclicality treatment measures provided by EMIR for the calculation of margining requirements, considering in particular the policies, procedures and methodologies adopted by the CCPs during their authorisation. The scope of the present review is limited to the arrangements for margining centrally cleared OTC and ETD products, since margining requirements for bilateral transactions have not been implemented yet.
5. Margin requirements are calculated to cover at a given confidence level the exposure of the CCPs arising from a default of a clearing participant and include the variation margin (current exposure), the initial margin (potential future exposure) and other purpose specific (e.g. credit risk) margin add-ons. Variation margin requirements can be a source of procyclical effects, but will cover the current exposure of the CCP on the basis of realised (mark to market) or theoretical (mark to model) prices and will therefore reduce procyclicality effects on initial margins, as losses in an adverse market environment will be covered gradually over time reducing the potential

future exposure and the necessity of excessive initial margin calls. The efficiency of variation margin requirements to limit these effects is discussed in this context.

6. The initial margin requirements will cover the risk from potential future exposures based on current positions. Thus, disruptive changes in the initial margin requirements may emerge as a result of sharp changes in the nominal exposures (positions), or changes in the short-term potential future volatility of prices. The Regulatory Technical Standards provide three alternative options for the treatment of procyclical effects linked to the volatility of prices. The efficiency of these options is discussed in detail. Procyclical effects from changes in positions can be addressed with the enhancement of transparency of margining procedures and the predictability of margin calls and this is further analysed in this report. Margin add-ons should also be set and revised taking into account the potential procyclical effects.
7. Moreover, changes in the eligibility and valuation of collaterals used to cover margin requirements can also be a significant source of instability during market and credit cycle fluctuations. The efficiency of relevant regulatory provisions is therefore also discussed.
8. The measures specified in EMIR to address procyclicality are analysed in Section 3, together with a discussion of the different interpretations implemented by CCPs and a qualitative and to the extent possible quantitative assessment of their efficiency on the basis of historical data. The conclusions are presented in Section 4 along with recommendations following the analysis.

3 Efficiency of EMIR provisions to limit procyclicality

3.1 Regulatory provisions

9. EMIR recognises in recital 68, that margin calls and haircuts on collaterals may have procyclical effects and mandates CCPs, the competent authorities and ESMA to adopt measures to prevent and control such effects to the extent that these measures will not affect negatively the soundness and financial security of CCPs.
10. Thus, the design and implementation of counter-cyclical measures shall be aligned with the overall objective of prudential requirements, which is to safeguard the financial stability of the CCPs. Moreover, such measures shall first target to prevent procyclical effects but then also control their impact to the clearing participants.
11. With reference to margin requirements, the Regulation provides for the obligation of CCPs to regularly monitor and, if necessary, revise the level of its margins to reflect current market conditions taking into account any potential procyclical effects of such revisions. The minimum confidence level, the time horizon for the liquidation of open positions and the selection of the historical look-back period are further specified in the Regulatory Technical Standards considering the regulatory requirement to limit procyclicality.
12. Collateral requirements are to be met with cash and highly liquid financial instruments having minimal credit and market risk in order to avoid potential disruptive changes with regards to the eligibility or valuation of posted collateral during stress events.
13. That is, EMIR identifies that calculation and revision of margin requirements along with eligibility and valuation of collateral are the main channels of transmission of procyclical effects through the

CCPs risk management arrangements to the clearing participants and the financial system in general. The specific provisions along with the different interpretations implemented by CCPs to comply with these provisions are discussed in the following sections.

3.2 Margin requirements

3.2.1 Calculation of Margin Requirements

14. CCPs have implemented procedures to fully collateralise exposures at least on a daily basis. The exposures are also measured and assessed on a near real time basis and margins are also collected on an intraday basis at least when predefined thresholds are exceeded.
15. Exposures can be broken down to current and potential future exposures. Depending on the clearing specifications of the products, the current exposures are collateralised either through daily exchange of variation margin or as a component of the initial margin. That is, the margin requirements cover the risks from unsettled current exposures and potential future exposures stemming from current positions. The exposures themselves mainly depend on the positions, the most recent available prices and the potential future variation of the prices within the time horizon for liquidation of positions. Thus, disruptive changes in the margin requirements may emerge as a result of sharp changes in the short-term potential future volatility of prices in case of default, changes in positions or changes in prices used for the calculation of variation margin.
16. Big step changes in margin requirements following an increase of volatility of the risk factors are addressed using the tools provided in Article 28 of the Regulatory Technical Standards, which are discussed in detail in 3.2.3. Procyclical effects from changes in positions can be mitigated with transparent and predictable margin requirements and this is further discussed in 3.2.5.
17. Furthermore, non-reliable prices stemming from illiquid markets (marked to market) or inadequate/miss-calibrated models (marked to model) could also have a destabilising effect on variation and initial margin requirements. However, specific rules are implemented to address the need to correctly collateralise current exposures. In particular, CCPs shall have timely access to the relevant pricing sources and consider the complexities and level of pricing uncertainties which may limit the validation of the calculation of initial and variation margin requirements. CCPs shall typically verify the validity of prices and adjust them if necessary or introduce specific margin add-ons to address the potentially procyclical effects of such big step changes stemming from illiquid markets. Furthermore, where pricing data is not readily available or reliable, the systems and valuation models used for this purpose shall be subject to appropriate governance, including seeking advice from the risk committee, validation and testing. The valuation models used by CCPs are validated under a variety of market scenarios by a qualified and independent party to ensure that they accurately produce appropriate prices.

3.2.2 Percentage of coverage and historical look-back period

18. The Regulatory Technical Standards specify that the initial margin shall cover the exposures arising from market movements over a minimum historical look-back period of the latest 12 months, while the CCP shall ensure that the data used to calculate historical volatility will capture a full range of market conditions including periods of stress. Exposures observed during the look-back period shall be covered at a minimum confidence level of 99.5% for OTC derivatives and 99.0% for other financial instruments.

19. The selection of the historical look-back period is expected to ensure that the initial margin calculations will:
 - be based on a historical look-back period (>12 months) that is sufficiently long enough to capture short- and medium- term market trends including seasonality effects, but also avoid being over-responsive to temporary short term volatility fluctuations that could further amplify procyclical effects, and
 - at the same time include periods of stress, in order to avoid the calibration of margin requirements solely on volatility estimates drawn from low volatility periods.
20. Furthermore, the level of the minimum confidence interval (>99.0%, 99.5%) is expected to ensure that stressed observations will effectively be taken into account when calculating the margin requirements in order to minimize the potential impact of a swift transition from a low volatility to a high volatility environment.
21. However, no binding rules are provided on how to identify and weight the stress observations to be included in the historical look-back period, especially as this requirement is not directly linked to the provisions detailing the methodology to be used to identify the worst historical events for the stress testing framework. Moreover, if margins are calibrated using longer (than the minimum) historical look-back periods, stress events can be averaged-out. The potential implications of the different practices are discussed in the following paragraphs in conjunction with the specific measures established in Article 28 of the RTS to address the procyclicality effects on margin requirements.

3.2.3 Options for the treatment of procyclicality

22. According to the Regulatory Technical Standards, a CCP shall ensure that its policy for selecting and revising the confidence interval, the liquidation period and the look-back period deliver forward looking, stable and prudent margin requirements that limit procyclicality to the extent that the soundness and financial security of the CCP is not negatively affected. This shall include avoiding when possible disruptive or big step changes in margin requirements and establishing transparent and predictable procedures for adjusting margin requirements in response to changing market conditions.
23. In doing so, the CCP shall apply at least one of three provided options. All three options build on the general concept that a counter-cyclical component shall be introduced in the margin calibration methodology in order to mitigate the need for big step changes following volatility peaks. This counter-cyclical component shall be immune to market, business and credit cycles in order to counter balance the fact that price volatility, positions, asset liquidity and counterparty credit exposures tend to be correlated with these cycles.
24. The RTS provide options that are discussed individually in paragraphs 3.2.3.1 - 3.2.3.3. The theoretical properties of each option in terms of strengths and weaknesses are analysed, taking also into account the different interpretations of these options as currently implemented by authorised CCPs. The theoretical analysis is complemented by a quantitative assessment of their efficiency to limit procyclicality of margining requirements. With regards to the quantitative assessment, the preferred option would be to use actual CCP margin requirements. However, a sufficiently long enough history of EMIR compliant margin data is not available, since most CCPs

were only authorised in mid and late 2014. Therefore, this analysis is performed on the basis of simulated margins using historical price variations.

25. The simulation is not meant to reproduce the margin requirements of individual CCPs as this would require the implementation of the individual margin models. Therefore, the analysis results should not be interpreted as the actual margin requirements that would have been calculated by authorised CCPs. The actual or potential key calibration choices are considered in an effort to assess the impact of these choices to the efficiency of margin requirements to address procyclicality. In terms of price data used, the simulation is based on historical price variations of EUROSTOXX 50 Price Index¹ and EUR/CHF exchange rate² in order to consider a wide range of different procyclicality related scenarios. The analysis will be based on the assessment of the performance of the different options and interpretations against the following criteria:

- Two day margin calls (maximum and 99% expected³ margin calls). The procyclicality adjustment is expected to limit the need for sudden, big step margin calls, especially during stressed periods.
- Margin shortfall (maximum and 99% expected margin shortfall) to cover 2d price variations. The procyclicality adjustment is expected to reduce the amount of margin shortfall when price variations exceed the intended coverage. However, it should be noted that the margin is not expected to cover all historical price variations. The margin should be able to cover at least 99% (99.5% for OTC derivatives) of the exposures, while the default fund and remaining financial resources should cover residual exposures under historical or hypothetical stress conditions.
- Margin amount (maximum and average). The procyclicality adjustment is expected to increase on average the margin requirements. However, it should avoid excessive overcollateralization of exposures, especially during stress periods.

