RISK MITIGATION METHODS IN EUROSYSTEM CREDIT OPERATIONS

Article 18.1 of the Statute of the ESCB allows the ECB and the NCBs to transact in financial markets by buying and selling assets outright or under repurchase agreements and requires all Eurosystem credit operations (i.e. refinancing operations and intraday credit operations) to be based on adequate collateral. Consequently, all Eurosystem liquidity-providing operations are based on underlying assets provided by the counterparties either by transferring ownership of the assets (in the case of outright transactions or repurchase agreements) or by granting a pledge over them (in the case of collateralised loans). The requirement of collateral and the application of a complementary risk control framework are designed to protect the Eurosystem against financial risk. This article describes the risks arising in reverse transactions (repurchase agreements and collateralised loans) and explains how the collateral and risk control frameworks cater for these risks.

1 INTRODUCTION: A DESCRIPTION OF EUROSYSTEM CREDIT OPERATIONS

The Eurosystem has a number of instruments available for the implementation of monetary policy. These instruments include reverse transactions, outright transactions, the issuance of debt certificates, foreign exchange swaps and the collection of fixed-term deposits. Of these, liquidity-providing reverse transactions have so far been the most important. In such transactions, the Eurosystem buys specific types of asset under repurchase agreements or conducts credit operations collateralised by such assets.[1]

On average in 2003 the Eurosystem provided €243 billion of liquidity to the market through reverse monetary policy operations. Of this, €198 billion was supplied through main refinancing operations with a maturity of generally two weeks, €45 billion through longer-term refinancing operations with a maturity of three months, and €0.3 billion through counterparties having (overnight) recourse to the marginal lending facility. It also provided intraday liquidity against collateral within TARGET.

By their very nature, reverse transactions are temporary operations, which provide funds for a limited and pre-specified period only. In these operations the Eurosystem incurs a counterparty risk, since the counterparty may be unable to meet its credit obligations. This type of credit risk is mitigated by the requirement of adequate collateral to guarantee the credit provided. The requirement is of a fundamental nature and is laid down by Article 18.1 of the Statute of the ESCB, which specifies that "… the ECB and the national central banks … conduct credit operations with credit institutions and other market participants, with lending being based on adequate collateral".

The Eurosystem's collateral framework is aimed at translating the statutory requirement of adequate collateralisation into concrete tools and procedures that guarantee sufficient mitigation of the financial risks in a reverse transaction. To achieve this goal, the collateral accepted in such a transaction must be of a quality and quantity such that, in the event of a counterparty default and a subsequent realisation of the collateral in the market, it is highly probable that the Eurosystem would be able to recover the full amount of its claim.

Therefore, in order to successfully mitigate the counterparty risk in a reverse transaction, the collateral framework must adequately limit three kinds of risk, all of which arise only if the counterparty defaults: (1) the credit risk associated with the collateral accepted; (2) the market risk of an adverse movement in the price of an asset accepted as collateral due to exogenous factors occurring between the last collateral valuation and collateral realisation;

1 For further details see "The implementation of monetary policy in the euro area: General documentation on Eurosystem monetary policy instruments and procedures", ECB, February 2004, also known as the "General Documentation".

(3) the liquidity risk of an adverse movement in the price of an asset caused by an attempt on the part of the Eurosystem to liquidate a potentially large position in that asset.

Section 2 describes the risks involved in a liquidity-providing reverse transaction between a Eurosystem NCB and a counterparty, highlighting the different types of risk that need to be taken into account by a sound risk management framework. The collateral and risk control frameworks, which use several methods to contain the identified risks, are described in more detail in Sections 3 to 5. Section 6 concludes.

2 THE RISKS INVOLVED IN REVERSE TRANSACTIONS

By the nature of lending, any lender bears credit risk, namely the risk that the borrower will fail to comply with its commitments to return the borrowed cash and/or provide the required compensation (i.e. interest) at the maturity of the transaction. Several tools are available to the lender to mitigate this risk.

