THE EUROSYSTEM'S OPERATIONAL FRAMEWORK IN THE CONTEXT OF ITS MONETARY POLICY STRATEGY

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Abstract: *This paper discusses the implications of the Eurosystem's monetary policy strategy for its operational framework, in the context of the transmission mechanism of monetary policy in the euro area. The first part of the paper uses an analytical framework common to many recent monetary analyses to distinguish the operational and strategic elements of monetary policy making. The second part of the paper describes and discusses the choices made by the Eurosystem with regard to its monetary policy strategy and operational framework. In this respect, the paper highlights that the design of both these two aspects of the single monetary policy reflect in large part the need for policy makers to retain flexibility in the face of an uncertain environment.*

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E52 (Monetary policy: targets, instruments and effects);
E58 (Central banks and their policies).

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1. Introduction

This paper explores the inter-relationship between the Eurosystem's monetary policy strategy and the operational framework used to implement the single monetary policy. Part A of the paper develops a simple conceptual framework that can be applied quite generally to the policies of any central bank. Part B describes the choices made by the Eurosystem within this structure, including the economic rationale on which they are based.

The starting point of the paper is the familiar classification of variables as monetary policy objectives, indicators and instruments, which is presented in Section 2. This section emphasises the broad consensus that the appropriate objective of monetary policy is price stability. Using this terminology, Section 3 characterises the problem faced by monetary policy makers in a very general way. In essence, in an uncertain and dynamic environment, policy makers have to choose settings for the instruments of monetary policy which best serve the maintenance of price stability over the medium term. The structure of the paper reflects the sequence of issues which a central bank needs to address in the process of solving this very general problem.

As a first step, Section 3 attempts to distinguish the different roles played by the strategy and the operational framework within the solution of the overall monetary policy problem. Given the objective of price stability, the strategy outlines how the appropriate monetary stance is determined on the basis of developments in indicator variables. In contrast, the operational framework describes how to set and maintain the stance of policy selected by policy makers on the basis of the strategy, using the available policy instruments.

Choosing the variable which is deemed to describe the monetary policy stance is therefore key. It is natural to focus on a variable that plays an important role in the early part of the transmission of monetary policy to the price level. The choice is therefore based on a view of the transmission mechanism of monetary policy. Section 4 describes a very simple, stylised view of the transmission mechanism which places market interest rates at centre-stage. Given this view of the transmission mechanism, it is natural to identify market nominal interest rates as the variable which describes the monetary stance. Against this background, the operational framework should be designed so that policy makers can determine the level of market interest rates and contain their volatility, whereas the strategy should determine what level of market rates best serves the maintenance of price stability given the prevailing economic conditions.

Having chosen to emphasise the role of market interest rates, a central bank must decide on which maturity to focus. One important aspect of this choice is the trade off between, on the one hand, greater controllability (which would point to shorter maturities) and, on the other hand, the stability of the relationship between the chosen interest rate and the ultimate objective of monetary policy, namely developments in the price level (which would point towards longer maturities). In the context of a central bank's clearing and payment system responsibilities, another aspect of the choice of maturity is the special relationship between central bank actions and the overnight interest rate. Section 5 concludes that the key operational question is how to use central bank instruments – the price and quantity of the supply of liquidity – to manipulate the overnight interest rate, so as to influence short-term money market interest

rates at somewhat longer maturities (that are of greater relevance for monetary transmission to the price level). Section 6 outlines a variety of approaches to this problem in general terms, in the context of a "corridor model" of the overnight interest rate, while Section 7 discusses the pros and cons of various options within this flexible overall framework.

Part B of the paper describes the choices made by the European Central Bank (ECB) with respect to the issues raised within the very general framework outlined in Part A. Section 8 briefly describes the key features of the Eurosystem's monetary policy strategy. Section 9 discusses the key choices of the Eurosystem with regard to the introduction of a "corridor model" for the evolution of overnight interest rates. Notably, this section describes in detail the institutional features of the operational framework and presents a description and assessment of the implementation of monetary policy within this framework since the introduction of the euro in January 1999. Section 10 concludes.

