Chapter 7

Market risk
7.10 Use of a Value at Risk Model

Application

7.10.1 BIPRU 7.10 applies to a firm with a VaR model permission.

Introduction and purpose

7.10.2 BIPRU 7.10 provides details of when the appropriate regulator expects to allow a firm to use a VaR model (value at risk model) for the purpose of calculating part or all of its PRR. It introduces the concept of a VaR model, the methodology behind it and the link to the standard market risk PRR rules. It then goes on to detail the application and review process. The bulk of BIPRU 7.10 specifies the model standards and risk management standards that firms will be required to meet in order to use a VaR model. It further stipulates requirements for stress testing, backtesting, capital calculations and finally the reporting standards expected by the appropriate regulator.

7.10.3 The models described in BIPRU 7.10 are described as VaR models in order to distinguish them from CAD 1 models, which are dealt with in BIPRU 7.9 (Use of a CAD 1 model). A VaR model is a risk management model which uses a statistical measure to predict profit and loss movement ranges with a confidence interval. From these results PRR charges can be calculated. The standards described in BIPRU 7.10, and which will be applied by the appropriate regulator, are based on and implement Annex V of the Capital Adequacy Directive.

7.10.4 The aim of the VaR model approach is to enable a firm with adequate risk management systems to be subject to a PRR requirement that is more closely aligned with the risks to which it is subject than the PRR requirements generated by the standard market risk PRR rules. This provides a firm with an incentive to measure market risks as accurately and comprehensively as possible. It is crucial that those responsible for managing market risk at a firm should be aware of the assumptions and limitations of the firm’s VaR model.

7.10.5 There are a number of general methodologies for calculating PRR using a VaR model. The appropriate regulator does not prescribe any one method of computing VaR measures. Moreover, it does not wish to discourage any firm from developing alternative risk measurement techniques. A firm should discuss the use of any alternative techniques used to calculate PRR with the appropriate regulator.
A firm should not use the VaR model approach to calculate PRR unless it has a VaR model permission. If a firm does not have such a permission it should use the standard market risk PRR rules. Therefore, a firm needs to apply for a VaR model permission in order to calculate its PRR using a VaR model instead of (or in combination with) the standard market risk PRR rules.

### Conditions for granting a VaR model permission

A waiver or other permission allowing the use of models in the calculation of PRR will not be granted if that would be contrary to the Capital Adequacy Directive and any VaR model permission which is granted will only be granted on terms that are compatible with the Capital Adequacy Directive. Accordingly, the appropriate regulator is likely only to grant a waiver or other permission allowing the use of models in the calculation of PRR if it is a VaR model permission or a CAD 1 model waiver.

BIPRU 7.10 sets out the minimum standards that the appropriate regulator expects firms to meet before granting a VaR model permission. The appropriate regulator will not grant a VaR model permission unless it is satisfied that the requirements of BIPRU 7.10 are met and it is satisfied about the procedures in place at a firm to calculate the model PRR. In particular the appropriate regulator will not normally grant a VaR model permission unless it is satisfied about the quality of:

1. the internal controls and risk management relating to the VaR model (see BIPRU 7.10.56G - BIPRU 7.10.82R);
2. the VaR model standards (see BIPRU 7.10.24R- BIPRU 7.10.55G); and
3. stress testing and backtesting procedures relating to a VaR model (see, in addition to (2), BIPRU 7.10.83R - BIPRU 7.10.112G).

The appropriate regulator recognises that the nature of VaR models will vary between firms. The scope of and the requirements and conditions set out in a VaR model permission may therefore differ in substance or detail from BIPRU 7.10 in order to address individual circumstances adequately. However any differences will only be allowed if they are compliant with the Capital Adequacy Directive. A VaR model permission will implement any such variation by modifying BIPRU 7.10. A VaR model permission may also include additional conditions to meet the particular circumstances of the firm or the model.

### The VaR model permission application and review process

Details of the general process for applying for a VaR model permission are set out in BIPRU 1.3 (Applications for advanced approaches). Because of the complexity of a VaR model permission, it is recommended that a firm discuss its proposed application with its usual contact at the appropriate regulator before it makes the application.

In order for a VaR model permission to be granted, the appropriate regulator is likely to undertake a review to ensure that it is adequate and appropriate for the PRR calculation.
The VaR model review process may be conducted through a series of visits covering various aspects of a firm’s control and IT environment. Before these visits the appropriate regulator may ask the firm to provide some information relating to the firm’s VaR model permission request accompanied by some specified background material. The VaR model review visits are organised on a timetable that allows the firm being visited sufficient time to arrange the visit and provide the appropriate pre-visit information.

As part of the process for dealing with an application for a VaR model permission the following may be reviewed: organisational structure and personnel; details of the firm’s market position in the relevant products; revenue and risk information; valuation and reserving policies; operational controls; information technology systems; model release and control procedures; risk management and control framework; risk appetite and limit structure; future developments relevant to model recognition.

A visit will usually involve the appropriate regulator wishing to meet senior management and staff from the front office, financial control, risk management, operations, systems development, information technology and internal audit areas.

The appropriate regulator may complement its own review of a VaR model permission request with one or more reviews by a skilled person under section 166 of the Act (Reports by skilled persons). Such a review may also be used where a VaR model permission has been granted to ensure that the requirements and of the VaR model permission continue to be met.

Conditions for a VaR model outside the United Kingdom

Where a VaR model used outside the United Kingdom differs from that used in the United Kingdom the appropriate regulator may request details of the reasons for using different models.

Where a firm operates any part of its VaR model outside the United Kingdom, the appropriate regulator may take into account the results of the home supervisor’s review of that model. The appropriate regulator may wish to receive information directly from the home supervisor.

Scope of VaR models

A firm must use the VaR model approach to calculate the PRR for a position:

1. to the extent that the risks in relation to that position are within the scope of the VaR model permission (see BIPRU 7.10.136R (Link to standard PRR rules: Incorporation of the model output into the capital calculation)); and

2. if the position is of a type that comes within the scope of the VaR model permission.
In accordance with BIPRU 7.10.18R (1) a VaR model permission will set out the risk categories that it covers, which are expected to be one or more of the following types:

1. interest rate general market risk;
2. interest rate specific risk (in conjunction with interest rate general market risk);
3. equity general market risk;
4. equity specific risk (in conjunction with equity general market risk);
5. CIU risk;
6. foreign currency risk; and
7. commodity risk.

A VaR model permission will generally set out the broad classes of position within its scope. It may also specify how individual products within one of those broad classes may be brought into or taken out of the scope of the VaR model permission.

The broad classes of position referred to in BIPRU 7.10.20G are as follows:

1. linear products, which comprise securities with linear pay-offs (e.g. bonds and equities) and derivative products which have linear pay-offs in the underlying risk factor (e.g. interest rate swaps, FRAs, total return swaps);
2. European, American and Bermudan put and call options (including caps, floors and swaptions) and investments with these features (see BIPRU 7.6.18R (Table: Option PRR: methods for different types of option) for an explanation of some of these terms);
3. Asian options, digital options, single barrier options, double barrier options, look back options, forward starting options, compound options and investments with these features (see BIPRU 7.6.18R for an explanation of some of these terms); and
4. all other option based products (e.g. basket options, quantos, outperformance options, timing options) and investments with these features (see BIPRU 7.6.18R for an explanation of some of these terms).

The categorisation described in BIPRU 7.10.21G may be amended or replaced in the case of a particular firm’s VaR model permission.

It is the appropriate regulator’s view that, where a firm uses a VaR model for one risk category as described in BIPRU 7.10.19G, it is good practice to extend its model over time to calculate all of its PRR risk categories. A firm will typically be expected to have a realistic plan in place to do this.
Model standards: General

7.10.24 R A firm must comply with the minimum standards set out in BIPRU 7.10.26R in calculating the model PRR.

7.10.25 G The appropriate regulator accepts that the scope and nature of VaR models varies across firms. This means that different firms are likely to calculate different estimates of market risk for the same portfolio. Systematic differences are due to length of data series, choice of methodology (historical or Monte Carlo simulation or variance-covariance method or a hybrid of these), differences in aggregating risks within and across broad risk factors, the treatment of options and other non-linear products and the specification of risk factors.