First, counterparty risk can be reduced by conducting operations only with counterparties of a high credit quality, so that the probability of a default is small. In order to establish equal treatment of institutions across the euro area, however, the Eurosystem has opted to give a broad range of institutions access to its monetary policy operations, while ensuring that they fulfil certain operational and prudential requirements.

Second, and reflecting the same idea, counterparty risk can also be reduced by implementing a system of limits linking the exposure to each counterparty to its credit quality, so that the potential loss is kept at low levels. For Eurosystem open market operations, however, such a system would be incompatible with an efficient and transparent tender procedure for allotting liquidity.

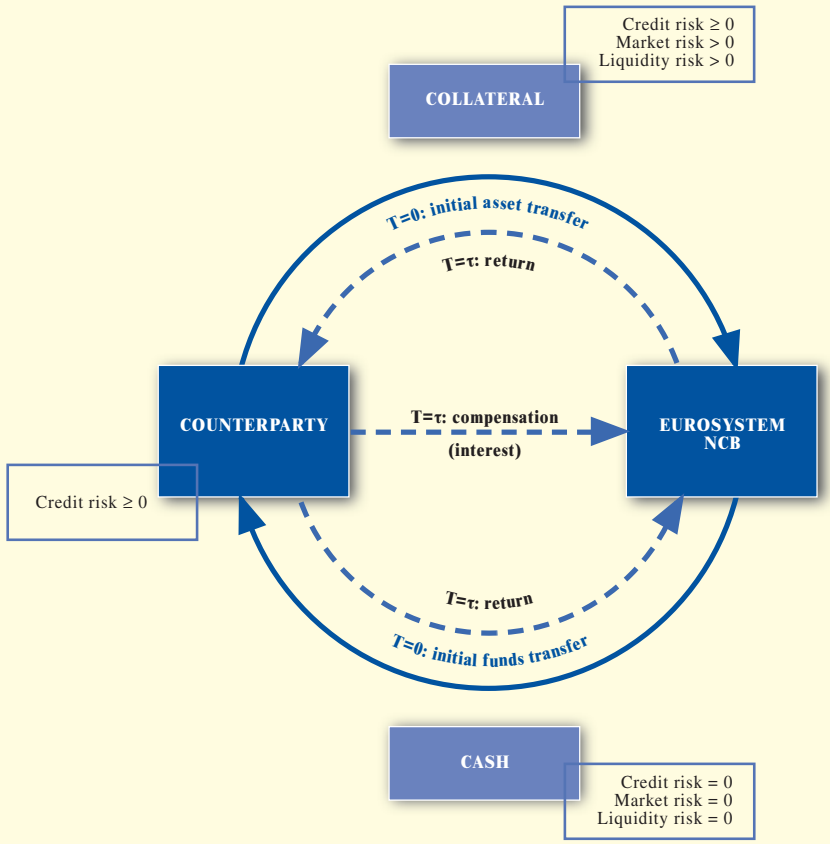
Finally, counterparty risk can be mitigated by requiring the borrower to provide adequate collateral. This approach mitigates financial risks without limiting the number of counterparties or interfering with the allotment procedure and is therefore the approach chosen by the Eurosystem. When combined with the appropriate risk management tools, collateralisation can reduce the overall risk to negligible levels.

The lender in a collateralised reverse transaction may still incur a financial loss. However, this would require more than one adverse event to occur at the same time. This could happen as follows: the borrower would first default on its obligation to the lender, resulting in the lender taking possession of the collateral. Assuming that at the time of the default the value of the collateral covered the value of the liquidity provided through the reverse transaction, financial risk could arise from the following two possible sources:

– *Credit risk associated with the collateral.* The issuer of the security or the debtor of the claim accepted as collateral could also default, resulting in a "double default". The probability of such a combination of defaults can be considered negligible if eligible assets satisfy high credit quality standards and if the lender does not accept assets issued by the borrower or entities having close financial links to the borrower. The Eurosystem's framework for the assessment of the credit quality of collateral ensures these requirements are met, as explained in Section 3.