Part A: THE CONCEPTUAL BACKGROUND

2. Monetary policy objectives, indicators and instruments

Following Friedman (1975, 1990) inter alia, this paper employs a classification of variables into monetary policy objectives, instruments and indicators.

2.1 The objective of monetary policy – price stability

A broad consensus has emerged over recent decades that the appropriate objective of monetary policy is the maintenance of price stability (e.g. Blinder, 1998). This consensus is built on the belief that both inflation and deflation are costly in terms of general economic welfare and performance.[1] It is typically argued that inflation introduces or exacerbates distortions in the real economy. High rates of inflation are usually associated with greater volatility of inflation and the price level. This volatility distorts the relative price signals upon which the market mechanism relies and raises the inflation risk premium in long-term real interest rates. Both phenomena may result in a misallocation of real resources and thereby prejudice economic growth.[2]

The institutional basis for the single monetary policy, described in the Treaty establishing the European Community, reflects these economic principles. First and foremost, the Treaty clarifies the objective of the single monetary policy and the Eurosystem. Article 105 of the Treaty states: "*The primary objective of the* [Eurosystem] *shall be to maintain price stability.*" The Treaty therefore establishes a clear hierarchy of objectives for the single monetary policy, with price stability unambiguously assigned overriding importance.

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1 Many studies have shown that inflation is harmful to economic growth, the general standard of living and economic welfare (e.g. Barro, 1996, 1997; Ghosh and Phillips, 1998).

2 High rates of inflation may also distort money holdings (Friedman, 1956) and exacerbate the distortions introduced into economic allocation by the dead-weight losses associated with tax and welfare systems (Feldstein, 1995). Unexpected inflation may also result in large and arbitrary re-distributions of wealth between creditors and debtors, inter alia. If such arbitrary redistribution is perceived to have violated property rights, social and political instability may come under threat, with adverse implications for the functioning of a market economy.

In order to guide inflation expectations and to provide a yardstick against which it can be held accountable, the Governing Council of the ECB has announced a quantitative definition of price stability. Price stability is defined "*as a year-on-year increase in the Harmonised Index of Consumer Price (HICP) for the euro area of below 2%*" (ECB, 1999). The Governing Council has also stated that price stability is to be maintained over the medium term. This definition therefore provides a quantification of the primary objective of the Eurosystem.

2.2 The instruments of monetary policy

Following Poole's (1970) classic article, monetary policy instruments are defined as those policy variables which the central bank can control "without error". Instruments can therefore "be set exactly for all practical purposes". Naturally, what constitute "practical purposes" is potentially open to considerable debate.

To satisfy Poole's definition, the monetary policy instrument must be either the price or the quantity of a component of the central bank's balance sheet, over which the central bank enjoys monopoly power. This means that the central bank controls either the monetary base (under one of several possible definitions) or a "dealing rate" at which the central bank trades in the market.[3] In practice, most major central banks use an interest rate at which they deal with the market as the main instrument of monetary policy. The reasons for this choice are discussed in Sections 4 and 5. In the case of the Eurosystem, the key instrument is the rate on the main refinancing operation, as described in Section 9.

2.3 Monetary policy indicators

Monetary policy indicators are variables that help policy makers fulfil the objectives of monetary policy by providing information relevant to the appropriate instrument setting. In principle, an "optimal" monetary policy will be based on a full information set. Since the price level is determined as the endogenous outcome of a complex inter-related economic system, every variable has the potential to affect the price level – even if only indirectly – and therefore may be relevant for the determination of monetary policy.