Model standards: Frequency of calculations and confidence level

7.10.26 R The model PRR must be computed at least once every business day, using a 99% one-tailed confidence limit.

7.10.27 G A firm may meet the requirement in BIPRU 7.10.26R by using different model parameters and employing a suitable adjustment mechanism to produce a figure which is equivalent to the figure produced using the parameters set out in BIPRU 7.10.26R. For example, a firm’s model may use a 95% one-tailed confidence limit if the firm has a mechanism to convert the output of the model to reflect a 99% one-tailed confidence limit.

7.10.27A R Stressed VaR must be calculated at least weekly, using a 99% one-tailed confidence limit.

Model standards: Holding period

7.10.28 R In calculating the VaR number, a firm must either use a ten business day holding period, or use a holding period converted to a ten business day holding period. However if the firm’s VaR model permission specifies that the firm must use a specific method, the firm must do so.

7.10.29 G If a firm uses a holding period other than 10 business days and converts the resulting VaR measure to a ten business day equivalent measure, it should be able to justify the choice of conversion technique. For example, the square root of time method will usually be justifiable. The appropriate regulator considers it good practice ultimately to move towards the application of an actual ten business day holding period, rather than using different holding periods.

Model standards: Observation period

7.10.30 R Subject to BIPRU 7.10.31R, the calculation of VaR numbers must be based on an effective historical observation period that is the longest possible consistent with a prudent VaR number. That period must be at least one year or such longer period as may be set out in the firm’s VaR model permission. However if using that prescribed observation period does not result in a sufficiently prudent way of calculating a VaR measure or a component of a
VaR measure the firm must shorten this observation period until the observation period is consistent with a prudent VaR number.

7.10.30A R
The stressed VaR measure must be based on inputs calibrated to historical data from a continuous twelve-month period of significant financial stress relevant to the firm’s portfolio. The choice of that historical period will be subject to the appropriate regulator’s approval and will form part of a firm’s VaR model permission.

7.10.30B R
A firm must review the selection of the stressed VaR historical observation period at least annually.

Model standards: Data series

7.10.31 R
A firm must ensure that the data series used by its VaR model is reliable. Where a reliable data series is not available, proxies or any other reasonable value-at-risk measurement technique must be used. A firm must be able to demonstrate that the technique is appropriate and does not materially underestimate the modelled risks.

7.10.32 G
A data series is unreliable if it has, for example, missing data points, or data points which contain stale data. Reliable data series may be difficult to obtain for new products (for example an instrument of longer dated tenor that did not previously trade) and for less liquid risk factors or positions. With regard to less liquid risk factors or positions, a firm may use a combination of prudent valuation techniques and alternative VaR estimation techniques to ensure there is a sufficient cushion against risk over the close out period which takes account of the illiquidity of the risk factor or position.

7.10.33 R
(1) If a weighting scheme or other similar method is used to calculate VaR numbers, then the effective observation period must be at least one year. Where a weighting scheme is used, the weighted average time lag of the individual observations must not be less than six Months.

(2) If a specific observation period or weighted average time lag is specified in a firm’s VaR model permission, the firm must comply with that if it is longer than the period specified in (1).

(3) However, if a weighting scheme in (1) or (2) would result in imprudent VaR numbers then the weighting scheme must be adjusted so that it is consistent with a prudent VaR number.

7.10.34 R
A firm must update data sets in accordance with the frequency set out in its VaR model permission. If volatility in market prices or rates necessitates more frequent updating in order to ensure a prudent calculation of the VaR measure the firm must do so.

7.10.35 G
The minimum updating frequency for the current VaR measure that can be specified in a VaR model permission is monthly.
### Model standards: Aggregation across risk categories

**7.10.36**  
The process for determining and implementing correlations within and across risk categories must be sound, implemented with integrity and consistent with the terms of the firm’s VaR model permission.

**7.10.37**  
In aggregating VaR measures across risk or product categories, a firm must not use the square root of the sum of the squares approach unless the assumption of zero correlation between these categories is empirically justified. If correlations between risk categories are not empirically justified, the VaR measures for each category must simply be added in order to determine its aggregate VaR measure. But to the extent that a firm’s VaR model permission provides for a different way of aggregating VaR measures:

1. that method applies instead of this rule; and
2. if the correlations between risk categories used for that purpose cease to be empirically justified then the firm must notify the appropriate regulator at once.

### Model standards: Risk factors: Introduction

**7.10.38**  
Subject to [BIPRU 7.10.53R](#) (Model standards: Materiality), a VaR model should capture and accurately reflect all material risks arising on the underlying portfolio on a continuing basis insofar as those risks are within the scope of the VaR model permission. This should encompass general market risk and, to the extent that this comes within the scope of the VaR model permission, specific risk. A firm should ensure that the VaR model has sufficient risk factor granularity to be able to capture all such material risks and that these are properly documented and specified.

### Model standards: Risk factors: General

**7.10.39**  
In the case of general market risk and risks with respect to which the standard market risk PRR rules do not distinguish between general market risk and specific risk, a firm’s VaR model must capture a sufficient number of risk factors in relation to the level of activity of the firm and in particular the risks set out in [BIPRU 7.10.40R](#) - [BIPRU 7.10.44R](#).

**7.10.39A**  
A firm must incorporate risk factors that are included in its pricing model in its VaR model. A firm’s VaR model must capture nonlinearities for options and other products, as well as correlation risk and basis risk. Where proxies for risk factors are used they must show a good track record for the actual position held. In addition, [BIPRU 7.10.40 R](#) to [BIPRU 7.10.44 R](#) apply for individual risk types.

**7.10.39B**  
A firm with a VaR model permission must justify to the appropriate regulator any omissions of risk factors from its VaR model, if they are included in its pricing model.

**7.10.40**  
For interest rate risk, a VaR model must incorporate a set of risk factors corresponding to the interest rate curves in each currency in which the firm has interest rate sensitive positions. A firm must ensure that it captures the
variations of volatility of rates along the yield curve. In order to achieve this, a firm must divide the yield curves of, at a minimum, the major currencies and markets in which it has material interest rate exposures into a minimum of six maturity segments. The VaR model must also capture the risk of less than perfectly correlated movements between different yield curves.

7.10.41 For equity risk, a VaR model must use a separate risk factor at least for each of the equity markets in which the firm has material positions.

7.10.42 For foreign currency risk, a VaR model must incorporate risk factors corresponding to the individual foreign currencies, including gold, in which the firm’s positions are denominated.

7.10.43 For commodity risk, the VaR model must use a separate risk factor at least for each commodity in which the firm has material positions. The VaR model must also capture the risk of less than perfectly correlated movements between similar, but not identical, commodities and the exposure to changes in forward prices arising from maturity mismatches. It must also take account of market characteristics, notably delivery dates and the scope provided to traders to close out positions.

7.10.44 For CIUs the actual foreign currency positions of the CIU must be taken into account.

(2) A firm may rely on third party reporting of the foreign currency position of the CIU, where the correctness of this report is adequately ensured.

(3) If a firm is not aware of the foreign currency positions in a CIU, this position must be carved out and treated in BIPRU 7.5.18R (Derivation of notional positions in CIUs for the foreign currency PRR).

7.10.45 (1) This paragraph contains guidance on the inclusion of CIUs in a VaR model.

(2) The appropriate regulator may allow all types of CIU to be included within the scope of a firm’s VaR model permission.

(3) BIPRU 7.10 does not distinguish between specific risk and general market risk for positions in CIUs. Therefore even if specific risk is not otherwise included within the scope of a firm’s VaR model permission, a firm should be able to demonstrate that its VaR model captures specific risk.

(4) A firm should also be able to demonstrate that its VaR model adequately captures correlations, concentration risk and risks associated with the illiquidity of the CIU itself should this be deemed necessary (see BIPRU 7.10.32G).