26. The RTS does not differentiate between margin components in terms of the application of the procyclicality adjustments. However, in order for the adjustments to efficiently address all sources of procyclicality effects, they should be applied to all margin components covering the potential future exposure of the CCP. The variation margin should not be subject to procyclicality adjustments as it covers the current exposure. However, the adjustments should be applied to all risk factors including price / implied volatility shifts, correlation offsets and maturity spreads. Furthermore, margin add-ons introduced to cover risks beyond the instrument specific risk factors, such as concentration and counterparty credit risk should also be set and revised taking into account the potential procyclical effects. The margin add-ons can exacerbate credit and market cycles as they will usually be called when the market liquidity or the creditworthiness of a member is deteriorating. Therefore, margin add-ons can be a significant source of procyclical effects and should be subject to mitigation measures. The RTS provided procyclicality treatment tools are usually not applicable to these margin add-ons, as they are member specific and event driven, i.e. the margin add-on will only be called if a specific member breaches some predefined soft or hard limits. The procyclicality effects should be mitigated by introducing more gradual limits and add-ons to avoid sudden big step margin changes and adopting transparent and predictable

¹ (SX5E), margin simulated for the period 7/8/1996 - 24/4/2015, including the 2008 crises.

² Margin simulated for the period 9/10/2008-11/5/2015, including the Jan 2015 de-pegging event.

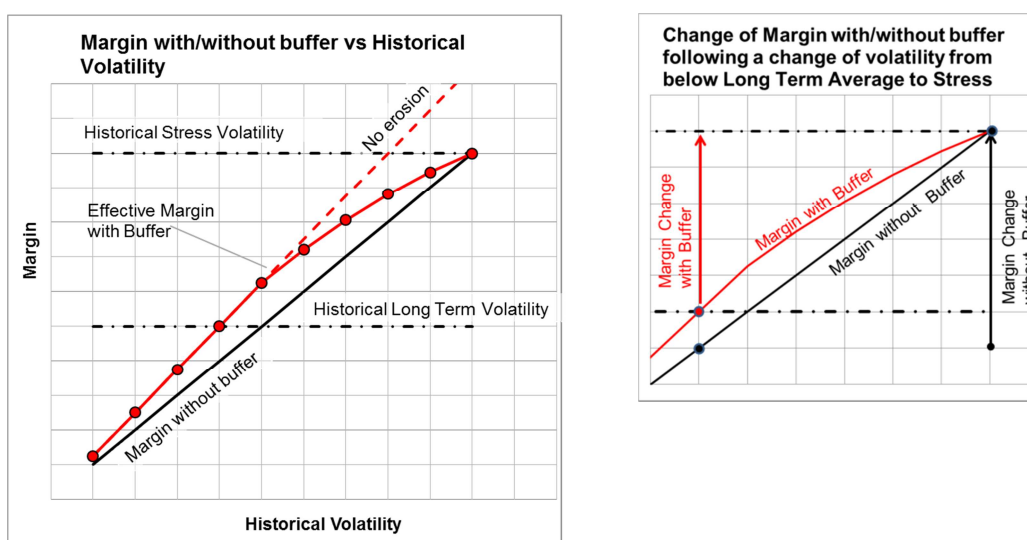
³ i.e. average of 1% largest margin calls

procedures for their application in line with RTS requirements. The buffer from RTS Article 28 (1a) procyclicality adjustment on standard margin requirements could also be temporarily eroded to alleviate the pressure from sudden large margin add-ons in order to allow for a more gradual increase of margins.

3.2.3.1 Option (a) - 25% Buffer on margin calculations

“The CCP shall apply a margin buffer at least equal to 25% of the calculated margins which it allows to be temporarily exhausted in periods, where calculated margin requirements are rising significantly.”

FIGURE 1: MARGIN REQUIREMENTS WITH 25% BUFFER



27. This Option scales up the applicable margins during periods of low margin requirements in order to mitigate the need for a potential future sharp increase.
28. As presented in Annex 5.1, the 25% buffer is one of the two most widely used options by CCPs. In particular, approximately 45% of the total cleared products are margined with this option. The share of this option is equally high both for derivatives and securities (45%). However, it is less used for OTC products (36%) and for margin models based on historical simulation (24%). Again, in terms of underlying asset classes, its share drops significantly for FX (33%) and Interest Rate (22%) based products, but is very high (63%) for commodity based products. This option is also generally used by CCPs that have implemented one of the other procyclicality treatment measures as a fall-back option for products with limited available history.
29. With reference to the application of the buffer on margin requirements, two alternative implementations are used in practice. The first alternative is to scale-up the individual margin parameters used to calculate margin requirements and the second is to scale-up the final margin amount. The two approaches are expected to produce identical results for linear products, but may lead to significantly different margin add-ons for non-linear products or products with inherent leverage. For example, the actual margin add-on for a short out-of-the money call may be

considerably higher than 25% if the buffer is applied on the individual risk factors (e.g. price/volatility shift) instead of the margin amount. That is, a 25% increase of the price shift may result to a higher than 25% increase of the options price. On the other hand, the add-on is generally expected to be lower for in-the-money options. Applying the buffer on the margin parameters will produce risk-sensitive margin add-ons that can efficiently address a sharp increase in the volatility of the underlying risk factors, subject to the condition that the buffer is applied to all risk factors. Nevertheless, applying the buffer on the end margin amount will be equally efficient for linear products with no inherent leverage.

30. In order for this procyclicality treatment option to be efficient, the buffer shall be used to partly or fully absorb margin calls when the margins are rising significantly. In the context of this review it is meaningful to distinguish between two potential scenarios of margin increases. That is, a sharp increase from a low volatility level and a sharp increase from an already stressed level. The latter is expected to have more detrimental effects as the additional collateral request will have to be met at a time when clearing members may already be under severe liquidity pressure.
31. The fact that the buffer is defined as a percentage of margins has the consequence that the margin add-on in absolute terms will be small during periods of low volatility but will then rise super-proportionally for higher volatility levels. Therefore, in order to avoid further amplifying the procyclical effects triggered by the increasing volatility, it is critical for the buffer to be gradually eroded as the volatility increases, and completely exhausted during stress periods.
32. The Regulatory Technical Standards do not include any detailed provisions for specific conditions that should trigger the exhaustion of the buffer or for the erosion pace. Existing CCPs implementations range in terms of sophistication from policy level provisions that the buffer may be eroded when margin requirements are rising significantly, to detailed quantitative soft or hard thresholds that trigger the erosion of the buffer. Where specific thresholds are defined, they are usually calibrated to consider the current level of volatility in relation to stress (i.e. the buffer will be eroded as the volatility approaches its historic stress levels), or even the pace at which current volatility approaches stress levels. The procyclicality buffer is an integral part of the margin model calculation and the limited transparency requirements with regards to the current buffer level and its usage prevent an assessment of whether the buffer was actually efficiently used in all cases to absorb big step changes. In order to enhance the level of transparency, this report considers complementing existing provisions with a requirement for CCPs to report the effective level and usage of the buffer. The implications of the different potential modelling approaches are further analysed in the following paragraphs using the simulation described in 3.2.3.
33. A standard HSVAR (Historical Simulation Value at Risk) model calibrated with a 12 month equally weighted look-back period, a 2 day liquidation period and a 99% confidence interval is used to simulate margin requirements. The performance of this model with the 25% procyclicality buffer using different potential modelling approaches for the erosion of the buffer is compared to the performance of the same model with no procyclicality adjustment. A model where the buffer is not exhausted is also considered in order to assess the consequences. Generally, it is expected that the procyclicality adjustment will limit the big step margin calls and the expected margin shortfalls but also induce higher margin requirements. The summary results for option (a) are presented in Figure 2 (EUROSTOXX 50 Index) and Figure 3 (EUR/CHF).