In the academic literature, monetary policy is often modelled as if it relied on a subset of key indicators, such as monetary aggregates (e.g. Issing, 1997) or composite indicators like inflation forecasts or estimates of the output gap (e.g. Svensson, 1997). However, policy regimes relying on such a subset of indicators are only able to replicate an "optimal" monetary policy under very restrictive assumptions. In general, an optimal policy will rely on all information and not react mechanically to the evolution of a single variable or forecast. This is reflected in the Eurosystem's monetary policy strategy, discussed in Section 8 below.

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[3] In the latter case, this dealing rate can be expressed as either an intertemporal price (i.e. an interest rate) or a price in terms of foreign currency (i.e. an exchange rate). However, using the exchange rate as an instrument ultimately depends on the availability of foreign exchange reserves. Recent experience (formalised in the self-fulfilling speculative attack models of Obstfeld (1994), inter alia) suggests that it is possible to exhaust foreign exchange reserves rapidly, thereby resulting in the exchange rate failing to pass the "for all practical purposes" criterion required by Poole's definition of a monetary policy instrument.

3. The monetary policy strategy and the operational framework

3.1 A stylised characterisation of the monetary policy problem

On the basis of the terminology developed above, Cecchetti (1998) characterises the problem facing monetary policy makers as an optimal control exercise. While recognising that this approach has a number of important drawbacks,[4] in the spirit of Blinder (1998) this paper uses this simple structure in order to address a number of key issues, albeit in a stylised way.

The optimal control problem is posed as follows. The central bank chooses how to manipulate a "control variable" (the instrument of monetary policy) in response to developments in "state variables" (monetary policy indicators). The central bank's choice is constrained by the structure of the economy, which describes how indicator variables (including policy objectives) evolve through time in response to policy actions and exogenous economic disturbances. In this context, optimal monetary policy is a mapping from developments in economic indicators to a setting for the policy instrument that, over time, minimises the central bank's expected loss (determined by a "loss function" that captures the objectives of monetary policy) (e.g. Rudebusch and Svensson, 1999).

One can characterise the distinction between the operational framework and the strategy within this highly stylised characterisation of monetary policy as follows. The strategy takes the choice of instrument as given and describes how the setting for this instrument is optimally determined on the basis of the current state of indicator variables. To design the operational framework, one simply solves the strategy problem for all possible policy instruments, and selects the instrument that has the smallest of all the minimised losses. In other words, the operational framework should be designed so that the overall minimum expected loss is obtained. This basic framework is common to both Poole's (1970) seminal analysis of the "instrument problem" and a large number of more recent papers on the implementation of monetary policy.

Although it may not offer much practical guidance for the design of the operational framework, the Poole (1970) model[5] demonstrates a key point, namely that the design of the operational framework should reflect the structure of the economy and, in particular, the joint distribution of shocks to it. However, the structure of the economy (including the distribution of shocks) is likely to change through time. Consequently, the appropriate operational framework will also need to evolve.[6] Therefore, it is important to introduce a dynamic – as well as a stochastic – dimension into the analysis of the monetary policy problem.

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4 For example, it assumes that the structure of the economy can be modelled in a fairly precise manner, thereby largely ignoring the important issue of model uncertainty.

5 To recall briefly, Poole (1970) demonstrates that, in the context of a stochastic version of the Hicksian IS-LM model, a "money stock rule" would be superior (in terms of stabilising output) to an "interest rate rule" whenever shocks of the LM curve are "small" relative to shocks of the IS curve. However, Poole did not identify the empirical counterparts to the notions of "money stock" and "interest rate" appearing in his model very clearly. Specifically, he largely ignored the distinction between instruments and closely related market-determined variables which do not satisfy the instrument definition (such as M1 or the overnight market interest rate).