– *Market and liquidity risk.* This would arise if the value of the collateral fell in the period between the counterparty's default and the realisation of the collateral. In the time between the last valuation of the collateral and the realisation of the collateral in the market, the collateral price could decrease to the extent that only a fraction of the claim could be recovered by the borrower. *Market risk* may be defined in this context as the risk

Chart 1 Risks involved in Eurosystem credit operations



Note: T is a time indicator that is equal to 0 at the starting date and equal to τ at the maturity date of the credit operation.

of financial loss due to a fall of the market value of collateral caused by exogenous factors. *Liquidity risk* may be defined as the risk of financial loss arising from difficulties in liquidating a position quickly without this having a negative impact on the price of the asset. Market and liquidity risk can also be reduced considerably by following best practices in the valuation of assets and the risk control measures applied. The Eurosystem's risk control framework is the subject of Sections 4 and 5.

Chart 1 provides a visual summary of a reverse transaction and the risks involved.

Therefore, collateral per se cannot eliminate or even sufficiently mitigate financial risks. To guarantee that the quality and quantity of collateral provide adequate protection to the lender, three separate, but highly interdependent, risk mitigation tools are required: the assessment of collateral credit quality, the correct valuation of collateral and the application of risk control measures to collateral. A description of each of these three elements is provided in the following sections.

3 THE ASSESSMENT OF COLLATERAL CREDIT QUALITY

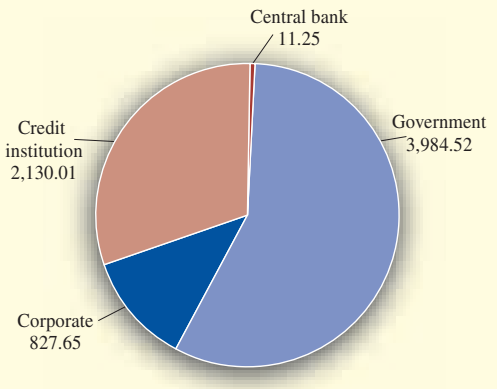
All assets used as collateral in Eurosystem credit operations have to fulfil certain common criteria. An important criterion of eligibility is that the assets meet high credit standards.

Government bonds have traditionally been preferred by central banks because of their low credit risk and high liquidity, allowing relatively simple risk control measures concentrated mainly on market risk. However, since the Eurosystem's collateral policy has also to take account of Article 102 (ex Article 104a) of the Treaty establishing the European Community, which prohibits privileged access for the public sector to financial institutions, discrimination between public and private assets is precluded. Chart 2 provides statistical information on the relative importance in terms of total outstanding volumes of the main issuer groups in the pool of eligible tier one assets[2] as at the end of 2003. Although it reveals a predominance of government paper, credit institution and corporate paper accounts for a substantial share (43%) of the total outstanding volume.

The assessment of the credit quality of private sector paper is more important than the assessment of government paper not only because of the increased default risk but also because private securities may be subject to higher price volatility and lower liquidity, which could result in losses if the assets have to be liquidated. When assessing the credit risk of debt instruments, the ECB takes into account, inter alia, available agency ratings and the NCBs' own credit assessment systems, as well as certain institutional criteria which ensure particularly high protection of holders, including guarantees. The Eurosystem does not accept as underlying assets debt instruments issued or guaranteed by the counterparty, or by any other entity with which the counterparty has close links. The credit quality of eligible assets is constantly monitored to check that it is equivalent to at least the minimum level of financial soundness specified by the Eurosystem.

Chart 2 Tier one eligible assets for Eurosystem credit operations by issuer group

(EUR billions; as at end-December 2003)



Source: ECB.