FIGURE 2: SUMMARY RESULTS FOR OPTION (A), 25% BUFFER ON MARGIN, EUROSTOXX 50 INDEX

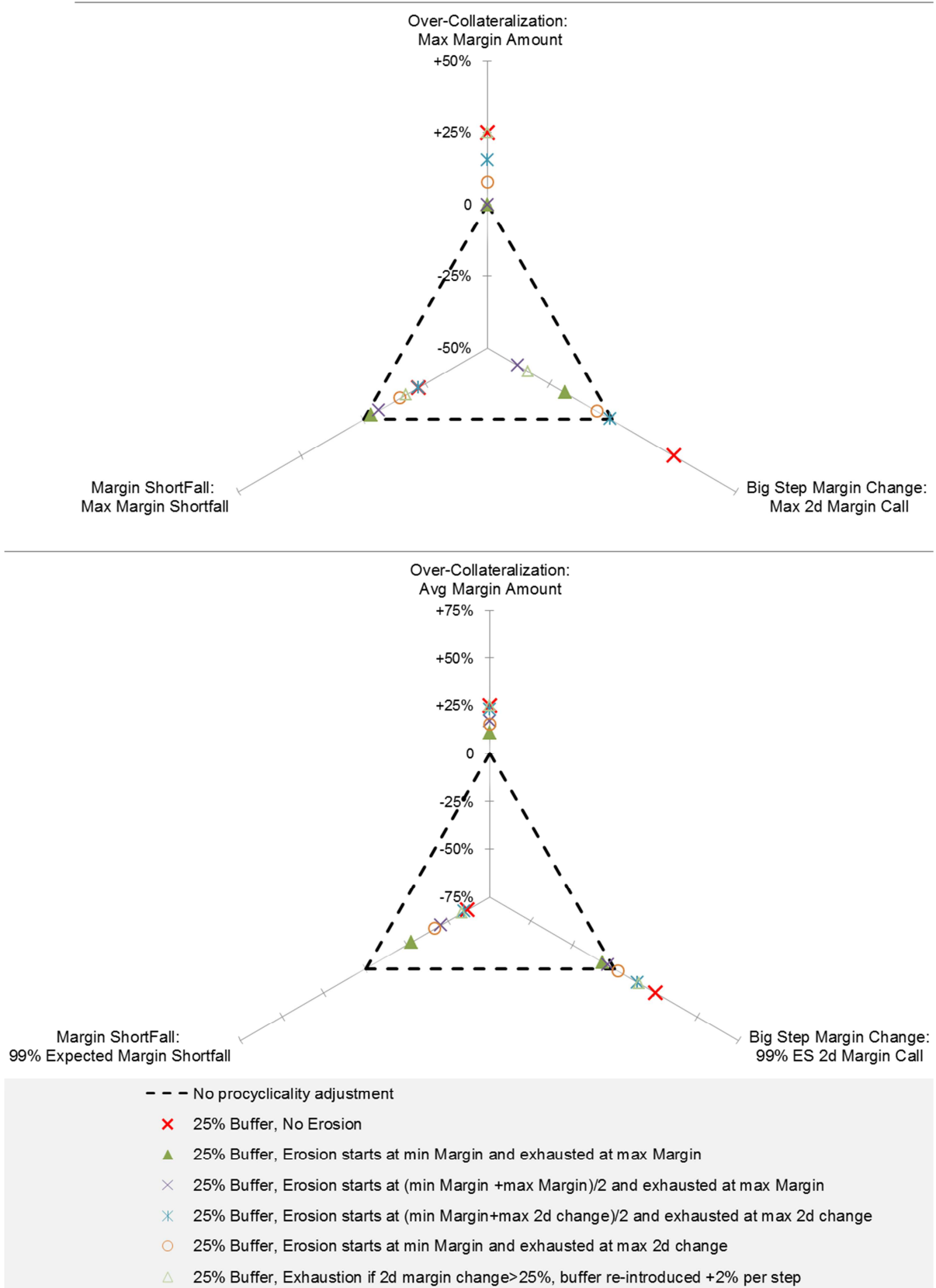
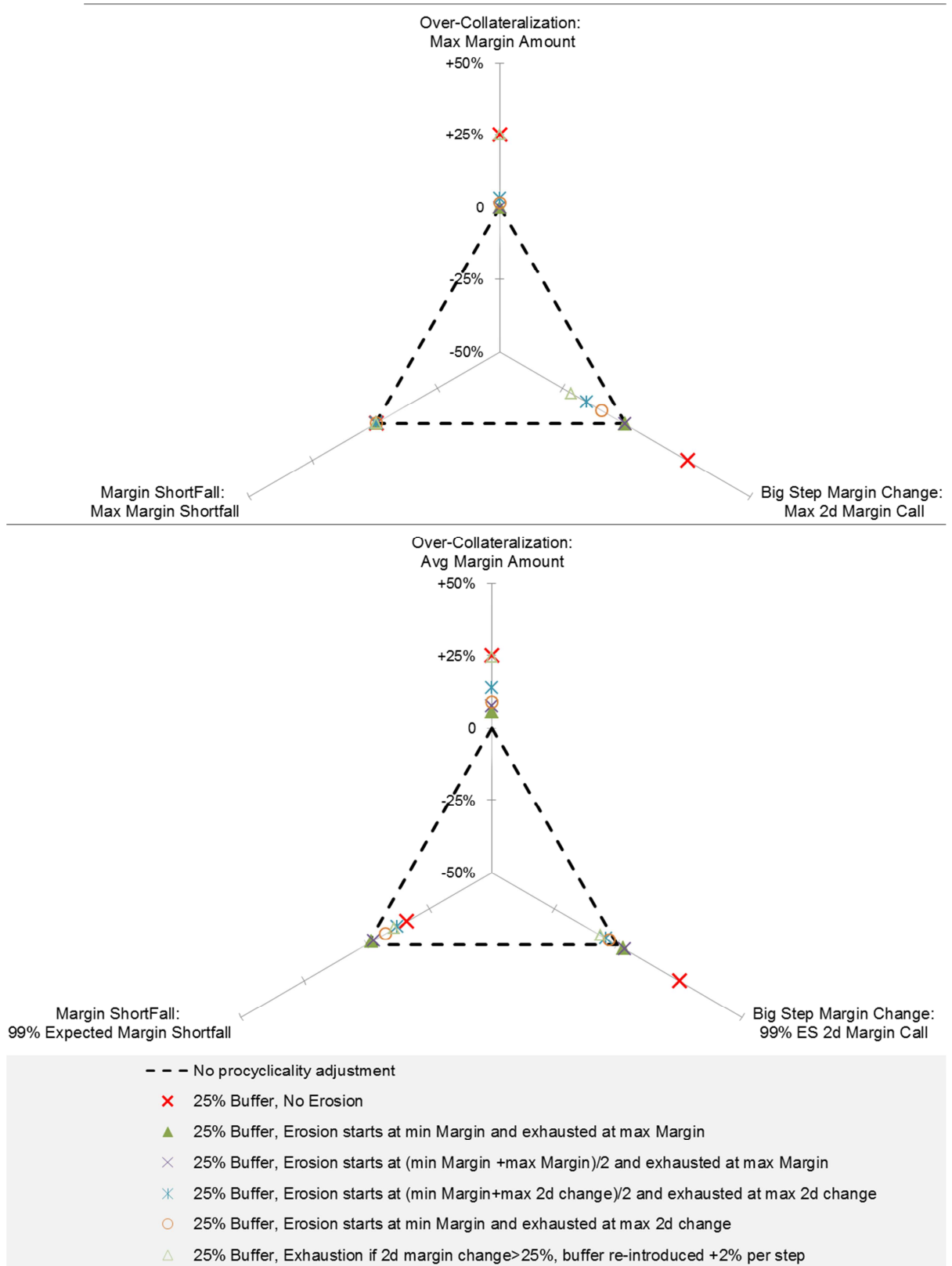


FIGURE 3: SUMMARY RESULTS FOR OPTION (A), 25% BUFFER ON MARGIN, EUR/CHF



34. The dashed line corresponds to the base model (model with no procyclicality adjustment). The maximum (average) margin amounts, the maximum (99% expected) margin shortfalls and the maximum (99% expected) 2 day margin calls are plotted for each modelling alternative on the three respective axes as the % difference from the base model. For example, for EUROSTOXX 50 (Figure 2) and the model with no erosion of the buffer (indicated as red x), the maximum margin amount is 25% higher than the maximum margin amount of the base model. Respectively, the maximum margin shortfall is 22% smaller and big step margin calls, measured as the maximum 2 days margin call are 25% higher. The condition that would trigger the erosion of the buffer could be linked to the current level of volatility (i.e. the buffer will be gradually eroded as volatility approaches its historic maximum/stress levels), the pace at which current volatility approaches historic maximum/stress levels or the required margin change (e.g. the buffer will be exhausted if the margin needs to be increased by more than 25%).
35. In terms of big step margin changes, the erosion of the buffer reduces the margin call amount because the margin can be re-adjusted from an already higher level, while at the same time since the buffer is applied in % terms, it may amplify changes if not eroded. The results indicate that the counter-cyclical buffer limits the big step margin changes that have the most detrimental effects, as the maximum margin call is lower irrespectively of the specific condition used to trigger the erosion of the buffer. The maximum margin call is only increased if the buffer is not eroded at all, indicating that the CCPs should have arrangements that will effectively allow the erosion of the buffer when margins are rising significantly. With regards to the lower than the maximum big step margin calls, the efficiency level of the individual models may vary depending on the conditions that will trigger the erosion and the volatility of the different assets or risk factors. Therefore, the CCPs shall test on a regular basis the efficiency of their conditions and thresholds for the different risk factors and adjust them accordingly.
36. Furthermore, the buffer is expected to reduce margin shortfalls resulting from large price variations beyond the targeted coverage. As it is also confirmed by the simulation results, the buffer alleviates more efficiently the margin shortfall if it has not already been exhausted ahead of the stress price variations. That is, the models that will erode the buffer at higher volatility levels, will achieve smaller margin shortfalls, but on the other hand also higher overall margin requirements. Furthermore, as already discussed, due to the fact that the buffer is defined in % terms, the effective buffer will be low during low volatility periods and will offer limited protection from excessive price variations during a low volatility environment as it can be seen in the case of EUR/CHF. In practice, a CCP that decides to exhaust the buffer following a margin increase will be exposed to procyclical effects from further margin increases, while on the other hand a decision to keep the buffer will not address any current procyclical effects. Therefore, the CCPs shall regularly, including also before any significant margin parameters revision, test the efficiency of their procyclicality treatment measures per risk factor and adjust their policies, conditions and thresholds accordingly. Furthermore, the CCPs shall have documented policies with predefined conditions and thresholds that will lead to the exhaustion of the 25% buffer when margins are rising significantly.
37. The choice of the value of the minimum buffer itself is considered as conservative, since the 25% buffer corresponds to an increase of the confidence level from 99.0% to 99.8% when it is not eroded⁴. The Regulatory Technical Standards do not differentiate between risk factors, financial

⁴Assuming normal distribution of returns.