6 Recent Japanese experience provides a prominent example. With economic recession and the threat of deflation, Japanese "official" short-term interest rates – the conventional policy instrument in most industrialised countries – have been reduced to historically very low levels. Indeed, they have essentially reached the zero lower bound on nominal interest rates. Consequently, Japanese monetary policy can no longer operate through a conventional "interest rate channel", but rather has to rely on "quantity effects", e.g. by expanding the monetary base in an attempt to stimulate credit expansion and spending. The operational framework has had to (and continues) to evolve accordingly (Nakahara, 1999). This notwithstanding, in the main text from Section 4 onwards we focus largely on interest rates.

The likelihood of structural changes to the economy would therefore argue in favour of retaining a high degree of flexibility in the design of the operational framework. As discussed in Section 9, flexibility is one characteristic of the Eurosystem's operational framework. One could envisage this flexibility as permitting the choice of instrument to be made each period, conditional on the state of the economy (i.e. the indicator variables). This would imply solving the "monetary policy problem" in a single step, ensuring a "global optimum" could be obtained.

3.2 Distinguishing the monetary policy strategy from the operational framework

The discussion presented in the last paragraph of Section 3.1 notwithstanding, in practice there does appear to be an important distinction between, on the one hand, a central bank's monetary policy strategy and, on the other hand, its operational framework.

Section 3.1 characterised how monetary policy responds to economic shocks, conditional on the prevailing economic environment, so as to maintain price stability over the medium term. The simplest way to characterise the practical distinction between the operational framework and the monetary policy strategy is to split this general problem into two parts, reflecting the relevant *horizon* and *type* of these economic disturbances. The role of the operational framework can be viewed as describing *how* to set the monetary policy stance using the available monetary policy instruments given short-term "technical" shocks to money market conditions, whereas the role of the strategy can be seen as describing, on the basis of information contained in monetary policy indicators, *what* monetary stance is required in response to macroeconomic shocks, so as to maintain price stability over the medium term.

It is illuminating to revisit Poole's work in this light. It is unclear how his notion of "shocks" should be interpreted. Therefore, it is uncertain whether his model is offering guidance regarding the strategy or the operational framework. One could argue that the shocks in Poole's model are macroeconomic disturbances (consistent with his IS / LM model), in which case Poole deals with strategic issues, and not with the design of the operational framework. Alternatively, one could argue that Poole is analysing more "technical" market related shocks (such as the "autonomous factors" affecting the liquidity situation – although, of course, these are not part of the IS / LM model he uses), in which case his model addresses operational issues. Poole's paper is silent on this distinction, but any practical implementation of his results requires the question to be addressed.

In contrast to Poole's analysis, this paper emphasises the distinction between the strategy and the operational framework. This distinction is made on the basis of a view of the transmission mechanism of monetary policy. Implicitly, monetary policy makers view the stance of monetary policy as being associated with (or measured by) a variable acting as starting point of the transmission mechanism. In the following, this variable will be referred to as the "trigger transmission variable". If the strategic or operational problem is not to become trivial, this trigger variable must be neither a policy instrument nor a policy objective.

A central bank's choice of the "trigger transmission variable", around which to divide the overall monetary policy problem into distinct operational and strategic questions, will naturally reflect its view of the transmission mechanism. A central bank that has a conventional "monetarist" view of monetary

transmission would typically choose a monetary aggregate as its trigger transmission variable, whereas a central bank that follows a "new neo-classical synthesis" interpretation of monetary transmission (e.g. Goodfriend and King, 1997) might choose an interest rate. Moreover, depending on how it wishes to communicate to the public and financial markets, a central bank may choose to identify the "trigger transmission variable" with varying degrees of precision.

4. The transmission mechanism of monetary policy

The identification of the variable acting as "trigger" requires a view of the transmission mechanism. Thus far, this has been viewed in very general terms, since the monetary policy problem has been outlined in a generic manner. However, the preceding discussion demonstrates that the design of both the operational framework and the monetary policy strategy are rooted in a specific view of the transmission mechanism.

