

By the Banking Regulation and Supervision Agency:

**COMMUNIQUÉ ON THE CALCULATION OF MARKET RISK BY RISK
MEASUREMENT MODELS AND EVALUATION OF RISK MEASUREMENT
MODELS**

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SECTION ONE

Objective and Scope, Basis and Definitions

Objective and Scope

ARTICLE 1- (1) The purpose of this Communiqué is to lay down the principles and procedures concerning the standards for risk measurement models to be used by banks in the calculation of market risk as well as evaluation of risk measurement models and calculation of market risk by risk measurement models.

Basis

ARTICLE 2- (1) This Communiqué has been prepared on the basis of Articles 43, 45, 93 of the Banking Law Nr. 5411 dated October 19, 2005 and Article 6(4) of the Regulation on Measurement and Evaluation of Capital Adequacy of Banks published in the Official Gazette dated November 01, 2006 Nr. 26333.

Definitions

ARTICLE 3- (1) The following terms and expressions used in this Communiqué shall have the meaning expressly designated to them below:

- a) Bank(s): Bank(s) which are defined by Article 3 of the Law Nr. 5411,
- b) Retrospective test: Test made by banks to measure the accuracy and performance of risk measurement models they use,
- c) Agency: Banking Regulation and Supervision Agency,

- c) Case risk: Downturn risk which may occur in portfolio value due to big changes in interest rates, stock prices and FX exchange rates,
- d) Value subject to risk: Value which defines the highest loss of a portfolio or asset value held, as a result of the changes that may occur due to fluctuations in interest rates, FX exchange rates and stock prices, in a certain time tranche and a certain probability level and which is predicted by various numerical methods,
- e) Deviation number: Number of cases in which the daily loss occurred in portfolio value due to the changes in interest rates, FX exchange rates and stock prices in a certain period is over the daily “value subject to risk” predicted by the bank’s risk measurement model as a result of the comparison made,
- f) Stress test: Whole of the various techniques towards the measurement of potential resistance of a portfolio against unexpected risks,
- g) Regulation: Regulation on Measurement and Evaluation of Capital Adequacy of Banks.

Basic principles for the usage of Risk measurement model

ARTICLE 4 – (1) Risk measurement model is used in risk management and in determining the legal capital requirement for market risk.

(2) Banks shall take all necessary measures against model risk which may arise from errors and missing issues in risk measurement model as well as interpreting risk which may arise from errors and missing issues during including the results of risk measurement model to decision mechanisms since they may lead to significant losses. Whole of the risk and loss which may occur from the usage of risk measurement model belongs to the bank.

(3) Maximum security measures are obliged to be implemented in making changes on and usage process of software and codes concerning risk measurement model as well as implementation of efficient internal controls and access to software.

(4) Banks are obliged to make necessary changes in risk measurement models depending on new developments in risk measurement techniques and implementations.

SECTION TWO

Standards for Risk Measurement Models

General Standards

ARTICLE 5 – (1) In order for the Agency to give permission to the usage of risk measurement model in the calculation of capital obligation to be held against market risks, the following are stipulated;

- a) Banks shall have internal control, internal audit and risk management systems compatible with the principles and procedures stated in the Regulation on Internal Systems of Banks,
- b) Operating and accuracy of the results of risk measurement model shall be approved by independent auditors,
- c) Risk measurement model shall be based on sound ground theoretically, be compatible with the principles and procedures determined in this Communiqué, be applicable in a prudential manner and be reliable,
- ç) The personnel to use and evaluate risk measurement models shall be in adequate number and quality,
- d) A sound and reliable data and registration system shall exist to be basis for the accuracy of risk measurement,
- e) Risk measurement model shall be used in the bank at least for one year, value subject to risk produced by risk measurement model relating to the last one year, stress test and retrospective test results shall be reported to the Agency,
- f) Stress tests and retrospective tests shall be applied regularly, stress test results shall be evaluated by senior management of the bank and shall be used in the determination of policies and limits,
- g) Risk measurement model shall be a part of daily risk management process,
- ğ) Risk measurement model shall be defined as detailed in writing.

Ratification of risk measurement models

ARTICLE 6- (1) It is obligatory that the risk measurement model should be ratified by the external auditors in development and revision stages regarding its theory, assumptions that it

is based on, functioning of the data used and accuracy of the results it produced. This ratification should be procured even in case the model is created out of bank.

(2) Ratification of the model is performed by putting the model to various tests and evaluating the results.

(3) In implementation of the model,

a) Retroactive tests made by using the periods determined provided that it is not less than the period defined in Article 10,

b) Tests on using a different confidence interval in the model other than what is defined in Article 7,

c) Tests on appropriateness of the assumptions used in the model and whether the risk has been under or super-measured,

ç) Tests made by developing hypothetical portfolios are used as a minimum.