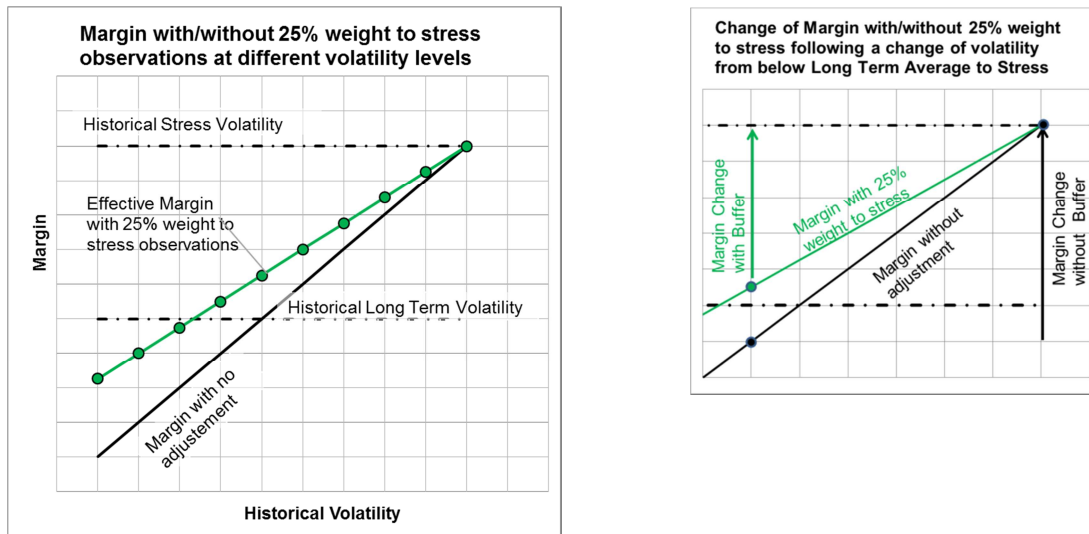
instruments or asset classes in terms of the minimum buffer level (25%). A one-size fit all approach cannot be considered as highly efficient, but from a practical point of view it would be even more challenging to attempt to set different buffer levels considering the number of products and individual risk factors. Moreover, the 25% buffer is the minimum buffer. CCPs should test the adequacy of the minimum buffer and adjust it if necessary. The introduction of detailed requirements for the CCP's to regularly test the applicable buffer per risk factor and disclose the summary test results along with information on the current buffer level and usage would probably be a more efficient policy choice.

3.2.3.2 Option (b) - Minimum 25% weight to stress observations

“The CCP shall assign at least 25% weight to stressed observations in the look-back period calculated in accordance with Article 26.”

38. For this option a counter-cyclical buffer is also introduced by assigning a minimum weight to stress observations. This allows for the buffer to be automatically exhausted during stress periods. In particular, as current volatility approaches its stress levels, the buffer will be increasingly reduced and totally exhausted when the stress levels are reached. According to the analysis provided in Annex 5.1, this option is the least used option by CCPs. That is, only 10% of the total cleared products are margined with this option.

FIGURE 4: MARGIN REQUIREMENTS WITH 25% WEIGHT TO STRESS OBSERVATIONS



39. The reference to article 26 of the Regulatory Technical Standards does not provide any insight for the definition of the look-back period to be used in order to identify the stressed observations. In particular, this specific article discusses the time horizon for the liquidation period (i.e. minimum of 2 or 5 days) and not the time horizon for the calculation of historical volatility which is more relevant and is discussed in article 25.
40. The definition of the look-back period is the first of the two critical factors for the calibration of this procyclicality treatment option and there are three possible alternative implementations. The first one is to consider the EMIR compliant look-back period used for the calibration of the margin requirements described in Article 25 (minimum 1 year), where it is explicitly specified that it should capture a full range of market conditions, including periods of stress. The second alternative is to take into account a longer historical period that would typically range from 5 to 10 years of recent history. The third and most conservative alternative is to look at the full available history.
41. The implications of any choice among these alternatives are clearly significant but need also to be assessed in parallel with the methodology used to identify and calibrate the stress component. Typical implementations include (i) the calculation of a 99% volatility measure on a short-term period selected as representative of extreme market conditions, (ii) the calculation of an expected shortfall measure, that is the average of volatility observations exceeding the 99% measure and (iii) the calculation of a 99% volatility measure from scenario prices each stemming from a stress period, subsequently scaled down to target a confidence level of 99%.
42. Relying only on recent history to identify stressed observations and not taking into account earlier, more severe stress events will result to an underestimation of the stress component during a low volatility period. Furthermore, it would be equivalent to using option (a), i.e. % buffer on margins, with a buffer that is lower than 25%. For example, if the stress component for option (b) is

calibrated at a 99.99% confidence level on the margin look-back period, then option (b) will produce identical results to option (a) with a buffer of 15%⁵ and no erosion. The stressed observations should also be selected to reflect extreme events that are relevant to the specific product or risk factor in order to produce an efficient buffer. Furthermore, additional weighting procedures, as in the case of EWMA models should not result to an effective weight for stressed observations of less than 25%.

43. In general, the buffer introduced by this option depends on the difference between the stress component and the current volatility⁶. The buffer is set equal to 25% of this difference. In practice, the buffer will be 25%, if the stressed component is set at a level that is double of current volatility, which implies that the stress observations should correspond to the most severe events in the full available history. Furthermore, the stress component needs to be counter-cyclical. That is, it is expected that it will not rise during stress shocks because otherwise it would amplify the procyclical effects instead of reducing them. In order to reduce the probability of needing to reset the stress component at a higher level during a future stress event, the stress component needs to be calibrated taking into account the most extreme events in the full available history. The implications of the different interpretations and modelling choices are further analysed in the following paragraphs using the simulation approach, where the performance of the base model (no procyclicality adjustment) is compared to the performance of different potential modelling approaches for the calibration of the stress component. The summary results of the simulations are presented in Figure 5 and Figure 6.
44. Different potential alternatives are assessed, where the stress component is calibrated either as a stress volatility measure (calculated to cover 2 day price variations over a standard or stress look-back period and/or at a higher than 99% confidence interval) or as the maximum 2 day price variation over the entire history. For the EUR/CHF simulation, a model where the stress component is set to cover a potential de-pegging event is also considered to assess the effects of taking into account hypothetical stress scenarios.

⁵i.e. assuming normal distribution of returns, $75\% \cdot \text{VAR}(99\%) + 25\% \cdot \text{VAR}(99.99\%) = 115\% \cdot \text{VAR}(99\%)$

⁶i.e. $75\% \cdot \text{VAR}(99\%) + 25\% \cdot \text{STRESS} = \text{VAR}(99\%) + 25\% \cdot (\text{STRESS} - \text{VAR}(99\%))$

FIGURE 5: SUMMARY RESULTS FOR OPTION (B), 25% WEIGHT TO STRESS, EUROSTOXX 50 INDEX

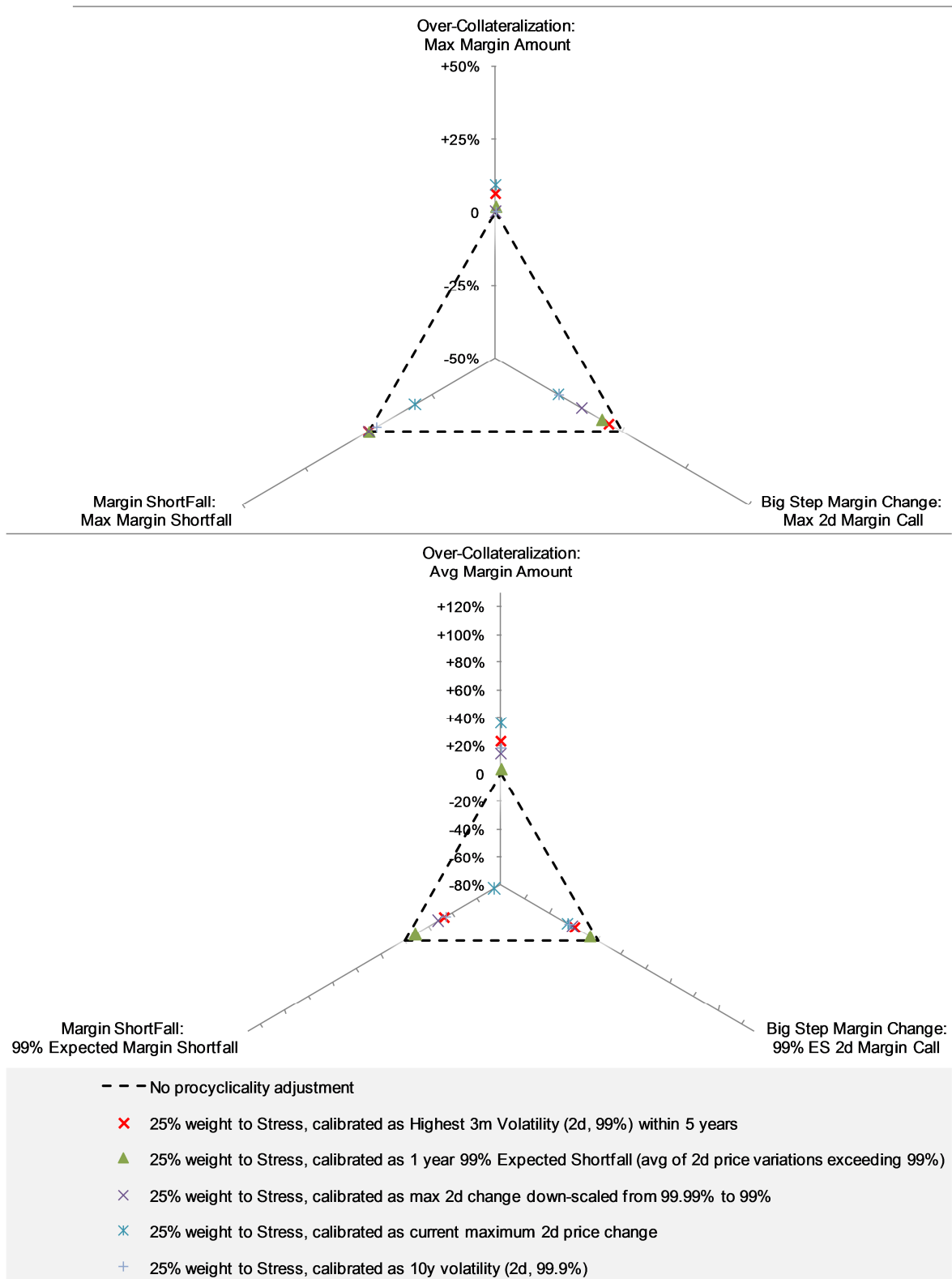
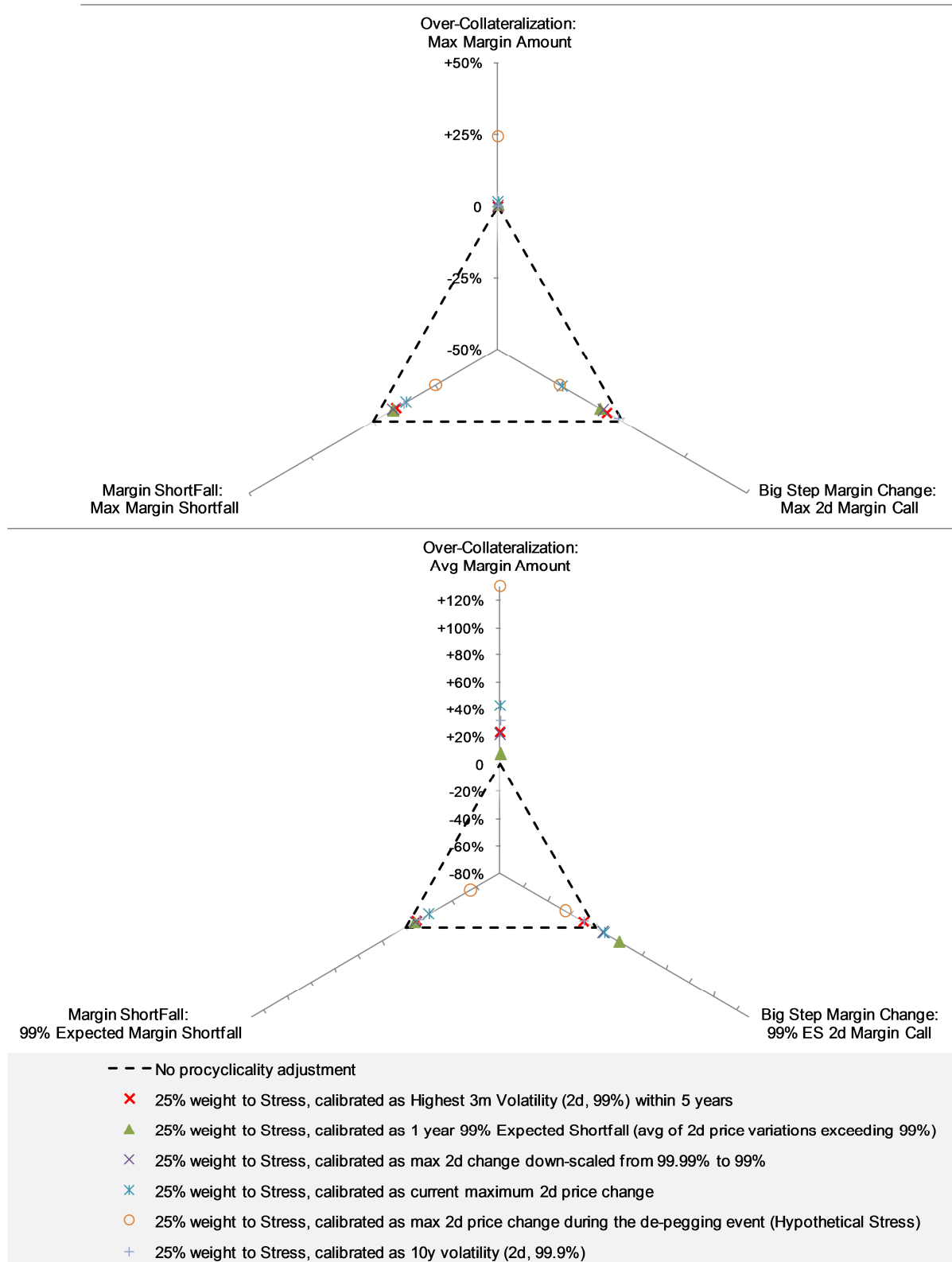