This section presents a very stylised view of the transmission mechanism, which – broadly speaking – is common to central banks responsible for monetary policy in large, relatively closed currency areas. In the current context, the most significant feature of this view of the transmission mechanism is that interest rates, rather than the monetary base, play an important role in the early part of the transmission process. Monetary policy actions allow a central bank to exert significant influence over short-term nominal market interest rates. Through the expectations theory of the yield curve, these actions thereby influence the entire structure of nominal yields, although the degree of control is likely to diminish at longer maturities, as the influence of other factors – changes in inflation expectations, in anticipated real interest rates, in the potential growth rate of the economy, etc. – all come to play a relatively greater role.

By changing the structure of interest rates, monetary policy influences the economy, and ultimately the price level, in a number of ways. Prominent channels would include the following. First, to the extent that inflation expectations are reasonably stable, monetary policy can alter the structure of real yields and thereby intertemporal consumption trade-offs. This is likely to alter the pattern of private consumption and investment through time and so, by influencing the magnitude of demand pressures and thus the output gap, will affect the evolution of the price level. In this regard, longer-term rates are likely to be of greater importance, since these correspond more closely to the horizon of firm investment and household consumption decisions, and are therefore more likely to have an impact on aggregate spending. Second, changes in the yield structure will influence asset prices and thereby may have wealth effects on consumption and investment, which also affect demand pressures and inflation. Third, changes in interest rates will have distributional effects, e.g. an interest rate rise will tend to favour creditors at the expense of debtors. To the extent that creditors and debtors have different propensities to spend, such distributional effects may have important implications for aggregate demand and ultimately for price developments. Fourth, changes in interest rates will affect the evolution of monetary aggregates and, in consequence, liquidity conditions. To the extent that liquidity and spending are inter-related, this in turn may influence demand and the price level.

The emphasis placed on the role of nominal interest rates in this characterisation of the early stages of the transmission mechanism does not exclude other channels of monetary transmission, notably via the exchange rate or through a credit channel (Bernanke and Gertler, 1996). However, these additional channels

are either related to the interest rate (e.g. the evolution of the exchange rate will be determined in part by interest rate differentials between domestic and foreign currency denominated deposits) or are of comparatively small or diminishing magnitude.

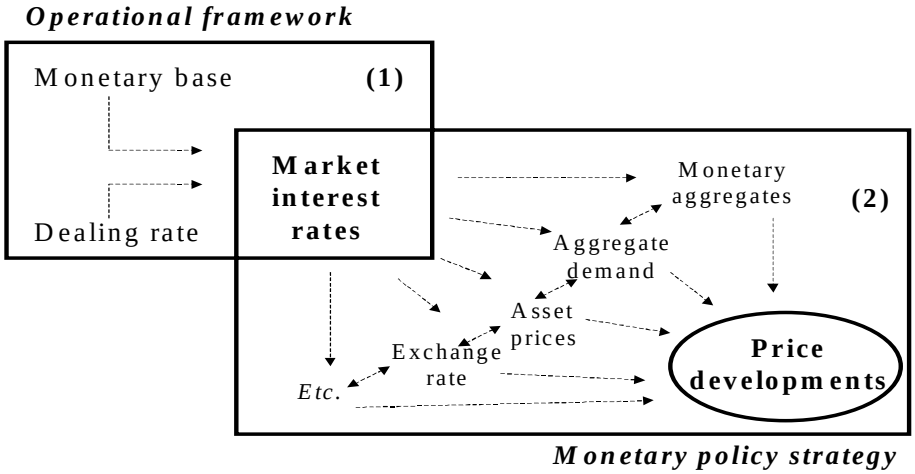
The emphasis placed on the structure of interest rates notwithstanding, this view of the transmission mechanism embraces Friedman's (1953) assertion – which is supported by a large body of theoretical and empirical literature (e.g. Lucas, 1995) – that "inflation is always and everywhere a monetary phenomenon". Analysis of the transmission mechanism must therefore incorporate an important role for money, based on the medium term relationship between money and the price level.