(5) A firm may use a look-through approach, under which the VaR model estimates are based on the underlying positions. If a firm uses a look through approach it should also ensure that all the relevant risk factors relating to the underlying positions are captured. BIPRU 7.7
Model standards: Risk factors: Specific risk

7.10.46 If a firm's VaR model covers the calculation of PRR with respect to specific risk the firm must meet the VaR specific risk minimum requirements in addition to the other requirements of BIPRU 7.10.

(1) The VaR model must explain the historical price variation in the portfolios concerned.

(2) The VaR model must capture concentration in terms of magnitude and changes of composition of the portfolios concerned.

(3) The VaR model must be robust to an adverse environment.

(4) The VaR model must capture name-related basis risk. That is the firm must be able to demonstrate that the VaR model is sensitive to material idiosyncratic differences between similar but not identical positions.

(5) The VaR model must capture event risk.

(6) In addition to the other requirements in BIPRU 7.10, a firm must have an approach in place to capture, in the calculation of its capital requirements, the incremental risk charge of its trading book positions that is incremental to the default and migration risk captured by the VaR measures, as specified in BIPRU 7.10.55A.R to BIPRU 7.10.55S.G and BIPRU 7.10.107R (Backtesting: Specific risk backtesting).

7.10.47 This paragraph provides guidance on BIPRU 7.10.46 R (2). Take as an example a VaR model based on a factor model or on a historical simulation model. The ability of the model to explain price variation could be demonstrated by a statistical comparison over the same period of time between actual price changes on the portfolio and the profit and loss impact of risk factors included within the model. A firm may wish to include an estimate of residual variation not explained by the model.

7.10.48 A firm’s VaR model must conservatively assess the risk arising from less liquid positions and positions with limited price transparency under realistic market scenarios. In addition, the VaR model must meet minimum data standards. Proxies must be appropriately conservative and may be used only where available data is insufficient or is not reflective of the true volatility of a position or portfolio.

7.10.49 As techniques and best practices evolve, a firm must avail itself of these advances.
A firm’s VaR model must capture accurately all material price risks for positions within the scope of its VaR permission, including risks relating to options or option-like positions. The firm must ensure that, if its VaR model does not accurately capture any material risk, the firm has capital resources adequate to cover that risk. These capital resources must be additional to those required to meet its capital resources requirement. For example, BIPRU 7.10.53R might involve creating and documenting a prudent incremental PRR charge for the risk not captured in the VaR model and holding sufficient capital resources against this risk. In that case the firm should hold capital resources at least equal to its capital resources requirement as increased by adding this incremental charge to the model PRR. Alternatively the firm may make valuation adjustments through its profit and loss reserves to cover this material risk. These reserves should be transparent to senior management and auditable. The reserves should also be consistent with GENPRU 1.3 (Valuation) while not being excessive in relation to the principles of mark-to-market accounting. Therefore, a firm should be able to satisfy the appropriate regulator that all material risks are adequately addressed, whether this be through the VaR model, through taking an incremental PRR charge or through making an adjustment through profit and loss reserves.

A firm is expected ultimately to move towards full revaluation of option positions. For portfolios containing path dependent options, an instantaneous price shock applied to a static portfolio will be acceptable provided that the risks not captured by such an approach are not material. Where a risk is immaterial and does not justify further capital resources, that immaterial risk should still be documented.

Incremental risk charge: Scope and parameters

A firm must demonstrate that its incremental risk charge meets soundness standards comparable to those under the IRB approach, assuming a constant level of risk and adjusted, where appropriate, to reflect the impact of liquidity, concentrations, hedging and optionality.

The incremental risk charge must cover all positions which are subject to a capital charge for interest-rate specific risk in accordance with the firm’s VaR model permission, except securitisation positions and nth-to-default credit derivatives. Where permitted by its VaR model permission, a firm may choose consistently to include all listed equity positions and derivatives positions based on listed equities for which that inclusion is consistent with how the firm internally measures and manages risk, but the approach must reflect the impact of correlations between default and migration events, and it must
not reflect the impact of diversification between default and migration events and other market risk factors.

7.10.55C  The firm’s approach to capture the incremental risk charge must measure losses due to default and internal or external ratings migration at the 99.9% confidence interval over a capital horizon of one year.

7.10.55D  The firm’s correlation assumptions must be supported by the analysis of objective data in a conceptually sound framework. The approach to capture the incremental risk charge must appropriately reflect issuer concentrations. Concentrations that can arise within and across product classes under stressed conditions must also be reflected.

7.10.55E  The firm’s approach must be based on the assumption of a constant level of risk over the one-year capital horizon, implying that given individual trading book positions or sets of positions that have experienced default or migration over their liquidity horizon are re-balanced at the end of their liquidity horizon to attain the initial level of risk. Alternatively, a firm may choose consistently to use a one-year constant position assumption.

**Incremental risk charge: Liquidity horizons**

7.10.55F  (1) The firm’s liquidity horizons for calculating incremental risk charge must be set according to the time required to sell the position or to hedge all material and relevant price risks in a stressed market, having particular regard to the size of the position.

(2) Liquidity horizons must reflect actual practice and experience during periods of both systematic and idiosyncratic stresses. The liquidity horizon must be measured under conservative assumptions and must be sufficiently long that the act of selling or hedging, in itself, would not materially affect the price at which the selling or hedging would be executed.

7.10.55G  The determination of the appropriate liquidity horizon for a position or set of positions is subject to a floor of three months. The determination of the appropriate liquidity horizon for a position or set of positions must take into account a firm’s internal policies relating to valuation adjustments and the management of stale positions.

7.10.55H  When a firm determines liquidity horizons for sets of positions rather than for individual positions, the criteria for defining sets of positions must be defined in a way that meaningfully reflects differences in liquidity. The liquidity horizons must be greater for positions that are concentrated, reflecting the longer period needed to liquidate those positions.

7.10.55I  The liquidity horizon for a securitisation warehouse must reflect the time to build, sell and securitise the assets, or to hedge the material risk factors, under stressed market conditions.
Incremental risk charge: Hedges

R7.10.55J  (1) Hedges may be incorporated into the calculation of a firm's incremental risk charge. Positions may be netted only when long and short positions refer to the same financial instrument.

(2) Hedging or diversification effects associated with long and short positions involving different instruments or different securities of the same obligor, as well as long and short positions in different issuers, may only be recognised by explicitly modelling gross long and short positions in the different instruments.

(3) A firm must reflect the impact of material risks that could occur during the interval between the hedge's maturity and the liquidity horizon, as well as the potential for significant basis risks in hedging strategies by product, seniority in the capital structure, internal or external rating, maturity, vintage and other differences in the instruments. A firm must reflect a hedge only to the extent that it can be maintained even as the obligor approaches a credit or other event.

For trading book positions that are hedged via dynamic hedging strategies, a rebalancing of the hedge within the liquidity horizon of the hedged position may be recognised only if the firm:

(1) chooses to model rebalancing of the hedge consistently over the relevant set of trading book positions;

(2) demonstrates that the inclusion of rebalancing results in a better risk measurement;

(3) demonstrates that the markets for the instruments serving as hedges are liquid enough to allow for this rebalancing even during periods of stress; and

(4) reflects in the capital charge any residual risks resulting from dynamic hedging strategies.

Incremental risk charge: Nonlinear positions and model risk

R7.10.55L  (1) The incremental risk charge must reflect the nonlinear impact of options, structured credit derivatives and other positions with material nonlinear behaviour with respect to price changes.

(2) The firm must also consider the amount of model risk inherent in the valuation and estimation of price risks associated with those products.

R7.10.55M  The incremental risk charge must be based on objective and up-to-date data.

Incremental risk charge: Validation

R7.10.55N  A firm must validate its approach to incremental risk charge. In particular, a firm must:
(1) validate that its modelling approach for correlations and price changes is appropriate for its portfolio, including the choice and weights of its systematic risk factors;

(2) perform a variety of stress tests (not limited to the range of events experienced historically), including sensitivity analysis and scenario analysis, to assess the qualitative and quantitative reasonableness of the approach, with particular regard to the treatment of concentrations; and

(3) apply appropriate quantitative validation including relevant internal modelling benchmarks.