FIGURE 6: SUMMARY RESULTS FOR OPTION (B), 25% WEIGHT TO STRESS, EUR/CHF



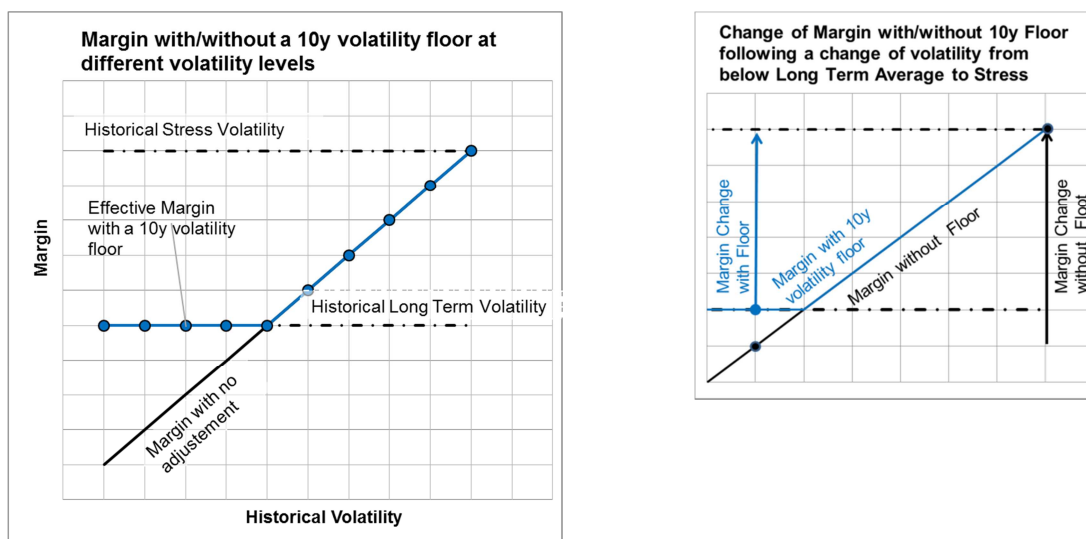
45. The results indicate that all assessed modelling alternatives reduce procyclicality effects in terms of the maximum margin call, while the models that are calibrated at maximum historic or hypothetical price variations outperform the models that are calibrated on the basis of stress volatility measures. On the other hand for EUR/CHF, the only model that also effectively reduces the average big step margin calls is the one that is calibrated using the de-pegging price variations. This model produces also the lowest margin shortfall, compared to all procyclicality options (a, b and c) tested for EUR/CHF, while the maximum and the average margin amounts increase significantly.
46. The procyclicality treatment tools are also expected to limit margin shortfalls as they induce higher margin requirements. In terms of maximum and expected margin shortfalls, the simulation results show as well that the models calibrated at maximum historic or hypothetical price variations outperform the models that are calibrated on the basis of stress volatility measures at the expense of higher maximum and average margin requirements.
47. The 25% weight defines the pace of the erosion of the buffer. A larger weight to stress observations would further reduce the procyclical effects but at the same time increase over-collateralization during non-stressed periods. From the simulation results it can be concluded that the 25% weight to stress will limit the procyclicality of margin requirements more efficiently, if the full available history is used and the identification of stress observations is linked to the stress (historical and hypothetical) scenarios applied in the context of the stress testing framework. Furthermore, CCPs should regularly, including also before any significant margin parameters revision, test the efficiency of procyclicality measures per risk factor, adjust their policies accordingly and disclose summary results of these tests along with information on the current procyclicality adjustment level and usage.

3.2.3.3 Option (c) - Floor of Margin calculated using a 10y look-back period

"The CCP shall ensure that its margin requirements are not lower than those that would be calculated using volatility estimated over a 10 year historical look-back period."

48. This option introduces a floor on the margin parameters calibrated at the long term average volatility. It is expected to address procyclical effects that could arise following a rapid reversion of the volatility from its lowest levels to the long term mean. Nevertheless, no buffer will be introduced when the current volatility is above its long term average level.

FIGURE 7: MARGIN REQUIREMENTS WITH A 10 YEAR VOLATILITY FLOOR



49. This option is together with option (a), i.e. 25% buffer on margin, the most widely used options by CCP's. The analysis provided in Annex 5.1, indicates that approximately 45% of the total cleared products are margined with this option. This option is marginally more popular for OTC (55%) vs ETD (40%) products and for Securities (52%) vs Derivatives (41%). In terms of underlying classes it is the top option for Currency (56%), Interest Rate (56%) and Equity/Debt (49%) based products, but is less widely used for Commodities (29%).
50. Typically, CCPs using a 10 year historical look-back period to calibrate margin parameters will also rely on this option to comply with the procyclicality treatment requirements. It can be argued that the calibration of margin requirements via a long term volatility measure will generally decrease the probability of big step changes and thus procyclical effects without the need for an additional buffer. However when, under stressed conditions, extraordinary margin calls become inevitable, no buffer will be available to absorb the rapid increase of margin requirements.
51. The term 'volatility' is not explicitly defined in EMIR and no detailed requirements are provided with regards to its calculation. Some CCPs have implemented this option by setting generic floors to the margin parameters using long term volatility estimates. However, this approach may fail to address idiosyncratic risks from the individual exposures, while the efficiency of this type of floors to limit procyclical effects will evidently depend on how conservatively these floors were estimated in the first place. The floor should at least be calibrated using the price history of each risk factor, along with the confidence interval and the liquidation period of the margin calculation.
52. Some CCPs use exponentially weighted moving average models (EWMA) to calculate volatility for their margin models. This methodology will assign exponentially increasing higher weights to more recent observations. The volatility estimate will therefore effectively only depend on the most recent observations and not on the full available history in the look-back period. A long-term volatility floor that is calibrated using this technique will therefore closely track current volatility levels and is expected to offer limited protection from procyclical effects.
53. However, a floor based on a 10 year equally-weighted volatility will offer some countercyclical protection to margin models calibrated using short term equally-weighted or long term EWMA

volatility estimates. But even in this case it is expected that this protection will only address shocks starting from low volatility levels and not the ones that start from above-average volatility levels. The efficiency of potential implementations of this tool to address procyclical effects is further investigated in the following paragraphs using the simulation approach, where the performance of the base model (1 year look-back-period with no procyclicality adjustment) is compared to the performance of different potential modelling approaches for the calibration of the margin model and the floor. The summary results of the simulations are presented in Figure 8 and Figure 9. Different potential alternatives are assessed, where the margin is calculated using different look-back periods (1, 5 or 10 years) and the floor is calibrated as the margin that would have been calculated using a 10 year equally weighted look-back period at various confidence intervals..