Work has recently been carried out to improve the comparability of the different sources of credit assessment and the analysis of new sources of credit assessment.[3] These efforts take into consideration, inter alia, the Basel Committee's proposals for the new Basel Capital Accord. In particular, the Eurosystem has taken note of the Committee's proposed approaches to credit risk as they relate to the recognition process and eligibility criteria for external credit assessment institutions and to the internal rating-based approach.

4 VALUATION OF COLLATERAL

Collateral must be regularly valued to ensure that the Eurosystem is in a position to judge whether additional assets are required, or whether it should return excess collateral to the counterparty. The Eurosystem NCBs calculate the required value of underlying assets on a daily basis, taking into account the valuation

2 Owing to the differences in financial structure across the countries of the euro area and for purposes internal to the Eurosystem, a distinction is made between two categories of assets eligible for Eurosystem credit operations. These two categories are referred to as "tier one" and "tier two". Tier one consists of marketable debt instruments which fulfil uniform euro area-wide eligibility criteria specified by the ECB. Tier two consists of additional assets (marketable and non-marketable) which are of particular importance to national financial markets and banking systems.

3 For further details on future improvements to the collateral framework see the public consultation launched on 11 June 2003 and entitled "Measures to improve the collateral framework of the Eurosystem" and the related "Summary of comments received" published on 15 January 2004.

principles set by the Eurosystem. In relatively efficient and liquid securities markets, the market price tends to be the best indicator of the value of an asset. Where such markets are absent, theoretical valuation models can be used to mark-to-model[4] the collateral position.

For marketable tier one and tier two assets, the most representative price on a single reference market is selected as the price source. This reference price is used to value the collateral in a mark-to-market approach. If more than one price is quoted on the reference market, the lowest price is used. For non-marketable tier two assets or for those marketable assets which are not normally traded (so that marking to market is not possible) the Eurosystem is in the process of implementing a mark-to-model approach, based on present-value discounting of future cash flows. The discounting is based on an appropriate zero coupon curve, and differences in credit risk between issuers are explicitly taken into account through credit spreads. Work is currently being carried out to enhance the valuation methods in order to satisfy the need for daily valuation of all collateral, with special attention being paid to the enhancement of theoretical valuation methods to include more complex assets.

The use of a theoretical model should provide a fair (i.e. neither too conservative nor too high) value for the assets delivered as collateral. While the risk control framework is designed to protect the Eurosystem against market and liquidity risk in its collateralised transactions, it also aims to allow counterparties to use the eligible assets efficiently.

5 RISK CONTROL MEASURES

Risk control measures are applied to collateral throughout the lifetime of a credit operation in order to safeguard the Eurosystem against financial losses. They are designed to minimise the likelihood that, should an asset accepted as collateral have to be realised, the proceeds from the sale of the asset in the market will not be sufficient to recover the liquidity originally provided by the Eurosystem. Risk control measures thus cater for market and liquidity risk. The Eurosystem's risk control measures as defined by the General Documentation[5] are listed in Box 1.

The two risk control measures currently applied in the implementation of the collateral framework are valuation haircuts and variation margins.

VALUATION HAIRCUTS

The distinction between the two risks addressed by valuation haircuts, namely market and liquidity risk, is not always simple. Market risk is generally considered to measure the sensitivity of prices to exogenous factors (such as the general level of interest rates) which would not normally be affected by the Eurosystem attempting to unwind a large collateral position. By contrast, liquidity risk refers to the potential price effect caused by an attempt on the part of the Eurosystem to quickly unwind a large position in an asset. For the purpose of defining adequate valuation haircuts, market risk is measured by asset price volatility while liquidity risk is expressed in terms of the time required for an orderly realisation of the asset.

Until March 2004, only valuation haircuts for tier two assets took liquidity risk into account; those for tier one assets addressed only market risk. However, the regular reassessment of the risk control framework has led to a revision of the haircut schedules for both tier one and tier two assets and to the discontinuation of initial margins as of March 2004. The discontinuation of initial margins was made possible not only by the enhanced treatment of liquidity risk in the valuation haircut schedules, but also by the broader availability of asset prices fulfilling the valuation principles defined by the Eurosystem. The haircut schedule for tier one assets has been

4 Marking to model is defined as any valuation which has to be benchmarked, extrapolated or otherwise calculated from a market input.

