Box 3

THE TRANSMISSION OF OVERNIGHT INTEREST RATE VOLATILITY TO LONGER-TERM INTEREST RATES IN THE EURO AREA MONEY MARKET

The transmission of overnight interest rate volatility to longer-term interest rates in the money market is an issue of great importance to a central bank. Any significant impact of the usual volatility of the overnight interest rate on interest rates at longer maturities would be of concern in terms of the appropriate implementation and signalling of the monetary policy stance. In particular, it would bring into question the "neutrality" of liquidity policy. A liquidity policy is "neutral" whenever the monetary policy stance is determined by the decisions taken by the competent policy-making body with respect to official rates, rather than influenced by its management of liquidity conditions. In the case of the latter, its decisions are focused solely on smoothing short-term shocks to the liquidity situation confronting MFIs.

In the empirical economics literature, several studies have already addressed this issue with respect to the euro area money market. Most were based on models for conditional volatility.[1] These studies generally find no significant evidence of a transmission of volatility along the yield curve. Most of these studies have used measures of the volatility of interest rates that were derived from specific models and estimated on the basis of data available at a relatively low frequency (daily or lower in virtually all cases). Recent studies analysing high-frequency data have used similar models. Furthermore, previous studies typically used data taken from the period prior to the introduction of changes to the Eurosystem's operational framework in March 2004.

In order to provide a new perspective, this box presents an evaluation of the transmission of volatility in the euro area money market that is based on a measure of realised volatility, as

1 The models used were autoregressive conditions heteroskedasticity (ARCH) models or variants thereof. In this class of models, conditional variance is modelled as a function of its past values. For details, see the seminal papers by R.F. Engle, "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of U.K. Inflation." in *Econometrica*, Vol. 50, 1982, pp. 987-1008, and T. Bollerslev, "Generalized Autoregressive Conditional Heteroskedasticity" in *Journal of Econometrics*, Vol. 31, 1986, pp. 307-327.

defined by Andersen and Bollerslev.[2] Such a measure does not rely on a specific model, but simply captures the volatility of returns on the basis of information on intraday interest rate movements.[3] Realised volatilities have been calculated for the overnight, one-month, three-month and one-year interest rates over the period from 24 December 2003 to 7 June 2005, using data on the respective return for each five-minute interval between 9 a.m. and 6 p.m. In this context, the advantage of using a model-free measure of volatility is twofold: first, the approach is more robust with respect to the potential impact of changes to the operational framework, which may affect interest rate dynamics, and, second, the measure permits the presence of structural breaks related to specific institutional factors. Using these measures, a vector autoregression (VAR) model with five lags was specified and estimated. Such models are a simple way of analysing the dynamic relationships between interest rate volatilities at various maturities.

In order to take account of the fact that the days between the last regular refinancing operation and the end of the reserve maintenance period are usually characterised by a more marked level of volatility in the overnight rate, a dummy variable for these days was also introduced in the model. This variable captures the effects on the estimates of the VAR model that derive from the systematic increase in volatility in the last days of each maintenance period and, thereby, facilitates a more accurate estimation of the parameters of the model.

The assessment of volatility transmission

Using this approach, the transmission of volatility along the yield curve has been assessed on the basis of impulse response functions. These functions illustrate the dynamic effects of an unanticipated movement in, or "shock" to, one variable at a specific point in time on itself and the other variables in the model in subsequent periods. More specifically, based on the four-dimensional VAR model specified for the series of four interest rates, the chart below shows the response of the volatility of interest rates with maturities ranging from overnight to one year to shocks to the volatility of the overnight interest rate, i.e. the rate most sensitive to liquidity conditions. For each maturity, impulse response functions are computed over a period of 25 days – i.e. roughly one business month – and are displayed together with a 95% confidence interval.

The four impulse response functions in the chart show that the response to overnight interest rate volatility shocks is statistically significant only for the overnight maturity and is limited, even in that case, to only very few days. The impact on the volatility of longer-maturity rates is extremely modest in size (please note the different scales in the individual panels of the chart) and statistically insignificant in all cases, as indicated by confidence intervals spanning zero. Furthermore, all effects dissipate after very few days, exhibiting no persistence.

Against this background and based on the measure of realised volatility, it can be concluded that episodes of a more marked volatility of the overnight interest rate – especially at the end of

2 For more details, see T.G. Andersen and T. Bollerslev, "Intraday periodicity and volatility persistence in financial markets" in *Journal of Empirical Finance*, Vol. 4, 1997, pp. 115-158.