7.10.55O A firm's approach for incremental risk charge must be consistent with the firm's internal risk management methodologies for identifying, measuring, and managing trading risks.

Incremental risk charge: Documentation and frequency of calculation

7.10.55P A firm must document its approach for the incremental risk charge clearly, setting out its correlation and other modelling assumptions.

7.10.55Q A firm must calculate its incremental risk charge at least weekly.

Incremental risk charge: Internal approaches based on different parameters

7.10.55R A firm may use an approach for incremental risk charge that does not comply with all the requirements in BIPRU 7.10.55A R to BIPRU 7.10.55P R, only if:

(1) such an approach is consistent with the firm's internal methodologies for identifying, measuring, and managing risks; and

(2) the firm can demonstrate that its approach results in a capital requirement that is at least as high as it would be if based on an approach in full compliance with the requirements in BIPRU 7.10.55A R to BIPRU 7.10.55P R.

7.10.55S The appropriate regulator will review at least annually any approach taken by the firm under BIPRU 7.10.55R R.

All price risk measure: General requirements

7.10.55T As part of its VaR model permission, the appropriate regulator may authorise a firm to use the all price risk measure to calculate an additional capital charge in relation to positions in its correlation trading portfolio if it meets the following minimum standards:

(1) it adequately captures all price risks at a 99.9% confidence interval over a capital horizon of one year under the assumption of a
constant level of risk, and adjusted, where appropriate, to reflect the impact of liquidity, concentrations, hedging and optionality;

(2) it adequately captures the following risks:

(a) the cumulative risk arising from multiple defaults, including the ordering of defaults, in tranched products;
(b) credit spread risk, including the gamma and cross-gamma effects;
(c) volatility of implied correlations, including the cross effect between spreads and correlations;
(d) basis risk, including both:
   (i) the basis between the spread of an index and those of its constituent single names; and
   (ii) the basis between the implied correlation of an index and that of bespoke portfolios;
(e) recovery-rate volatility, as it relates to the propensity for recovery rates to affect tranche prices; and
(f) to the extent that the all price risk measure incorporates benefits from dynamic hedging, the risk of hedge slippage and the potential costs of rebalancing those hedges.

7.10.55U The amount of the capital charge for the correlation trading portfolio calculated in accordance with the all price risk measure must not be less than 8% of the capital charge that would result from applying BIPRU 7.2.48L R to all positions in the correlation trading portfolio subject to the all price risk measure.

7.10.55V A firm may include in its all price risk measure positions that are jointly managed with positions in the correlation trading portfolio and would otherwise be included in the incremental risk charge. In that case, the firm must exclude these positions from the calculation of its incremental risk charge.

7.10.55W A firm must have sufficient market data to ensure that it fully captures the salient risks of the positions in its all price risk measure in accordance with the standards set out in BIPRU 7.10.55T R.

7.10.55X A firm must demonstrate through backtesting or other appropriate means that its all price risk measure can appropriately explain the historical price variation of these positions. A firm must be able to demonstrate to the appropriate regulator that it can identify the positions within its correlation trading portfolio, in relation to which it is authorised to use the all price risk measure, separately from those other positions in relation to which it is not authorised to do so.

7.10.55Y A firm must calculate the capital charge under the all price risk measure at least weekly.
All price risk measure: Stress testing

7.10.55Z R

(1) For positions within its correlation trading portfolio in relation to which a firm may use the all price risk measure, a firm must regularly apply a set of specific, predetermined stress scenarios. These stress scenarios must examine the effects of stress to default rates, recovery rates, credit spreads, and correlations on the profit and loss of the correlation trading portfolio.

(2) A firm must apply the stress scenarios in (1) at least weekly and report the results to the appropriate regulator in accordance with BIPRU 7.10.129 R.

7.10.55ZA R

If the results of the stress tests carried out in accordance with BIPRU 7.10.55Z R indicate a material shortfall in the amount of capital required under the all price risk measure, a firm must notify the appropriate regulator of this circumstance by no later than two business days after the business day on which the material shortfall occurred.

7.10.55ZB G

The appropriate regulator may use its powers under section 55J (Variation etc. on the Authority’s own initiative) of the Act to impose on the firm a capital add-on to cover the material shortfall reported under BIPRU 7.10.55ZA R.

7.10.55ZC G

The all price risk measure is based on the incremental risk charge. Therefore, when applying the all price risk measure, a firm should have regard to the requirements in BIPRU 7.10.55A R to BIPRU 7.10.55R R.

Risk management standards: Introduction

7.10.56 G

A firm with a complex portfolio is expected to demonstrate greater sophistication in its modelling and risk management than a firm with a simple portfolio. For example, a firm will be expected to consider, where necessary, varying degrees of liquidity for different risk factors, the complexity of risk modelling across time zones, product categories and risk factors. Some trade-off is permissible between the sophistication and accuracy of the model and the conservatism of underlying assumptions or simplifications.

7.10.57 G

A firm should be able to demonstrate that it meets the risk management standards set out in the VaR model permission on a legal entity basis. This is particularly important for a subsidiary undertaking in a group subject to matrix management where the business lines cut across legal entity boundaries.

Risk management standards: General requirement

7.10.58 R

A firm must have a conceptually sound risk management system surrounding the use of its VaR model that is implemented with integrity and that in particular meet the qualitative standards set out in BIPRU 7.10.59R - BIPRU 7.10.82R.
Risk management standards: Use requirement

7.10.59  A firm must base its model PRR calculation on the output of the VaR model which is used for its internal risk management rather than one developed specifically to calculate its PRR.

7.10.60  The VaR model must be fully integrated into the daily risk management process of the firm, and serve as the basis for reporting risk exposures to senior management of the firm.

7.10.61  A firm’s VaR model output should be an integral part of the process of planning, monitoring and controlling a firm’s market risk profile. The VaR model should be used in conjunction with internal trading and exposure limits. The links between these limits and the VaR model should be consistent over time and understood by senior management. The firm should regard risk control as an essential aspect of the business to which significant resources need to be devoted.

Risk management standards: Risk control unit

7.10.62  A firm must have a risk control unit which is independent from business trading units and which reports directly to senior management. It:

(1) must be responsible for designing and implementing the firm’s risk management system;

(2) must produce and analyse daily reports on the output of the VaR model and on the appropriate measures to be taken in terms of the trading limits; and

(3) conduct the initial and on-going validation of the VaR model.

Risk management standards: Senior management

7.10.63  A firm’s governing body and senior management must be actively involved in the risk control process, and the daily reports produced by the risk control unit must be reviewed by a level of management with sufficient authority to enforce both reductions of positions taken by individual traders as well as in the firm’s overall risk exposure.

7.10.64  It is the responsibility of a firm’s own management to ensure the accuracy and integrity of its VaR model. This responsibility includes obtaining appropriate independent validation of the VaR model.

Risk management standards: Skilled staff

7.10.65  A firm must have sufficient numbers of staff skilled in the use of sophisticated models in the trading, risk control, audit and back office areas.

Risk management standards: Controls and compliance

7.10.66  A firm must establish, document and maintain policies, controls and procedures to an auditable standard:
(1) concerning the operation of its VaR model approach; and
(2) for monitoring and ensuring compliance with the policies, controls and procedures in (1).

**Risk management standards: Documentation**

7.10.67  
A VaR model must be adequately documented.

7.10.68  
(1) An example of documents required by BIPRU 7.10.67R may be a manual that describes the basic principles of the risk management framework, clearly setting out empirical techniques, principles and assumptions used within it.

(2) This documentation should be of sufficient detail for the appropriate regulator to be able to develop a clear understanding of how the VaR model works from that documentation on its own.