5 See footnote 1.

Box 1

RISK CONTROL MEASURES

The Eurosystem currently applies the following risk control measures in its liquidity-providing reverse transactions:

Valuation haircuts

The Eurosystem applies valuation haircuts, meaning that the value of the underlying asset is calculated as the market value of the asset less a certain percentage (haircut). In a framework with daily valuation of underlying assets, haircuts need to cover normal daily price fluctuations (i.e. fluctuations which, in statistical terms, fall with a specified confidence level within certain bounds) due to both market and liquidity factors.

Variation margins (marking to market)

The Eurosystem requires the haircut-adjusted market value of the underlying assets used in its liquidity-providing reverse transactions to be maintained over time. This implies that if the value, measured on a regular basis, of the underlying assets falls below a certain level, a margin call will be triggered, i.e. the NCB will require the counterparty to supply additional assets or cash. Similarly, if the value of the underlying assets exceeds a certain level, the counterparty may retrieve the excess assets or cash.

The following risk control measures are available to the Eurosystem but currently not applied:

Initial margins

The Eurosystem may apply initial margins, meaning that counterparties would need to provide, on the settlement date of a reverse transaction, underlying assets with a value at least equal to the liquidity provided by the Eurosystem plus the value of the initial margin. Initial margins might be used to provide an up-front incentive against counterparty default due to abrupt changes in market conditions. Until the Eurosystem suspended initial margins in March 2004, their levels were defined so as to depend on the maturity of the reverse transaction (1% for intraday and overnight transactions, 2% for any longer maturity).

Limits in relation to issuers/debtors or guarantors

The Eurosystem may apply limits to the exposure vis-à-vis issuers/debtors or guarantors.

Additional guarantees

The Eurosystem may require additional guarantees from financially sound entities in order to accept certain assets.

Exclusion

The Eurosystem may exclude certain assets from use in its monetary policy operations.

revised so as to cater specifically for the differences in the liquidity characteristics of the various types of eligible assets. Using both the institutional characteristics of the assets and quantitative measures of liquidity, four new liquidity categories have been defined:

– *Category I*: central government debt instruments, debt instruments issued by central banks

– *Category II*: local and regional government debt instruments, jumbo Pfandbrief-style debt instruments, agency debt instruments, supranational debt instruments

– *Category III*: traditional Pfandbrief-style debt instruments, credit institution debt instruments, debt instruments issued by corporate and other issuers

– *Category IV*: asset-backed securities.

The new haircut schedule is based on views regarding market risk (volatility) and the total time required for an orderly liquidation of a large asset position. Volatility estimates are based on historical and simulated scenarios for government bond yield changes and include a baseline stress scenario (based on the market volatility experienced in the aftermath of the 11 September 2001 attacks in the United States and a simulated worst-case scenario with high volatility). The higher the volatility levels – which are common to all liquidity categories – the larger the haircuts. Total liquidation time is based on three components: a valuation period, a grace period and a realisation time. The valuation period, which is one day (reflecting daily valuation), and the grace period, which is assumed to be three to four days, are again common to all liquidity categories. By contrast, the realisation time required for an orderly sale of the assets is assumed to be an increasing function of the liquidity category ranking. Since the Eurosystem has never needed to realise an asset due to the default of a counterparty, the estimated realisation time is based on information gathered in the financial markets.

Box 2 presents some further, more technical information on two methods used to derive haircuts.