FIGURE 8: SUMMARY RESULTS FOR OPTION (C), 10Y VOLATILITY FLOOR, EUROSTOXX 50 INDEX

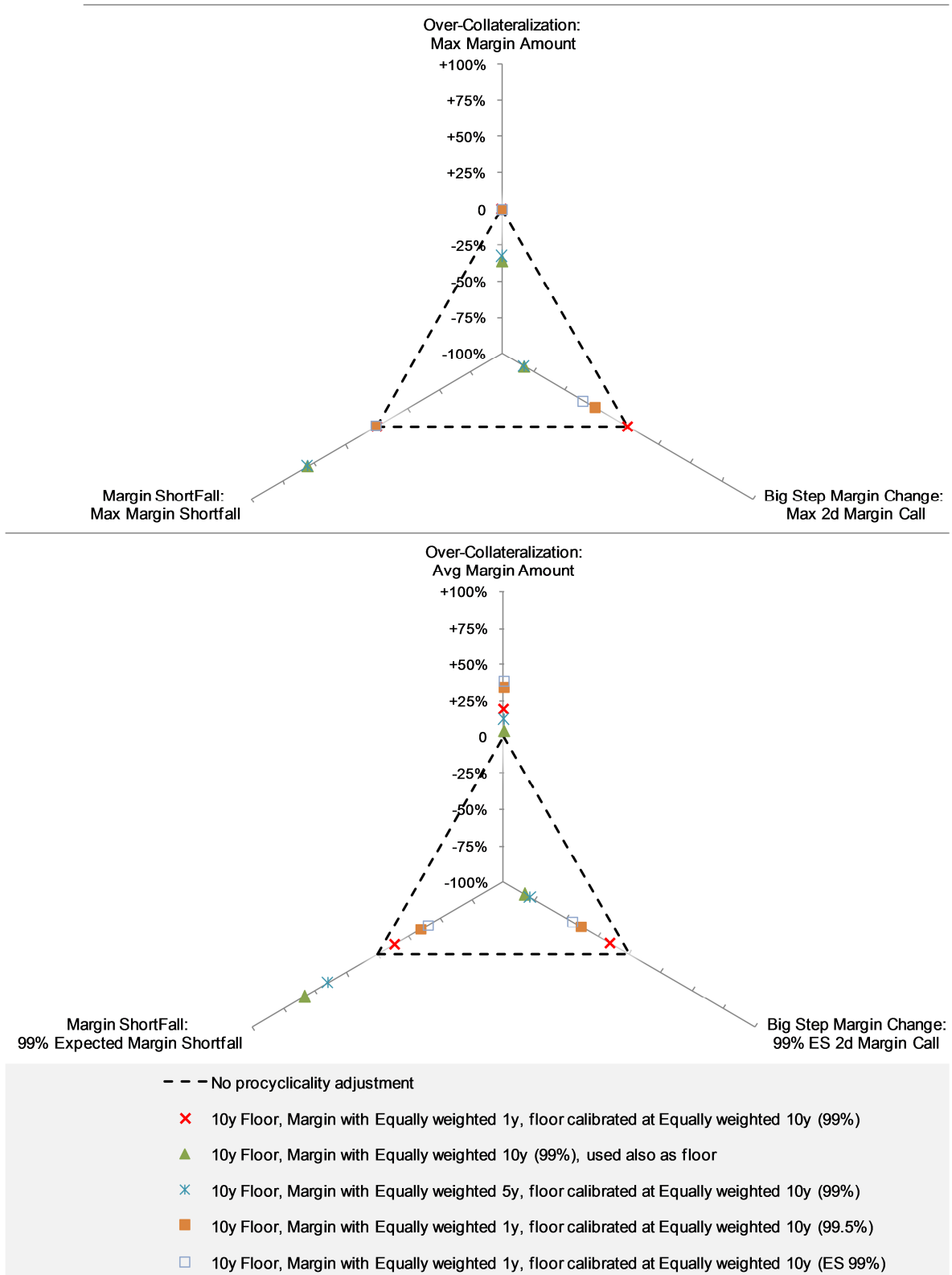
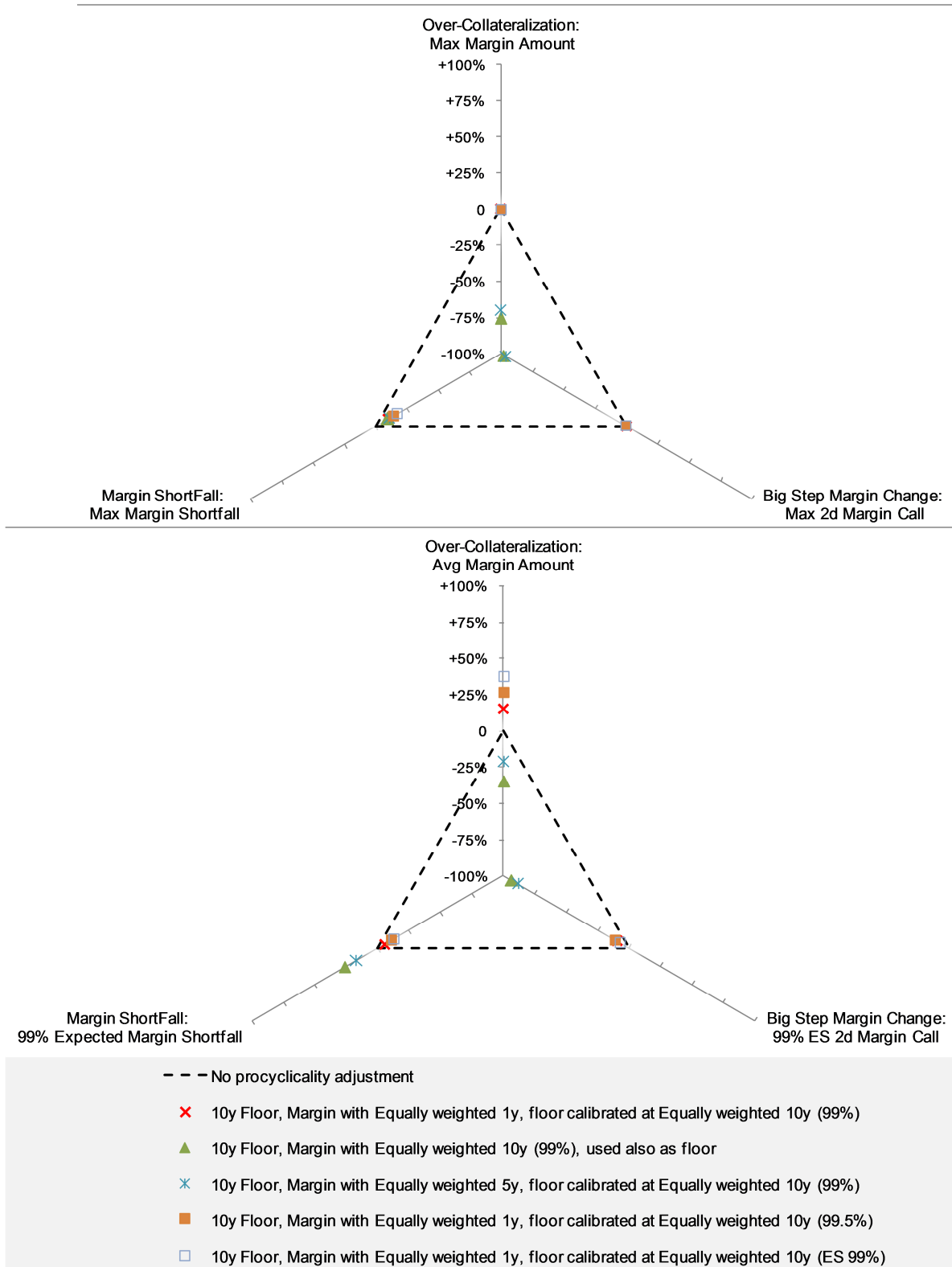


FIGURE 9: SUMMARY RESULTS FOR OPTION (C), 10Y VOLATILITY FLOOR, EUR/CHF



54. The simulation results confirm that if the margin is calculated over an equally weighted 10 year look-back period also used to comply with the procyclicality requirements, the big step margin changes are significantly reduced as the margin calculation is insensitive to short-term volatility shifts and the maximum margin requirements are considerably lower as the model averages out short-term volatility peaks. However, this model did not limit margin shortfalls when compared to the base model. Instead, the 10 year margin model further exacerbated the margin shortfalls with the exception of the maximum margin shortfall for EUR/CHF, which was caused by a shock starting from below average volatility levels.
55. For the models where the margin was calculated using the minimum EMIR compliant look-back period (1 year), the 10 year floor limited the big step margin changes and the margin shortfalls, when the volatility was below the long term average, but performed as well as the base model with no adjustment otherwise. The performance further improved when the 10 year volatility floor was calibrated at a higher than the minimum confidence interval, while the average margin was increased due to the floor being set at a higher level. As expected, the maximum margin requirement was not affected as the counter-cyclical add-on is only applicable when the margin is below its long term average levels.
56. From the simulation results it can be concluded that the 10 year floor will limit the procyclicality of margin requirements if the margin is calibrated using a considerably shorter look-back period and when the margin is below its long term average levels. A floor calibrated at a higher than the EMIR minimum confidence interval can improve its performance without affecting the maximum margin requirements. The CCPs should regularly, including also before any significant margin parameters revision, test the efficiency of procyclicality measures per risk factor, adjust their policies accordingly and disclose summary results of these tests along with information on the current procyclicality adjustment level and usage.