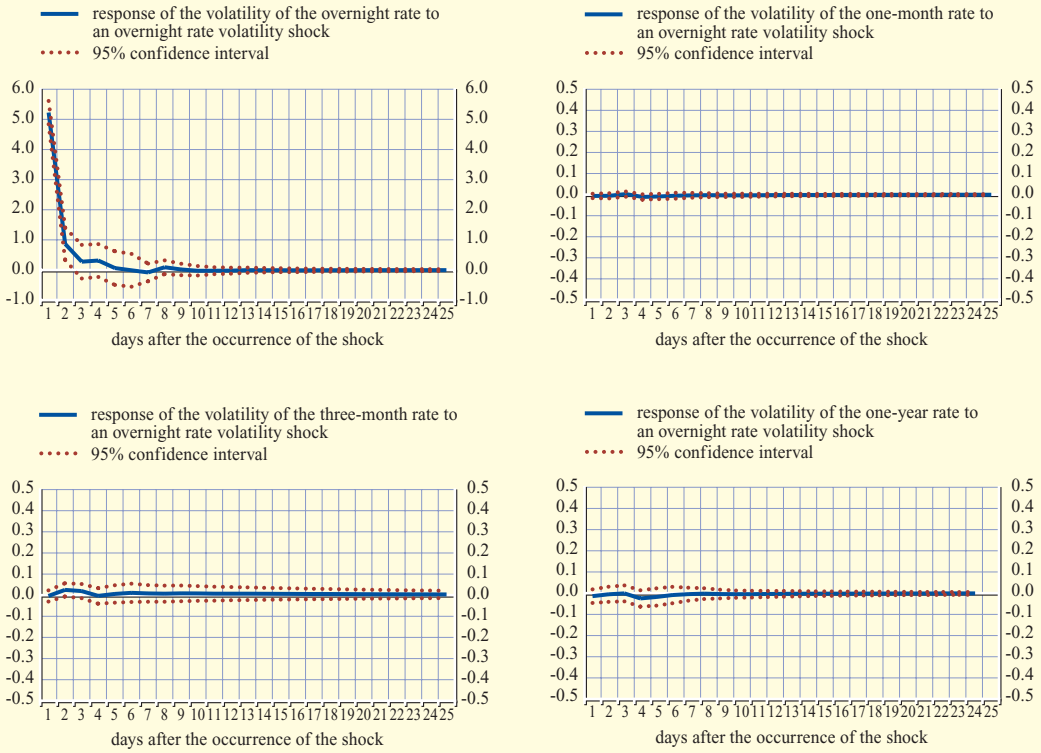
3 It can be shown that this measure provides an accurate and consistent estimate of interest rate volatility. For this purpose, see T. G. Andersen and T. Bollerslev, "Answering the skeptics: yes, standard volatility models do provide accurate forecasts" in *International Economic Review*, Vol. 39, 1998, pp. 885-905.

the reserve maintenance period – have not had any significant impact on longer-maturity rates. There is thus no evidence of a transmission of volatility along the euro area money market yield curve in recent months. Together with the evidence showing that a substantive decline in the (realised) volatility of the overnight rate took place after the introduction of some changes to the operational framework in March 2004, this result confirms that the Eurosystem's operational framework functions well from a monetary policy perspective and that the introduction of these changes has not impaired this performance.[4]

These results, although based on a relatively simple statistical model, largely confirm the conclusions reached in existing literature. In general, the exercise has indicated that there is no evidence of a transmission of overnight interest rate volatility to longer-term interest rates in the euro area money market. All in all, the exercise has confirmed that the operational framework of the Eurosystem performs well in facilitating the signalling of the monetary policy stance, one of its core functions.

Impulse response functions of the overnight, one-month, three-month and one-year interest rates with respect to the overnight interest rate over 25 days

(in basis points)



4 For a comprehensive review of the changes to the Eurosystem's operational framework, see the article "Initial experience with the changes to the Eurosystem's operational framework for monetary policy implementation" in the February 2005 issue of the Monthly Bulletin. For the results on the volatility of the overnight interest rate, see Box 2 "The volatility of the overnight interest rate from a medium-term perspective" in the March 2005 issue of the Monthly Bulletin.