Calculation of value exposed to risk

ARTICLE 7- (1) Value at risk with risk measurement model is calculated daily by using one-sided ninety nine per cent confidence interval. The minimum holding period to be used in Value at risk account is ten workdays. Banks may use Value at risk figures they calculated having considered holding periods less or more than ten days by scaling it to ten workdays according to square root of time formula.

(2) Banks may use one of “Variance-Covariance”, “Historical Simulation” and “Monte Carlo Simulation” methods in value at risk account, on condition that it includes all market risks they are exposed to.

Including risk measurement model in risks from option transactions

ARTICLE 8- (1) Risk measurement model have to measure risks typical for options with non-linear price movements and quasi-option financial instruments and volatilities of price and ratios regarding option positions.

(2) Banks having substantial option portfolio should be able to determine in detail the volatilities of values at option in different maturities.

Stress tests

ARTICLE 9- (1) Banks which use risk measurement models in calculation of capital requirement subject to market risk are obliged to apply a detailed stress test on a regular basis.

(2) Stress tests of banks include the factors that may cause extraordinary profit or loss in purchase-sale accounts of the bank or that would strengthen the management of the risk. These factors include situations that affect all main risks including market risk, credit risk, operational risk, liquidity risk and concentration risk, has little chance to realize yet the extent of loss could be big. Stress tests are also applied to positions having linear or non-linear price characteristics.

(3) Stress tests are applied for measuring capacity of capital level of the bank to meet possible big losses, taking risk-decreasing and capital protective measures. Banks are obliged to include the stress scenarios deemed necessary by the Agency in portfolio or financial instrument basis within stress test programs.

Retroactive test

ARTICLE 10- (1) Banks, in order to determine accuracy and performance of risk measurement models they use, are obliged to determine the variation figure by comparing daily profits and losses with the exclusion of commissions and interest accruals in portfolio values realized within the past two-hundred-fifty work days due to the changes that may occur in risk factors with daily value at risk figures they projected by means of risk measurement models. One-day holding period is taken into consideration when value at risk is calculated for retroactive test.

(2) Banks are obliged to apply retroactive test by taking hypothetical portfolio as a basis. In this test, bank position in end of the day is taken as a basis and change in value of portfolio is referred considering the prices during the day.

Data set

ARTICLE 11- (1) Historical monitoring period used in calculation of value at risk by risk measurement model cannot be less than one year. Historical monitoring period which shall be used also for banks which use exponentially weighted moving average or similar other methods is at least one year and the data to be put to weighting that is being used in the model actually includes a period of at least six months. If the model does not virtually include this period, values calculated by means of equal weighted average and exponentially weighted average methods are compared and the one having the highest value at risk is used. In case high volatility occurs in prices, on condition that the Agency is informed and the existence of high volatility is accepted also by the Agency, a shorter monitoring period may be used or data sets can be changed. Changes to be made in data sets due to high volatility in prices are notified to the Agency before the change.

(2) In case the data cannot be found, another financial instrument having the closest characteristic can be used for the financial instrument with lack of data and value at risk can be calculated by determining an approximate standard deviation. It is obligatory that this situation is recorded and stated in the reporting to be made to the Agency with the bank management.

(3) Data sets that are used in order to calculate value at risk are updated on a daily basis. Data which cannot be procured on a daily basis yet can be procured in different frequencies (such as weekly, monthly) are also updated considering the related frequencies. Each data set is reviewed at least quarterly as a group and it is controlled if data is transferred on time, consistent and reliably. In case market movements are irregular, the said review is performed more frequently. No retroactive correction can be made on data sets. If such correction is necessary, the situation is notified to the Agency immediately with a detailed report including justification of correction.

(4) In case the Agency determines data sets and time series to be used in calculation of value at risk or gives reference regarding these, banks should use them.

Data flow

ARTICLE 12- (1) The process which data flow followed until it reaches risk measurement model in the system should be clearly visible and comprehensible. Documents regarding data flow should at least cover;

- a) Arrival ways of information and documents concerning positions from purchase-sale regions,
- b) From which units the position data to be used in risk measurement model came from (for ins. middle, back office)
- c) How these systems are used in purchase-sale regions and to which extent these systems cover the products,
- ç) The necessary interfaces in the process,
- d) Methods used in markets for data non -simultaneous due to time difference.