3.2.4 Arrangements for the Revision of Margin Requirements

57. With regards to the need to address procyclical effects on margins, the arrangements used to revise margin requirements are also very important. The actual frequency of margin revisions and the timeframe for revisions to become effective are the most critical aspects.
58. EMIR requires CCPs to regularly monitor and, if necessary, revise the level of its margins to reflect current market conditions taking into account any potential procyclical effects of such revisions. Furthermore, in the RTS it is further specified that the CCP shall establish transparent and predictable procedures for adjusting margin requirements. Moreover, when a CCP revises the parameters of the margin model in order to better reflect the current market conditions, it shall take into account any potential procyclical effects of such revision.
59. Historical Simulation models will on a daily basis incorporate volatility updates. For parametric margin models, any change in the volatility will only affect the margin requirements when the margin parameters are actually revised. A more frequent recalibration of margin models will clearly reduce the probability of big steps changes in margin requirements due to changes in the underlying volatility of risk factors. It will cater for smooth and gradual adaptation of margin requirements to changes in the volatility regime.
60. The Regulation provides for the obligation of CCPs to regularly adjust margin parameters, but does not introduce specific requirements for the frequency of such revisions. To date our experience from procedures implemented by CCPs shows that the minimum frequency for

parametric margin models typically ranges from daily to semi-annually, with most CCPs revising their parameters on a monthly basis. CCPs that use historical simulation models to calculate margin requirements will incorporate volatility updates on a daily basis without the need to explicitly revise margin parameters. For parametric margin models, the frequency for revising margin parameters shall clearly depend on the volatility of margin parameters, i.e. the volatility of volatility of the underlying risk factors. A more frequent revision of parameters will be required for risk factors with non-linear effects on margins or during stress events. This will also be the case when margin parameters are not sharing the same measure with the actual risk factors. For example, if the margin parameters are disclosed in the form of monetary amounts (e.g. in EUR per lot) while the appropriate measure for the calculation of the risk exposure is % of nominal exposure (as for example in the case for equities). In this case the parameters should be revised more frequently as the effects of a potential price increase will not be taken into account until the parameters are actually revised. A failure to revise the parameters on a more frequent basis may result in big step changes when the parameters are eventually revised.

61. Beyond the minimum frequency of margin revisions, the time horizon for the implementation of revisions is also relevant from a procyclicality point of view. That is, informing the clearing participants well ahead of any significant margin parameters revisions is expected to alleviate the pressure from margin calls. Clearly there is a trade-off between the frequency of margin revisions, the time given to members to react and of course the need to swiftly collateralise rising exposures. However, when margin parameters revisions are more frequent, the effective changes are expected to be on average smaller and the limited time given to participants will not hinder their timely coverage. Furthermore, the CCPs should also perform an impact analysis before any significant revision of the margin parameters and should notify at least the market participants with significant expected margin calls as early as possible before the new parameters become effective.
62. CCPs have introduced further arrangements to cope with big step margin parameter changes. Examples of such arrangements are the introduction of a limit on the maximum upward change of parameters following a single review or also the provision that any proposed reduction in margin parameters shall pass a number of consecutive regular reviews before being actually implemented. This kind of procedures is expected to reduce the probability of big step margin changes. However, risk parameter changes should not be delayed solely on the basis of the need to avoid big step margin changes. The counter-cyclical tools provided in the RTS can be used to alleviate the pressure of sudden margin calls. The design and implementation of counter-cyclical procedures shall be aligned with the overall objective of prudential requirements, which is to safeguard the financial stability of the CCPs.
63. The introduction of requirements that will induce more frequent regular margin parameters revisions could be considered as a tool to strengthen the efficiency of the procyclicality treatment tools provided by the RTS.

3.2.5 Predictability and Transparency

64. The predictability of margin requirements is also a critical factor that can reduce the impact of sharp margin increases when such changes are necessary to ensure the proper collateralisation of exposures. In order for margin requirements to be predictable, the participants need to understand the methodologies used to calculate margin requirements and parameters, have access to all relevant data required to partially predict such changes and also be able to replicate these calculations.

65. Specific requirements are provided by EMIR and the RTS for this purpose. That is, CCPs shall disclose to its clearing members the price information used to calculate its end-of day exposures. Furthermore, a CCP shall employ robust information and risk-control systems to provide, where appropriate, its clearing members and, where possible, clients with the capacity to obtain timely information. Furthermore, CCPs shall make information available to public regarding the risk management systems, techniques and performance, including information on price data sources and models used in margin calculations.
66. With regards to the implementation of these provisions, CCPs provide in their websites summary information on the models used to calculate margin requirements. The level of detail differs from CCP to CCP and ESMA effort on supervisory convergence will continue to further enhance the detail of available information. CCPs also provide pricing data information to members at least on a daily or in some cases also on an intraday basis, usually through the clearing system.
67. A point that might be further strengthened is for CCPs to provide clearing members with tools that will enable them to calculate margin requirements for simulated positions, prices and margin parameters. This will make it easier for the clearing participants to anticipate big margin changes ahead of changes in positions, parameters or prices, but may also raise confidentiality and intellectual property concerns. Moreover, CCPs could make publicly available the entire history of margin parameters revisions including a justification for the changes in order to further increase the level of transparency and the level of awareness of the clearing participants for margin revision policies.

3.3 Collateral

3.3.1 Eligible Collateral

68. The Regulation provides strict requirements with regards to the assets that can be used to cover margin requirements. In particular, the CCP is allowed to accept only highly liquid collateral with minimal credit and market risk. The specific conditions that need to be met for a financial instrument to be eligible collateral are set out in the Regulatory Technical Standards.
69. The conditions that are of interest in the context of potential procyclical effects are the ones that are correlated with market and credit cycles and could therefore force the CCPs to remove one instrument or a category of instruments from the eligible collateral list causing additional liquidity pressure to clearing members at a time when they are already stressed. In particular, (a) the issuer shall have a low credit risk, (b) the instrument shall have a low market risk and (c) an active outright sale or repo market shall be available. For conditions (a) and (b), the assessment of credit and market risk shall be performed by the CCP internally using a defined and objective methodology and shall not fully rely on external opinions. This provision is expected to mitigate the probability of all CCPs removing at the same time particular collaterals from the eligible list following a deterioration of their credit rating from Credit Rating Agencies that could further fuel procyclical effects.
70. In terms of available liquidity, i.e. condition (c), the CCP shall demonstrate for all eligible collateral that it will have reliable access to an active market, including in stress conditions. Furthermore, the RTS provide that the CCP shall establish and implement transparent and predictable procedures to assess and continuously monitor the liquidity of assets accepted as collateral and take remedial action where appropriate.

71. The RTS have already introduced strict conditions in order to ensure as much as possible that only high quality collateral will be eligible, thus limiting the probability of collateral being no longer eligible during market or credit downturns. With the caveat of the limited observation time window due to the short period of EMIR implementation, no evidence of significant and disruptive changes in the eligible collateral list have been identified. However, no explicit reference is made in EMIR in terms of the need for CCPs to take into account potential procyclical effects when revising the eligible collateral list.

3.3.2 Valuation of Collateral and Haircuts

72. According to EMIR, a CCP shall apply adequate haircuts to asset values that reflect the potential for their value to decline over the interval between their last revaluation and the time by which they can reasonably be assumed to be liquidated. It shall take into account the liquidity risk following the default of a market participant and the concentration risk on certain assets that may result in establishing the acceptable collateral and the relevant haircuts
73. With regards to the haircuts on collateral, the RTS set out that a CCP shall demonstrate to the competent authority that haircuts are calculated in a conservative manner to limit as far as possible procyclical effects. Furthermore, a CCP should avoid as far as possible disruptive or big step changes in haircuts that could introduce procyclicality.
74. Moreover, for the calibration of haircuts, it is further specified that haircuts shall recognise that collateral may need to be liquidated in stressed market conditions and take into account the time required to liquidate it. A set of criteria to be considered when determining the haircuts is provided. The criteria that could in the aforesaid context trigger procyclical effects are: (a) the level of credit risk of the instrument, (b) the historical and hypothetical future price volatility of the asset in stressed market conditions and (c) the liquidity of the underlying market.
75. With reference to the level of credit risk, the CCP shall perform an internal assessment using a defined and objective methodology and shall not fully rely on external opinions. This shall ensure that the CCP will not revise the haircuts based solely on external input.
76. Regarding the criterion to consider the liquidity of the underlying market, EMIR sets out that the CCP shall take into account the liquidity risk following the default of a market participant. That is, the CCPs policy for calibration of haircuts shall take into account the liquidity under stressed conditions. Therefore, it is not expected to be overly sensitive to new stress shocks.
77. The regulation does not provide a clear binding link of the RTS requirements to consider historic and hypothetical future price volatility and liquidity in stress conditions when calibrating the haircuts, to the detailed provisions set out to identify the worst historic and hypothetical scenarios in the context of the stress testing framework used to test the size of the default fund and the total financial resources. EMIR and subsequently the RTS could be complemented with more prescriptive requirements for the stress-based calibration and revision of haircuts that limit procyclicality by minimising the probability for CCPs to be forced to raise the collateral haircuts during periods of stress.