**Risk management standards: Track record**

7.10.69  
A firm's VaR model must have a proven track record of acceptable accuracy in measuring risk.

**Risk management standards: Development validation**

7.10.70  
Adequate procedures must be in place to ensure that model changes are validated before being introduced.

7.10.71  
The procedures in BIPRU 7.10.70R need not necessarily rely on backtesting using a back-run of recreated data.

**Risk management standards: Stress testing**

7.10.72  
(1) A firm must frequently conduct a rigorous programme of stress testing. The results of these tests must be reviewed by senior management and reflected in the policies and limits the firm sets.

(2) The programme must particularly address:
   (a) concentration risk;
   (b) illiquidity of markets in stressed market conditions;
   (c) one way markets;
   (d) event and jump to default risks;
   (e) non linearity of products;
   (f) deep out of the money positions;
   (g) positions subject to the gapping of prices;
   (h) full revaluation, or a reliable approximation, of positions;
   (i) instant shocks as well as effects of longer term periods of stress;
   (j) calibration changes under stressed conditions;
(k) secondary risk factors (such as volatility);
(l) basis risk;
(m) systemic and localised stresses; and
(n) other risks that may not be captured appropriately in the VaR model (for example, recovery rate uncertainty, implied correlations and skew risk).

(3) The shocks applied must reflect the nature of the portfolios and the time it could take to hedge out or manage risks under severe market conditions.

7.10.73 The stress testing under BIPRU 7.10.72R should be taken into account under the overall Pillar 2 rule.

7.10.73A The firm’s stress testing programme should be comprehensive in terms of both risk and firm coverage, and appropriate to the size and complexity of trading book positions held.

Risk management standards: Valuation

7.10.74 A firm must have procedures to ensure that the valuation of assets and liabilities is appropriate, that valuation uncertainty is identified and appropriate reserving is undertaken where necessary.

Risk management standards: Risk review

7.10.75 At least once a year, a firm must conduct, as part of its regular internal audit process, a review of its risk management process. This review must include both the activities of the business trading units and of the independent risk control unit, and must be undertaken by suitably qualified staff independent of the areas being reviewed. This review must consider, at a minimum:

1. the adequacy of the documentation of the risk management system and process;
2. the organisation of the risk control unit;
3. the integration of market risk measures into daily risk management;
4. the integrity of the management information system;
5. the process for approving risk pricing models and valuation systems used in front and back offices;
6. the validation of any significant changes in the risk management process;
7. the scope of risks and products captured by the VaR model;
8. the accuracy and completeness of position data;
(9) the process used to ensure the consistency, timeliness, independence and reliability of data sources (including the independence of such data sources);

(10) the accuracy and appropriateness of volatility and correlation assumptions;

(11) reserving policies and the accuracy of the valuation procedures and risk sensitivity calculations;

(12) the process employed to evaluate the VaR model’s accuracy, including the programme of backtesting;

(13) the controls surrounding the development of the VaR model; and

(14) the process employed to produce the calculation of the model PRR.

Risk management standards: Validation and backtesting

The appropriate regulator will require a period of initial monitoring or live testing before a VaR model can be recognised. This will be agreed on a firm by firm basis.

In assessing the firm’s VaR model and risk management, the appropriate regulator has regard to the results of internal model validation procedures used by the firm to assess the VaR model.

A firm must have processes in place to ensure that its VaR model has been adequately validated by suitably qualified parties independent of the development process to ensure that it is conceptually sound and adequately captures all material risks. This validation must be conducted when the VaR model is initially developed and when any significant changes are made to the VaR model. The validation must also be conducted on a periodic basis but especially where there have been any significant structural changes in the market or changes to the composition of the portfolio which might lead to the VaR model no longer being adequate. As techniques and best practices evolve, a firm must avail itself of these advances. Model validation must not be limited to backtesting, but must, at a minimum, also include the following:

(1) tests to demonstrate that any assumptions made within the VaR model are appropriate and do not underestimate or overestimate the risk (including testing of the validity of the assumptions and approximations underlying the VaR model);

(2) in addition to the regulatory backtesting programmes, a firm must carry out its own model validation tests in relation to the risks and structures of its portfolios, such as statistical validation techniques and other methods of measuring performance and validity;

(3) the use of hypothetical portfolios to ensure that the VaR model is able to account for particular structural features that may arise, for example material basis risks and concentration risk; and
(4) investigation of the limitations of the VaR model including testing of the accuracy of parts of the VaR model as well as of the whole.

7.10.79

(1) In addition to regulatory backtesting programs, testing for model validation should be carried out using additional tests which may include for example:

(a) testing carried out using hypothetical changes in portfolio value that would occur were end of day positions to remain unchanged;

(b) testing carried out for longer periods than required for the regular backtesting programme (for example, 3 years);

(c) testing carried out using confidence intervals other than the 99 percent interval required under the quantitative requirements in BIPRU 7.10; and

(d) testing of parts of portfolios.

(2) A longer time period generally improves the power of backtesting. However a longer time period may not be desirable if the VaR model or market conditions have changed to the extent that historical data is no longer relevant.

7.10.80

Further material on backtesting can be found in BIPRU 7.10.91G - BIPRU 7.10.112G.

Risk management standards: Information technology

7.10.81

In assessing whether the VaR model is implemented with integrity as described in BIPRU 7.10.58R (Stress testing), the appropriate regulator will consider in particular the information technology systems used to run the model and associated calculations. The assessment may include:

(1) feeder systems; risk aggregation systems; time series databases; the VaR model system; stress testing system; the backtesting system including profit and loss cleaning systems where appropriate; data quality; reconciliations and checks on completeness of capture;

(2) system development, change control and documentation; security and audit trails; system availability and contingency procedures; network adequacy; and

(3) operational statistics relating to the VaR model production process, including, for example, statistics relating to timeliness, number of re-runs required and the reliability of data feeds.

Risk management standards: Controls

7.10.82

A firm must ensure that it has adequate controls relating to:

(1) the derivation of the model PRR;

(2) the integrity of the backtesting programme, including the calculation of the profit and loss account;
(3) the integrity and appropriateness of the VaR model, including the VaR model’s geographic coverage and the completeness of data sources;

(4) the VaR model’s initial and ongoing development, including independent validation;

(5) the valuation models, including independent validation; and

(6) the adequacy, security and integrity of the information technology infrastructure.

**Stress testing**

7.10.83  **R** BIPRU 7.10.84G–BIPRU 7.10.90G relate to stress testing of a VaR model (see BIPRU 7.10.72R (Risk management standards: Stress testing)).

7.10.84  **G** Stress testing is a way of identifying the risk to a firm posed by a breakdown of model assumptions or by low-probability events. Where stress tests reveal unacceptable vulnerability to a given set of circumstances, a firm should take prompt steps to manage those risks appropriately, for example by hedging against the outcome or reducing the size of the firm’s exposure.

7.10.85  **R** A firm must have the capacity to run daily stress tests.

7.10.86  **R** Stress testing must involve identifying market scenarios or other low probability events in all types of risks that generate the greatest losses on a firm’s portfolio.

7.10.87  **R** A firm must periodically and actively identify all the worst case scenarios that are relevant to its portfolio. Scenarios used must be appropriate to test the effect of adverse movements in market volatilities and correlations and the effect of any change in the assumptions underlying the VaR model. Scenarios involving low probability market events must nevertheless be plausible.

7.10.88  **R** Stress testing must capture non-linear effects.

7.10.89  **R** A firm must have procedures to assess and respond to the results produced from stress testing. In particular, stress testing results must be:

(1) used to evaluate its capacity to absorb such losses or identify steps to be taken to reduce risk; and

(2) communicated routinely to senior management and periodically to the governing body.

7.10.90  **G** A firm may want to conduct the more complex stress tests at longer intervals or on an ad hoc basis.
A firm must also carry out reverse stress tests.

**Backtesting: Introduction**

Backtesting is the process of comparing value-at-risk risk measures to portfolio performance. It is intended to act as one of the mechanisms for the ongoing validation of a firm’s VaR model and to provide incentives for firms to improve their VaR measures.

It is a condition for granting a VaR model permission that a firm should have a backtesting programme in place and should provide three months of backtesting history.