SECTION THREE

Utilization Permit to Risk Measurement Models

Application by Related Bank

ARTICLE 13- (1) Banks who want to calculate their capital requirements necessary for market risk by using risk measurement model shall apply to the Agency with a bank's board decision decreeing that their models are provided with standards specified in Section Two and a report approved by their executives responsible for information systems, internal control, internal audit and risk management including also following information and documents:

- a) General organization scheme inside and outside the country and partnership structure,
- b) Detailed organization schemes of fund management unit, unit responsible for registration and evaluation of purchase-sale transactions, internal control unit, risk management unit, internal audit unit and other units related to risk measurement model and their job and responsibility definitions (with names of senior officials),
- c) Distribution form of activities concerning purchase-sale between and inside units,
- d) Names of personnel working in risk management unit and job definitions of each personnel as well as information related to the qualifications and work experiences of these persons,
- e) Explanations concerning the training programs to personnel working In risk measurement model,
- f) Documents concerning the approval process of risk measurement model during decision process by bank before use,
- g) Information concerning the equipment and software used for risk measurement model,
- h) Detailed explanations concerning the methods used in value subject to risk accounts,
- i) Explanations concerning the method used to calculate the returns of market risk factors (logarithmic return, percent return etc.), as well as confidence interval used and holding terms,
- j) Explanations concerning statistical assumptions used regarding the distribution of market risk elements such as interest rate risk and stock position risk,
- k) Explanations concerning the estimation method used and its evaluation,
- l) Information concerning the analysis of strong and weak sides of the method used,
- m) Explanations concerning continuous evaluation of the adequateness and performance of risk measurement model,

- n) Explanations concerning the test program used before the implementation of risk measurement model throughout the bank and results thereof, as well as its performance and problems appeared, if any, after use,
- o) Mathematical formulas and examples concerning the pricing methods used as entries in risk measurement model and pricing methods used in purchase-sale transactions as well as the estimation success of pricing methods,
- p) Information concerning the methods used for measurement of risks related to instruments without a liquid market,
- q) Information concerning the methods used to provide market data concerning risk factors if some them are missing (such as interpolation),
- r) Information concerning the approaches used in modeling risks related to financial instruments such as option without linear price movements as well as specific risks,
- s) Explanations concerning the problems faced in evaluating complex options due to the fact that these options have irregular profit-loss characteristics,
- t) Information concerning whether or not the risk measurement model includes the exchange risk to which both purchase-sale accounts and other accounts are subject to,
- u) In-bank written procedures concerning the running of risk measurement model,
- v) If the bank is a subsidiary, affiliate or a branch of a bank established abroad and if it will use the same risk measurement model used by the main partner or the central office, documents concerning compliance approval for this risk measurement model, taken from the foreign audit authority,
- w) All kinds of information and documents concerning the implementation methods of retrospective tests,
- x) All kinds of information and documents concerning the implementation methods of stress tests and scenario analyses,
- y) Explanations concerning the theories and assumptions underlying the estimation method of return curves as well as the advantages and disadvantages of this method,
- z) If any, reasons of usage of another method to estimate the return curves, different from methods commonly used,
- aa) In case several return curves are formed for just one foreign currency, explanations concerning the variable data used to form a special curve and the method used to select these variable data,
- bb) Explanations on how the curves provided from the data and related functions are made suitable,

- cc) Explanations concerning the limit determination system implemented by the risk measurement model used,
- dd) Information concerning the usage of daily limits and principles to follow in case of limit excess,
- ee) In distribution of limits between units, information and documents concerning the distribution and showing if this distribution is central one or not,
- ff) Explanations concerning the nominal and market values of each position, market risk calculated with the method of value subject to risk and limits as well as the realization levels thereof,
- gg) Information concerning the source of data used as entry in the risk measurement model, as well as the length of its historical time-series, its updating method and frequency,
- hh) Explanations concerning the methods to be used in case of data deficient
- ii) Explanations concerning the methods to be used in evaluating extraordinary observations and showing how these are included to the risk measurement model,
- jj) If there isn't a minimum annual data concerning all time-series and if another financial instrument showing the closest characteristics to the financial instrument in question is taken into consideration in obligatory cases, explanations and reasons concerning this situation,
- kk) Explanations concerning the estimation method used in determining volatility and covariance
- ll) Principles concerning the assessment of financial instruments taking place in purchase-sale accounts and rules applied to calculate the cash flow dates and to discount cash flows,
- mm) Explanations concerning the software used in realization of purchase-sale transactions and payments,
- nn) Explanations concerning how the data are provided from data providers,
- oo) All kinds of information and documents deemed necessary by the Agency.

Measurement of specific risk by risk measurement model

ARTICLE 14- (1) The banks authorized by the Agency to use risk measurement model to measure the capital requirement they must have in stock face to market risks are authorized to calculate specific risks using the model, only if the risk measurement model is;

- a) Explaining sufficiently the historical price variations of the portfolio and its confidentiality and performance shall be tested by using several econometric and statistical modeling techniques, for example, by obtaining a high result such as ninety percent for the Certainty Coefficient (R²) value obtained as a result of a regression,
- b) Taking into consideration the concentrations inside the portfolio by their size and compositions and sensitive to portfolio structure and showing that high capital requirement is emanating from bigger concentrations,

c) It has to be designed to respond to unexpected market conditions and it has to warn relating to unexpected market conditions by realizing also simulations relating to worst condition scenarios probable with historical simulations.