4 Conclusions

78. EMIR prudential provisions have objectively strengthened the ability of authorised European CCPs to prevent and control risks and potential procyclical effects. All authorised CCPs have implemented arrangements that will mitigate procyclical effects in compliance with EMIR provisions. Having said that, there is still room for improvement and the experience from the implementation of existing provisions can be used to further increase their effectiveness. On the basis of the analysis performed, the following paragraphs elaborate on possible changes that can be introduced in EMIR Level I, including also the need to define additional intervention capacity in this area. Further reference is also made to potential amendments of RTS requirements that could be implemented by ESMA following a consultation process on the basis of existing or new mandates as a response to the EMIR Level I changes and the need to improve the overall efficiency of margin requirements to limit procyclicality. Furthermore, the effort for international convergence, also in the area of procyclicality treatment, shall continue in order to avoid regulatory arbitrage and accommodate the mitigation of systemic risks. In particular, the convergence of procyclicality treatment measures on a global level towards best practices is critical to ensure a level playing field as European CCPs already face more prescriptive requirements.
79. The fact that CCPs use different tools and calibration methods to address procyclicality effects is beneficial from a systemic perspective as it can help alleviate potential model risks. However, the three options provided in RTS Article 28 have different theoretical properties and will not perform equally under different market conditions. CCPs should actively and regularly identify and manage potential procyclicality threats in a timely manner. Therefore, it could be considered to complement existing RTS requirements with a provision for CCPs to define one or more procyclicality metrics and to test regularly, including also before any significant margin parameters revision, as part of the sensitivity analysis programme, the efficiency of the procyclicality treatment arrangements for all risk factors taking into consideration the current point in market, credit and business cycles and the specificities of their product offerings and risk management practices and adjust policies, conditions and thresholds on the basis of these results. This can be part of the sensitivity testing and analysis procedure (RTS Article 50) and could be amended following a consultation process by ESMA on the basis of the mandate specified in Article 49(4) of EMIR. In compliance with RTS Articles 50 and 61, the CCP will also have to periodically report its sensitivity testing results and analysis in a form that does not breach confidentiality to the risk committee in order to seek its advice in the review of the margin model and publicly disclose information including high level summary test results and any corrective actions taken.
80. The options to address procyclicality provided in Article 28 of the RTS can also be further specified by ESMA to increase their effectiveness, within the existing mandate of Article 41(5) of EMIR following a consultation process. In particular, the CCP should employ at least one of the provided options to all the individual risk factors used to calculate margin requirements (e.g. price shifts, implied volatility shifts, maturity spreads and offsets). The CCP may apply these adjustments to the end margin requirement for products that have a linear risk profile and no inherent leverage or if it can provide evidence that the adjustments will perform at least as effective as if they were applied to the individual risk factors. With regards to the requirements for the calibration of the individual procyclicality treatment options of the RTS article 28, option (a) (i.e. 25% buffer on margins) could be complemented with an obligation for CCPs that use this option to have documented policies and procedures with predefined conditions and thresholds, that will lead to the exhaustion of the buffer when margins are rising significantly. Furthermore,

option (b) (i.e. 25% weight to stress) could be amended to require CCPs to assign at least 25% weight to stressed observations identified in the stress (historical and hypothetical) scenarios applied in the context of the stress testing framework in compliance with the detailed requirements included in RTS Chapter XII. Moreover, the use of Option (c) (10 year floor) should be conditioned on the CCP using also a short look-back period (e.g. minimum of 1 year and maximum of 2 years or longer if the CCP uses a weighting procedure that will effectively apply a larger weight to recent observations) to calculate the margin requirements. Under this condition, it could be specified that the margin requirements should not be lower than those that would be calculated using volatility estimated over a 10 year equally weighted historical look-back period, a minimum liquidation period according to RTS article 26 and a minimum confidence interval according to RTS article 24.

81. With regards to the arrangements used for the revision of margin parameters we suggest that article 41 of EMIR is amended to extend the mandate for ESMA to develop draft regulatory technical standards to specify the frequency of monitoring and revising margin parameters and the information that needs to be publicly disclosed or provided to the clearing members, taking into account the objective to limit procyclicality. The RTS could then be complemented by ESMA following a consultation process with a requirement for CCPs to regularly revise parameters used for margin requirements. The revision should be more frequent for risk factors with non-linear effects on margins, during stress events or if the parameters do not share the same measure with the risk factors (e.g. parameters set in monetary amounts instead of %). Furthermore, the CCP could be required to perform an impact analysis before any significant margin parameters revisions and notify at least the market participants with significant expected margin calls as early as possible before the new parameters become effective.
82. The predictability of margin requirements and the awareness of market participants could also be raised if the existing requirements were complemented with an obligation for CCPs to either make publicly available or, as a minimum, share with the clearing members the entire history of margin parameters revisions including a justification for the changes, the current procyclicality adjustment level & usage and provide clearing members with tools that will enable them to calculate margin requirements for simulated positions, prices and margin parameters. The latter may also raise confidentiality and intellectual property concerns and should be subject to consultation and further considerations.
83. In terms of collateral, we suggest that article 46 of EMIR is complemented with a requirement for CCPs to take into account any potentially procyclical effects when revising the list of acceptable collateral and haircuts to the extent that this will not affect negatively its soundness and financial security. Furthermore, in order to minimise the probability for CCPs to be forced to raise the collateral haircuts during periods of stress, we suggest that the same article is complemented with a requirement for CCPs to take into account the scenarios of extreme but plausible market conditions referenced in article 42, when setting the adequate haircuts. This is expected to increase collateral requirements and their costs and benefits should be duly analysed. The RTS article 41 could then be complemented to link the current requirement to take into account the historical and hypothetical future price volatility of the asset in stressed market condition, to the identified stress (historical and hypothetical) scenarios applied in the context of the stress testing framework described in RTS Chapter XII.

5 Annexes

5.1 Analysis of the usage of EMIR provisions

FIGURE 10: USAGE (%) OF PROCYCLICALITY TREATMENT OPTIONS ACROSS CCP'S AND PRODUCTS

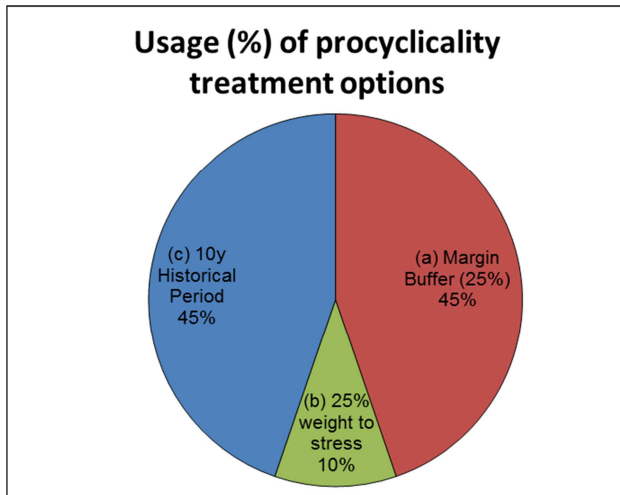


FIGURE 11: USAGE (%) OF PROCYCLICALITY TREATMENT OPTIONS FOR ETD/OTC PRODUCTS

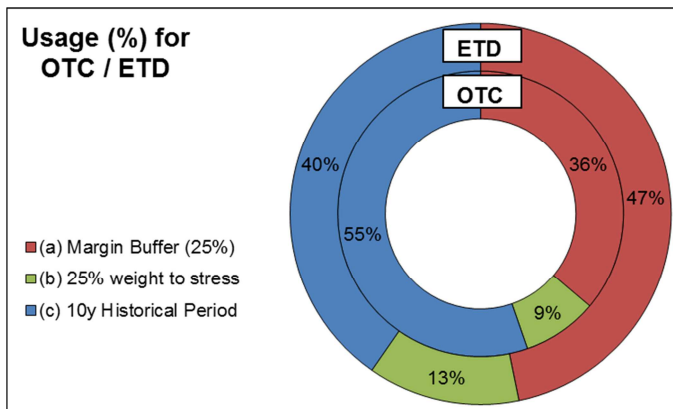


FIGURE 12: USAGE (%) OF PROCYCLICALITY TREATMENT OPTIONS FOR DERIVATIVES/SECURITIES

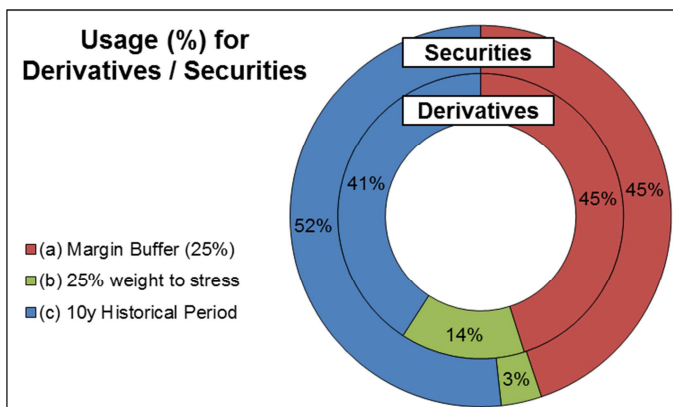


FIGURE 13: USAGE (%) OF PROCYCLICALITY TREATMENT OPTIONS FOR DIFFERENT MARGIN MODEL TYPES

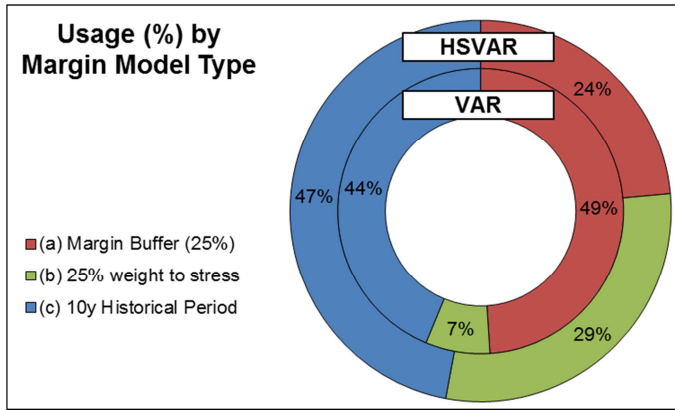


FIGURE 14: USAGE (%) OF PROCYCLICALITY TREATMENT OPTIONS FOR DIFFERENT UNDERLYING CLASSES