VARIATION MARGINS

The second risk control measure applied is variation margins. The Eurosystem requires that the market value of the underlying assets used in its reverse transactions cover the provided liquidity over the life of the transaction. Thus if this value, measured on a daily basis, falls below a certain level, NCBs will require counterparties to supply additional assets or cash i.e. they will issue a margin call. Similarly, if the value of the underlying assets exceeds a certain level, the counterparty may retrieve the excess assets or cash. The frequency of margin calls depends not only on the volatility of asset prices but also on the collateral system in place at the NCB in question. Depending on both the legal framework and national operational systems, NCBs either allow underlying assets to be pooled or require the assets used in each individual transaction to be earmarked. Some NCBs use both methods. In a collateral pooling system, counterparties have a pool account in which to deposit assets collateralising their transactions with the central bank. In practice, counterparties generally provide NCBs that use a pooling system with more collateral than required, so margin calls are very rare.

The combination of daily asset valuation and the possibility of margin calls guarantees that the collateral value at all times covers the liquidity provided through a reverse transaction. Valuation haircuts, therefore, are designed to cover market moves during the time required for the realisation of the asset, and not during the life of the transaction. This feature considerably simplifies the risk control framework as it means that haircuts do not need to differentiate between different types of reverse transaction and their different maturities (which range, in the case of the Eurosystem, from intraday to three months).

Box 2

METHODS APPLIED TO DERIVE HAIRCUTS

This box provides a technical description of two methods applied to derive haircuts. The first is used for marketable securities and the second for non-marketable assets.

1. The adverse market move risk approach (marketable assets)

The general methodology builds on the concept of Value at Risk (VaR)[1] with a given confidence level during the liquidation period. The level of the haircut that gives the appropriate level of protection against adverse market moves can be formulated in terms of the probability of a large movement in the value of the collateral securities. The value of asset V_i on day t is defined as $V_{i,t}$. The gain or loss in collateral value between dates t and $t+\tau$ (τ being the total liquidation time) is $V_{i,t+\tau}-V_{i,t}$.

The total collateral received following the haircut h_i at date t ($h_i V_{i,t}$) should be such that

$$P(V_{i,t+\tau}-V_{i,t} < -h_i V_{i,t}) = \xi.$$

The symbol ξ represents a small probability value (e.g. 1%), which is the probability that the loss in the value of the collateral will not exceed the additional provision of collateral received through the haircut. Dividing by $V_{i,t}$ results in

$$P(n_{i,t+\tau} < -h_i) = \xi$$

where $n_{i,t+\tau}$ denotes the percentage change in value of the collateral (i.e. $\{(V_{i,t+\tau}-V_{i,t})/V_{i,t}\}$).

The expressions above are the VaR of a portfolio consisting of just the asset i computed at a confidence level equal to ξ. This VaR should equal the value h_i.

2. The opportunity cost risk approach (non-marketable assets)

Haircuts applied to non-marketable assets should reflect the risk associated with the opportunity cost of having to hold an asset until maturity, corresponding to the difference between the yield to maturity on the collateral and the yield that would have been realised on the roll-over of monetary policy operations until the maturity date of the collateral. This is the risk of missing the opportunity to invest at a potentially higher rate in the future as a result of being locked into an instrument with a fixed yield to maturity.

1 The Value at Risk (VaR) of a position in an asset or a portfolio of assets for a time horizon T and at a certain confidence level p (usually between 90% and 99%) is the value q for which probability $P(\Delta V<-q)=1-p$, where ΔV is the change in the value of the position within the time horizon T.

6 CONCLUSION

Risk mitigation in the framework of the Eurosystem's liquidity-providing reverse operations is based on three elements:

– The Eurosystem uses *assets of a high credit quality* to collateralise its operations. For this purpose, it uses market sources and applies best practices to assess the credit quality of the heterogeneous set of eligible assets.

– Collateral needs to be *valued accurately and on a daily basis* to ensure that the Eurosystem is appropriately covered against credit risk.

– To address market and liquidity risk, *risk control measures* are applied to the properly valued collateral. While protecting the Eurosystem from financial risks in its operations, these measures aim to avoid penalising counterparties and to allow them to use eligible assets efficiently.