Backtesting conducted only at a whole portfolio level using a single measure of profit and loss has limited power to distinguish an accurate VaR model from an inaccurate one. Backtesting should therefore be regarded as an additional safeguard rather than a primary validation tool. Such testing does however form the basis of the appropriate regulator’s plus factor system. The test has been chosen as the basis of the backtesting regime because of its simplicity. A firm will therefore be expected to complement this backtesting with more granular backtesting analysis and involving more than one measure of profit and loss (i.e. both a profit and loss figure and a hypothetical profit and loss figure).

A firm must have the capacity to analyse and compare its profit and loss figures and hypothetical profit and loss figures to the VaR measure, both at the level of the whole portfolio covered by the VaR model permission and at the level of individual books that contain material amounts of risk.

At a minimum, backtesting of hypothetical profit and loss figures must be used for regulatory backtesting and also to calculate plus factors.

Backtesting of hypothetical profit and loss figures is also used for model validation and for reporting to the appropriate regulator.

**Backtesting: Basic testing requirements**

At a minimum, a firm must, on each business day, compare each of its 250 most recent business days’ hypothetical profit and loss figures (ending with the business day preceding the business day in question) with the corresponding one-day VaR measures.

Generally the positions underlying the profit and loss account and VaR measures should not be materially different.

The one-day VaR measure for a particular business day is the VaR number for that business day calibrated to a one business day holding period and a 99% one-tailed confidence level.
Backtesting: Calculating the profit and loss

7.10.99 G

The ultimate purpose of backtesting is to assess whether capital is sufficient to absorb actual losses. Actual daily profit and loss means the day’s profit and loss arising from trading activities within the scope of the VaR model permission. This measure should, however, be ‘cleaned’ using inclusion in profit and loss of non-modelled factors.

7.10.100 R

The profit and loss figure for a particular business day is the firm’s actual profit or loss for that day in respect of the trading activities within the scope of the firm’s VaR model permission, adjusted by stripping out:

(1) fees and commissions;
(2) brokerage;
(3) additions to and releases from reserves which are not directly related to market risk (e.g. administration reserves); and
(4) any inception profit exceeding an amount specified for this purpose in the firm’s VaR model permission (where inception profit is defined as any profit arising immediately on entering into a new transaction).

7.10.101 G

The definition of profit and loss figure may be amended or replaced in an individual VaR model permission if the firm can demonstrate to the appropriate regulator that the alternative method meets the spirit and purpose of the provisions in BIPRU 7.10 about the profit and loss figure.

7.10.102 G

The appropriate regulator will review as part of a firm’s VaR model permission application the processes and documentation relating to the derivation of profit and loss used for backtesting. A firm’s documentation should clearly set out the basis for cleaning profit and loss. To the extent that certain profit and loss elements are not updated every day (for example certain reserve calculations) the documentation should clearly set out how such elements are included in the profit and loss series.

Backtesting: Definition of backtesting exception

7.10.103 R

A backtesting exception is deemed to have occurred for any business day if the hypothetical profit and loss figure for that business day shows a loss, which in absolute magnitude, exceeds the one-day VaR measure for that business day. The only exception is if that business day is identified in the firm’s VaR model permission as giving rise to an excluded backtesting exception.

Backtesting: Obligation to notify the appropriate regulator

7.10.104 R

If a backtesting exception occurs, the firm must notify its usual supervisory contact at the appropriate regulator orally by close of business two business days after the business day for which the backtesting exception occurred. Within five business days following the end of each Month, the firm must submit to the appropriate regulator a written account of the previous Month’s backtesting exceptions (if any). This explanation must include the causes of the backtesting exceptions, an analysis of whether the backtesting
exception indicate a deficiency in the firm's VaR model and the firm's planned response (if any).

**Backtesting: Summary of the backtesting cycle**

1. This paragraph gives guidance on the backtesting calculation and reporting process in [BIPRU 7.10.96R - BIPRU 7.10.104R].

2. Let the day on which the loss referred to in [BIPRU 7.10.100R] is made be day n. The value-at-risk measure for that day will be calculated on day n-1, or overnight between day n-1 and day n. Profit and loss figures are produced on day n+1, and backtesting also takes place on day n+1. The firm's supervisor should be notified of any backtesting exceptions by close of business on day n+2.

3. Any backtesting exception initially counts for the purpose of the calculation of the plus factor even if subsequently the appropriate regulator agrees to exclude it under the process described in [BIPRU 7.10.106G]. Thus, where the firm experiences a backtesting exception and already has four or more backtesting exceptions for the previous 250 business days, changes to the multiplication factor arising from changes to the plus factor become effective at n+3 (using the time-line terminology in (2)).

**Backtesting: Process for disregarding backtesting exceptions**

1. This paragraph gives guidance on the process for excluding backtesting exceptions as referred to in [BIPRU 7.10.103R].

2. The appropriate regulator will respond flexibly to backtesting exceptions. However, the appropriate regulator's starting assumption will be that a backtesting exception should be taken into account for the purpose of the calculation of plus factors. If the firm believes that a backtesting exception should not count for that purpose, then it should seek a variation of its VaR model permission in order to exclude that particular backtesting exception. The appropriate regulator will then decide whether to agree to such a variation.

3. One example of when a firm's backtesting exception might properly be disregarded is when it has arisen as a result of a risk that is not captured in its VaR model but against which capital resources are already held.

**Backtesting: Specific risk backtesting**

If a firm's VaR model permission covers specific risk, the firm must validate its VaR model through backtesting aimed at assessing whether specific risk is being accurately captured. This backtesting must be carried out in accordance with the provisions of its VaR model permission. If the VaR model permission provides for this backtesting to be performed on the basis of relevant sub-portfolios, these must be chosen in a consistent manner.

Specific risk backtesting involves the backtesting of a standalone specific risk VaR measure against a profit and loss series determined by reference to exposure risk factors categorised as specific risk. Alternatively specific risk
backtesting may take the form of regular backtesting of trading books and portfolios that are predominantly exposed to risk factors categorised as specific risk. The precise requirements for specific risk backtesting will be specified in the firm's VaR model permission as will the definition of a specific risk backtesting exception.

### Backtesting: Multiple exceptions

7.10.109 R
If ten or more backtesting exceptions or ten or more specific risk backtesting exceptions are recorded in a 250 business day period, a firm must take immediate corrective action.

7.10.110 G
Where backtesting reveals severe problems with the basic integrity of the VaR model, the appropriate regulator may withdraw model recognition. In particular, if ten or more backtesting exceptions are recorded in a 250 business day period, the appropriate regulator may apply a plus factor greater than one or the appropriate regulator may consider revoking a firm's VaR model permission. The appropriate regulator may also consider revoking a firm's VaR model permission if ten or more specific risk backtesting exceptions occur in such a period.

### Backtesting: Hypothetical profit and loss

7.10.111 R
A firm must perform backtesting against a hypothetical profit and loss figure with respect to each business day. A hypothetical profit and loss figure for a business day means the hypothetical profit and loss figure that would have occurred for that business day if the portfolio on which the VaR number for that business day is based remained unchanged.

7.10.112 G
(1) A hypothetical profit and loss figure is based on the day's change in the value of the same portfolio that was used to generate the value-at-risk forecast.

(2) [deleted]

(3) The firm may also need to calculate a hypothetical profit and loss figure in order to produce profit attribution reports and to analyse the cause of backtesting exceptions.

7.10.112A G
The definition of hypothetical profit and loss figure may be amended or replaced in an individual VaR model permission if the firm can demonstrate to the appropriate regulator that the alternative method meets the spirit and purpose of the provisions in BIPRU 7.10 about the hypothetical profit and loss figure.