While liquidity effects on aggregate spending suggest money and credit aggregates may themselves constitute channels of monetary transmission, the main role for money is providing a nominal anchor for monetary policy over the medium term. At short horizons, the relationship between broad money and the price level is more complex, and potentially less stable, than over the medium term. Moreover, broad money is an endogenous variable – it is determined by the behaviour of money holders and the banking sector (i.e. respectively those demanding and supplying broad money), rather than by the central bank. Monetary policy will influence the evolution of broad monetary aggregates, but naturally cannot control it perfectly in the short term. Therefore, the important role of money is largely seen as being a very prominent indicator on which policy makers can draw in assessing the appropriate monetary stance. In particular, monetary developments are likely to be correlated with the underlying low frequency dynamics of the price level, and therefore may be an important indicator of price developments over the medium term.

This very stylised view of the transmission mechanism is shown in Chart 1 overleaf. Characterising the transmission mechanism in this way illustrates the distinction between the operational and strategic monetary policy problems outlined above. The monetary policy strategy is designed to select an appropriate level of market interest rates such that price stability is maintained. The evolution of market rates feeds through to the price level through a variety of transmission channels which work at different speeds and with different degrees of precision. In contrast, the operational framework is concerned with how to manipulate market interest rates using the instruments of monetary policy.

Market interest rates, rather than a narrow monetary aggregate such as M1, are characterised as the variable acting as starting point of the transmission mechanism in Chart 1. This is a reflection of the observation that each of the various channels of monetary transmission described in the chart is influenced substantially by the evolution of market interest rates. In contrast, the empirical evidence suggests that the connection between narrow monetary aggregates and macroeconomic developments, including the evolution of the price level (as captured, for example, by the stability of money demand equation) is less stable and / or predictable than the relationship between short-term market interest rates and the price level (reflected, for example, in macroeconomic models) (e.g. Goodhart, 1989). In other words, identifying M1 as the "trigger transmission variable" could introduce noise into the relationship between the stance of monetary policy capture by the evolution of M1 and the price level, thereby damaging the outlook for price stability. Given these problems, it is natural to focus more closely on market interest rates as the "trigger transmission variable".

Chart 1 Simple stylised description of the transmission mechanism of monetary policy



5. General issues in the design of the operational framework

5.1 A general view

The previous section concluded that, according to the dominant view, the variable which plays a relevant role in the early part of the transmission mechanism is a market interest rate. The task of this section is to explore how a central bank may steer the chosen market interest rate using the policy instruments at its disposal, i.e. it will deal more directly with the issue of the design of the operational framework.

It is probably useful to sketch the different steps which a central bank needs to take in order to accomplish this task. First, a central bank needs to decide which market interest rate should play the role of "trigger transmission variable". The ensuing analysis will conclude in favour of a short-term market nominal interest rate (for example, the rate on interbank deposits with a three-month maturity). Second, while the overnight interest rate is probably not the most suitable candidate as "trigger transmission variable", its pivotal role in the modus operandi of a central bank should nevertheless be recognised. Third, the central bank may decide to convey its preferences about the chosen short-term market interest rate by giving a special status to its dealing rate. Alternatively, it may use a "volume" expression such as, for example, the concept of non-borrowed reserves held by the banking system. Once more, the current consensus is in favour of the interest rate expression, this time likely for the sake of clarity of the communication policy.

In a nutshell, the problem of the operational framework can therefore be described, at least referring to the current mainstream view, in terms of the use on the part of the central bank of its dealing rate to steer the short-term market interest rate , via the overnight interest rate.

5.2 The choice of the "trigger" market interest rate

Many candidate market interest rates exist for the role of key starting variable for the transmission mechanism. For example, a spectrum of interest rate maturities exists and the central bank may choose, with varying degrees of precision, from this spectrum. The key issues in making this choice – familiar from

the literature on intermediate monetary targeting – are, on the one hand, *controllability* of the market interest rate and, on the other, the *stability* or predictability of its relationship with the ultimate objective of monetary policy, namely the price level.