ç) Its performance and accuracy relating to specific risk measurement has been confirmed by subjecting it to a separate retrospective test period

d) Its comprising risks emanating from securities issuer and risks due to their being traded in different markets, similar but not the same positions.

e) Its including event risk.

Reporting Obligation in Risk Measurement Model

ARTICLE 15-(1) In calculation of capital liability subject to market risk, banks started to use risk measurement models, calculate and declare their capital liability subject to market risk as to standard method within the scope of principles and procedures determined in the Regulation at the same time during at least three reporting period.

(2) Banks taken permission of usage of model, continue to practice retrospective tests and stress tests. The results of stress tests and retrospective tests are transmitted to the Agency in the period determined in the second paragraph of the article 20 of the Regulation.

Usage of Standard Method and Risk Measurement Models Together

ARTICLE 16-(1) Banks granted authorization to use risk measurement model as to the principles determined, can calculate the capital ,that they are obligated to set aside in return for small risk categories that can be neglected in purchase-sale accounts, by using standard method.

(2) Banks calculate their capital liabilities by using risk measurement model for one or more than one risk category afterwards can not use standard method again if it is not dependent on a reasonable excuse for the same risk category. Banks have to declare the said excuse to the Agency in written and have to have the confirmation of the Agency.

(3) The capital, to be set aside for each risk category including sub-items included in the same risk category, can be calculated by using just one of the standard method or risk measurement model methods.

(4) Banks developed their risk measurement models in including the said risk factor or the factors in time can pass to risk measurement model in case of their reasoned applications shall be deemed appropriate by the Agency .

(5) In case of using standard method and risk measurement model be used at the same time, the amount taken into account in calculating the amount subject to market risk is the total of the values gained separately as a result of calculation made with both methods as to calculation principles determined in the Article 6 of the Regulation.

Making Change in Risk Measurement Models

ARTICLE 17-(1) the Banks', taken permission from the Agency for risk measurement model usage, making change on model is subject to the permission of the Agency. The minimum respects required for applications to include relating to make changes in risk measurement model are the followings;

- a) Changes to be made on the current risk measurement model and results of which the changes in system and/or methodology have made them arisen by its interaction with work flows.
- b) Changes in limit structure.

c) Changes in the amount of value subject to risk calculated for seeing the effects of changes of risk measurement model and changes in stress test results.

Termination of Permission

ARTICLE 18-(1) Banks which are convinced by Agency that their reliability and adequacy are lost or risk measurement models are lost the predicted conditions, are warned and it is given a due period up to three months for them to complete their deficiency of their risk measurement model. Authorization to use risk measurement models in capital liability account are cancelled of the banks which do not fulfill the said conditions, do not complete their deficiencies and do not bring their risk measurement models to an adequate and reliable manner. The banks warned have to use standard method in calculation of capital liability subject to market risk until they complete their deficiencies and they provide adaptation to the said conditions.

(2) Banks use risk measurement model in the account of capital liability subject to market risk, can not calculate capital liability by using standard method at own request.

SECTION FOUR

Capital Requirement Dependent to Value Subject to Risk

Calculation of capital requirement dependent to value subject to risk

ARTICLE 19-(1) Banks are take into account of amount found as a result of multiplying the value subject to average risk of previous sixty business days with the total to be comprised by adding Multiplication factor and if exists Plus Multiplication Factor, and the higher one of the amount of value subject to risk of the previous day.

Multiplication factor and plus Multiplication Factor

ARTICLE 20-(1) Multiplication factor is implemented as 3 for all banks use risk measurement models in market risk account. By taking into account of variation number gained from retrospective test results, the bank add multiplication factor rates, determined in the statement hereunder, multiplication factor. In case that bank presents adequate reasons in respect that risk measurement model is essentially right and the reason of the variation is not rational, the Agency can grant permission to implementation of plus multiplication factor relating to this variation

Number of Variation	Plus Multiplication Factor
4 and Less	0.00
5	0.40
6	0.50
7	0.65
8	0.75
9	0.85
10 and more	1.00

(2) The Agency, without being limited with variation numbers, can determine a coefficient change between zero and one, by taking into account of criteria such as internal audit , internal control and risk management systems, organizational structure and management quality, and can add the said coefficient, independent from plus multiplication factor, on multiplication factor taken into account in calculation of capital required to be set aside against market risks.

(3) Bank informs the Agency immediately in case of a variation. The said period can not ever exceed 5 business days.

SECTION FIVE

Final Provisions

Entry into Force

ARTICLE 21-(1) This communiqué enters into force on the date of its publication

Enforcement

ARTICLE 22-(1) The provisions of this Communiqué are enforced by the Chairman of the Banking Regulation and Supervision Agency.