### Capital calculations: General

7.10.113 R
The model PRR is, for any business day (the "relevant" business day), calculated in accordance with the following formula:

(1) the higher of:

(a) the VaR number for the relevant business day; and
(b) the average of its daily VaR numbers for each of the 60 business days ending with the relevant business day, multiplied by the multiplication factor for the relevant business day; and

(2) (in the case of a VaR model permission that covers specific risk) the higher of:
  (a) the incremental risk charge for the relevant business day; and
  (b) the average of the twelve-week incremental risk charge; and

(3) the higher of:
  (a) the latest stressed VaR number; and
  (b) the average of the firm’s daily stressed VaR number for the 60 business days ending with the relevant business day, multiplied by the multiplication factor applied to the stressed VaR measure for the relevant business day; and

(4) (in the case of a VaR model permission that covers all price risk measure) the higher of:
  (a) the all price risk measure for the relevant business day; and
  (b) the average of the twelve-week all price risk measure.

For any day that is not a business day, the model PRR is the amount for the prior business day.

The VaR number for any business day means the VaR measure, in respect of the previous business day’s close-of-business positions in products coming within the scope of the VaR model permission, calculated by the VaR model and in accordance with BIPRU 7.10 and any methodology set out in the VaR model permission. The VaR number must not be calculated taking into account matters on the business day for which it is the VaR number.

The incremental risk charge for any business day means the incremental risk charge required under the provisions in BIPRU 7.10 about specific risk, in respect of the previous business day’s close-of-business positions with respect to which those provisions apply.

The all price risk measure for any business day means the all price risk measure required under the provisions in BIPRU 7.10 about specific risk for the correlation trading portfolio.

The following equation expresses BIPRU 7.10.113R mathematically:

\[
PRR_{\text{Var}} = \max \left\{ VaR_t, \frac{1}{60} \sum_{i=1}^{60} VaR_{t-i} \right\} + \max \left\{ \frac{1}{60} \sum_{i=1}^{60} VaR_{t-i} \right\} + \max \left\{ \frac{1}{60} \sum_{i=1}^{60} SR_{t-i} \right\} + \max \left\{ \frac{1}{60} \sum_{i=1}^{60} IRC_{t-i} \right\} + \max \left\{ \frac{1}{60} \sum_{i=1}^{60} APR_{t-i} \right\}
\]

where:

(1) \( PRR_{\text{Var}} \) is a firm’s model PRR;

(2) \( VaR_t \) represents the previous day’s value-at-risk figure;
(3) \( \text{VaR}_{t-i} \) represents the value-at-risk calculated for \( i \) business days earlier;

(4) \( f \) is the multiplication factor for VaR;

(5) \( \text{SVAR}_t \) represents the latest stressed VaR figure;

(6) \( \text{SVAR}_{t-i} \) represents the stressed VaR calculated for \( i \) business days earlier;

(7) \( s \) is the multiplication factor for stressed VaR;

(8) \( y \) is the number of times the stressed VaR was calculated in the last 60 business days;

(9) \( \text{IRC}_t \) represents the latest incremental risk charge;

(10) \( \text{IRC}_{t-i} \) represents the incremental risk charge calculated for \( i \) business days earlier;

(11) \( z \) is the number of times the incremental risk charge was calculated in the last 12 weeks;

(12) \( \text{APR}_t \) represents the latest all price risk measure;

(13) \( \text{APR}_{t-i} \) represents the all price risk measure calculated for \( i \) business days earlier; and

(14) \( w \) is the number of times the all price risk measure was calculated in the last 12 weeks.

**Capital calculations: Multiplication factors**

7.10.118 **R**
The multiplication factor, for VaR and stressed VaR, for any business day is the sum of the minimum multiplication factor and the plus factor for that day.

7.10.119 **R**
The minimum multiplication factor, for VaR and stressed VaR, is three or any higher amount the VaR model permission defines it as.

7.10.120 **G**
The minimum multiplication factor, for VaR and stressed VaR, will never be less than three. If the appropriate regulator does set the minimum multiplication factor, for VaR and stressed VaR, above three the VaR model permission will have a table that sets out the reasons for that add on and specify how much of the add on is attributable to each reason (see BIPRU 7.10.121R). If there are weaknesses in the VaR model that may otherwise be considered a breach of the minimum standards referred to in BIPRU 7.10.24R the appropriate regulator may apply such an add on to act as a mitigant for those weaknesses.

7.10.121 **R**
Something that would otherwise be a breach of the minimum standards in BIPRU 7.10.26R - BIPRU 7.10.53R is not a breach to the extent that that thing is identified in the firm's VaR permission as a reason for an increase in the minimum multiplication factor, for VaR and stressed VaR, above 3.
Typically, any add on will be due to a specific weakness in systems and controls identified during the appropriate regulator’s review that the appropriate regulator does not consider material enough to justify withholding overall model recognition. The firm will be expected to take action to address the reasons for any add on. The appropriate regulator will then review these periodically and, where satisfactory action has been taken, the add on will be removed through a variation of the VaR model permission.

The plus factor system is designed so that the more often a VaR model has under-predicted losses in the past, the higher should be the capital requirement based on the VaR model. It is intended to provide a capital incentive for the firm to continue to improve the accuracy of its VaR model.

The table in BIPRU 7.10.125 sets out the plus factors to be added to the minimum multiplication factor, for VaR and stressed VaR, for any business day. It is based on the number of backtesting exceptions that occurred during the backtesting period as referred to in BIPRU 7.10.96R (Backtesting: Basic testing requirements) ending three business days preceding the business day for which the model PRR is being calculated.

### Table: Backtesting plus factors

<table>
<thead>
<tr>
<th>Zone</th>
<th>Number of recorded exceptions</th>
<th>Plus factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>4 or less</td>
<td>0.00</td>
</tr>
<tr>
<td>Yellow</td>
<td>5</td>
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<tr>
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<td></td>
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<tr>
<td></td>
<td>9</td>
<td>0.85</td>
</tr>
<tr>
<td>Red</td>
<td>10 or more</td>
<td>1.00</td>
</tr>
</tbody>
</table>

A VaR model that correctly predicts a one-tailed 99% confidence level is expected to produce, on average, 2.5 backtesting exceptions every 250 days. Random events may cause the number of backtesting exceptions actually observed to vary. The plus factor system is designed to take this into account. Hence plus factors are only imposed on the firm if it has five or more recorded backtesting exceptions. Therefore, where a backtesting exception appears to be caused simply by chance, it will not be appropriate for a VaR model permission to be varied to exclude that backtesting exception as described in BIPRU 7.10.106G (Backtesting: Process for disregarding backtesting exceptions).

Capital calculations: Specific risk surcharge: transitional requirements

Firms who gained model recognition before 1 January 2007 will be permitted to calculate PRR for specific risk in accordance with the methodology they were permitted to use immediately before that date.
instead of capturing event and default risk in their models (see BIPRU TP 14 (Market risk: VaR models)). This treatment will not be available to a firm that gains model recognition after that date.

Reporting procedures and requirements

A VaR model permission will contain requirements for what the firm should report to the appropriate regulator and the procedures for reporting. The precise requirements will vary from VaR model permission to VaR model permission. BIPRU 7.10.129R - BIPRU 7.10.130R set out what the appropriate regulator regards as the standard requirements.

A firm must, no later than the number of business days after the end of each quarter specified in the VaR model permission for this purpose, submit, in respect of that quarter, a report to the appropriate regulator about the operation of the VaR model, the systems and controls relating to it and any changes to the VaR model and those systems and controls. Each report must outline as a minimum the following information in respect of that quarter:

1. methodological changes and developments to the VaR model;
2. the introduction of all new pricing models used in connection with the VaR model and any changes to any pricing models used in connection with the VaR model, including details of any material associated valuation or risk management issues;
3. a summary of backtesting performance against profit and loss figures (if calculated) and hypothetical profit and loss figures, which must be provided in electronic format as stipulated by the VaR model permission;
4. (if the VaR model permission covers specific risk) the results of the specific risk backtesting including specific risk backtesting exceptions;
5. any change to any feeder or pre-processing systems in connection with the VaR model, including changes to any of the systems set out in the list described in BIPRU 7.10.131G (1) (as it exists at the date of the VaR model permission), and any introduction of a new such system;
6. any changes to the products coming within the scope of the VaR model;
7. any material changes or additions to any of the matters referred to in the firm’s internal documentation in relation to the VaR model (as it exists at the date of the VaR model permission) or to any matters subsequently notified under (7);
8. any changes in senior management;
9. an up-to-date list of products covered by the VaR model permission showing all changes made since the VaR model permission was granted;
10. where applicable (nil returns are not required), details of:
(a) any use of a changed historical observation period in accordance with BIPRU 7.10.30R or any change in the use of any weighting scheme as described in BIPRU 7.10.33R;

(b) any data series becoming unreliable as described in BIPRU 7.10.31R and any subsequent use of alternative value-at-risk measurement techniques;

(c) the frequency of updating data sets being increased in accordance with BIPRU 7.10.34R;

(d) any change in the method employed to derive 10-day VaR measure (see BIPRU 7.10.28R);

(e) to the extent that the use of correlations is permitted by a firm’s VaR model permission, a summary of any notifications that are required under BIPRU 7.10.37R; and

(f) the VaR model not accurately capturing risks (as referred to in BIPRU 7.10.53R) and any steps taken under BIPRU 7.10.53R; and

(11) the results of the stress tests on the firm’s correlation trading portfolio under BIPRU 7.10.55ZR, including a comparison to the current capital charge.

A firm must provide to, and discuss with, the appropriate regulator details of any significant planned changes to the VaR model before those changes are implemented. These details must include information about the nature of the change and an estimate of the impact on VaR numbers and the incremental risk charge.

**Updating the VaR model permission**

The VaR model permission will generally contain a list of the following:

1. feeder systems and pre-processing systems;
2. products covered by the VaR model permission; and
3. the firm’s internal documentation in relation to the VaR model.

The information in BIPRU 7.10.131G will vary over time. It is therefore not included in a VaR model permission as a rule but for information only. The appropriate regulator will update that information regularly in accordance with information supplied under BIPRU 7.10.129R. That updating will not amount to a variation of the VaR model permission.

**Link to standard PRR rules: Incorporation of the model output into the capital calculation**

A VaR model permission will modify GENPRU 2.1.52R (Calculation of the market risk capital requirement) to provide that a firm should calculate its market risk capital requirement in accordance with BIPRU 7.10 to the extent set out in the VaR model permission.
By modifying GENPRU 2.1.52 R (Calculation of the market risk capital requirement) to allow the firm to use the VaR model to calculate all or part of its PRR for certain positions, the appropriate regulator is treating it like an application rule. The modification means that the PRR calculation set out in BIPRU 7.10 supersedes the standard market risk PRR rules for products and risks coming within the scope of the VaR model permission.

To the extent that a position does not fall within the scope of a firm's VaR model permission the firm must calculate the PRR under the standard market risk PRR rules or, as applicable, those provisions as modified by the firm's CAD 1 waiver.

(1) This rule applies to a position of a type that comes within the scope of a firm's VaR model permission.

(2) Subject to BIPRU 7.10.136A R, if, where the standard market risk PRR rules apply, a position is subject to a PRR charge and the firm's VaR model permission says that it covers the risks to which that PRR charge relates, the firm must, for those risks, calculate the PRR for that position under the VaR model approach rather than under the standard market risk PRR rules.

(3) If, where the standard market risk PRR rules apply, a position is subject to one or more PRR charges and the firm's VaR model permission does not cover all the risks to which those PRR charges relate, the firm must calculate the PRR for that position under the VaR model approach (for those risks that are covered) and under the standard market risk PRR rules (for those other risks).

(4) Where the standard market risk PRR rules distinguish between specific risk and general market risk a firm's VaR model permission covers specific risk to the extent that it says it does. If the firm's VaR model permission does not cover specific risk, GENPRU 7.10.143R and GENPRU 7.10.144R apply.

(5) If a firm's VaR model permission covers positions in CIUs it covers specific risk with respect to those positions.

A firm must calculate the market risk capital requirement for securitisation positions and positions in the correlation trading portfolio in accordance with the standard market risk PRR rules, with the exception of those positions subject to the all price risk measure.

A firm may exclude from the VaR model approach immaterial risks within the scope of its VaR model approach. If a firm does so it must instead apply the standard market risk PRR rules to those risks.

(1) If a firm calculates its market risk capital requirement using a combination of the standard market risk PRR rules and either the VaR model approach or the VaR model approach with the CAD 1 model approach the PRR from each method must be added together.
(2) A firm must take appropriate steps to ensure that all of the approaches are applied in a consistent manner.

7.10.139 G An example of the effect of BIPRU 7.10.138R is that where a firm normally calculates the PRR for a particular portfolio using a VaR model, a firm should not switch to the standard market risk PRR rules purely to achieve a more attractive PRR.

7.10.140 R If:

(1) the standard market risk PRR rules provide for a choice of which of the PRR charges to use or specify that one type must be used in some circumstances and that another type must be used in other circumstances;

(2) one of those types is disapplied under BIPRU 7.10.136R; and

(3) the other type is not disapplied;

the firm:

(4) must use the VaR model approach if under the standard market risk PRR rules the firm must use the standard market risk PRR rules in (2); and

(5) may use the VaR model approach if under the standard market risk PRR rules the firm may use the standard market risk PRR rules in (2).

7.10.141 G The treatment of a convertible is an example of a situation in which BIPRU 7.10.140R applies. The table in BIPRU 7.3.3R (Table: Instruments which result in notional positions) shows that there are circumstances in which under the standard market risk PRR rules a firm should calculate an equity PRR and that there are circumstances in which a firm may choose between calculating an equity PRR and an interest rate PRR. BIPRU 7.10.140R would be relevant if a firm’s VaR model permission only covers one of equity risk and interest rate risk.

7.10.142 R The standard market risk PRR rules for the option PRR are only disapplied to the extent that the derived positions arising under BIPRU 7.6.13R (Table: Derived positions) come within the scope of the VaR model permission.

**Link to standard PRR rules: General market risk only**

7.10.143 R If a firm’s VaR model permission covers interest rate general market risk but not interest rate specific risk, the firm must calculate the interest rate PRR so far as it relates to interest rate specific risk in accordance with the standard market risk PRR rules except that the firm must not use the basic interest rate PRR calculation in BIPRU 7.3.45R (Basic interest rate calculation for equity instruments).
If a firm's VaR model permission covers equity general market risk but not equity specific risk, the firm must calculate the equity PRR so far as it relates to equity specific risk in accordance with the standard market risk PRR rules except that the PRR for equity specific risk must be calculated under the standard equity method.

(1) To the extent that a firm's VaR model permission does not allow it to use an approach set out in BIPRU 7.10 the relevant provisions in BIPRU 7.10 do not apply to that firm.

(2) If a provision of the Handbook refers to BIPRU 7.10, that reference must, in the case of a particular firm with a VaR model permission, be treated as excluding provisions of BIPRU 7.10 that do not apply under the VaR model permission and as taking into account any modifications to BIPRU 7.10 made by the VaR model permission. Such references also include requirements and conditions contained in the VaR model permission but not BIPRU 7.10 and to the rules modified by the VaR model permission.

A VaR model must be a value-at-risk model. It must provide an estimate of the worst expected loss on a portfolio resulting from market movements over a period of time with the specified confidence level.

If a firm ceases to meet any of the requirements set out in BIPRU 7.10, the appropriate regulator's policy is that the VaR model permission should cease to have effect. In part this will be achieved by making it a condition of a firm's VaR model permission that it complies at all times with the minimum standards referred to in BIPRU 7.10.26R - BIPRU 7.10.53R. Even if they are not formally included as conditions, the appropriate regulator is likely to consider revoking the VaR model permission if the requirements are not met.

If a firm ceases to meet the conditions or requirements in its VaR model permission or BIPRU 7.10 it must notify the appropriate regulator at once.

A firm may change its VaR model to such extent as it sees fit, except that it must not make a change that (either on its own or together with other changes since the date of VaR model permission) would:

(1) be inconsistent with VaR model permission or BIPRU 7.10; or

(2) mean that backtesting in accordance with BIPRU 7.10 and the VaR model permission would result in the use of data that is inappropriate for the purposes of measuring the performance of the VaR model.