For a given choice of interest rate maturity based on a certain view of the transmission mechanism, a trade-off may exist between controllability and stability. The shorter the maturity of the interest rate, the easier it may be to control using monetary policy instruments but potentially the less important it may be in influencing economic behaviour and therefore the less stable may be its relationship with the price level. In principle, when selecting an appropriate interest rate maturity on which to focus, the central bank should trade-off the cost of "control errors" – the deviations from price stability resulting from imperfect control of the market rate using monetary policy instruments – against the cost of "noisy transmission" – the deviations from price stability resulting from instability in the relationship between the price level and the key interest rate accounted for by economic shocks. Clearly, the former costs relate to the operational framework whereas the latter relate to the monetary policy strategy.

Given the choice of a specific interest rate maturity, one way to reduce control errors – and thus, other things equal, to improve the central bank's ability to stabilise the price level – would be to impose administrative controls of some form on the evolution of that interest rate. However, achieving greater control of the "trigger" interest rate through administrative controls is associated with a number of costs. First, by construction, the greater control the central bank exerts over the rate, the less it is determined by the operation of market forces. However, the general presumption is that the market is a more efficient mechanism for pricing and allocating resources than administrative controls, not least because the market makes more efficient use of information. This presumption underlies the benefits of relying on market-based methods of monetary policy implementation rather than direct administrative controls. This economic argument is reflected in the Treaty, which requires that the Eurosystem "*shall act in accordance with the principle of an open market economy with free competition*". Failure to respect this principle of market orientation may be prejudicial to economic performance, the effectiveness of monetary policy and therefore ultimately to the stability of the price level.

Second (and related), the greater the control exerted by the central bank over the "trigger" interest rates, the more developments in these variables will represent the actions of policy makers and, by implication, the less information they will contain about broader economic developments. One consequence of greater direct central bank control of "trigger" transmission variables is therefore that the indicator properties of these variables are diminished. As a result, policy makers may be less well informed about economic developments with implications for the outlook for price stability. In consequence, their determination of the monetary policy stance based on the strategy may suffer increasing "transmission noise" and ultimately raising the volatility of the price level. However, as discussed below, the evolution of short-term market interest rates largely reflects information on market expectations of policy actions, which is likely to be available from other sources (e.g. futures prices). Therefore, this consideration only applies with any force to longer-term maturities, which anyway are unlikely candidates to be the key variable for the reasons discussed in subsequent paragraphs.

Third, to the extent that a central bank exerts greater control over interest rates, it is likely that its operational capabilities will become less flexible. In particular, if the central bank attempts to control longer-term interest rates through operations at longer maturities, it will "freeze" a larger proportion of and / or lengthen its balance sheet. As was mentioned in Section 2, flexibility may be a key requirement for effective monetary policy implementation in an ever-changing economic environment. This is facilitated by focusing on shorter-term rates and dealing in shorter maturities, which allow greater flexibility in the management of the central bank balance sheet.

Finally, the central bank will need to manage its exposure to various forms of risk. Ultimately a central bank's ability to freely implement monetary policy so as to maintain price stability rests on its own solvency. Central banks must carefully manage their balance sheets in order to eliminate – to the extent possible – the risk they assume. This suggests dealing in securities of good standing with relatively short maturities, so as to limit counterparty and interest rate risks.

On balance, consideration of these arguments typically leads to the adoption of a short-term nominal money market interest rate as the variable acting as a starting point of the transmission mechanism. Short-term interest rates are sufficiently controllable by the central bank that they constitute an effective communication device and a convenient organising principle around which to organise the design of the operational and strategic frameworks. At the same time, short-term market rates exert an influence over macroeconomic developments – in particular, over the evolution of the price level over the medium term – and therefore constitute a natural starting point for the assessment of the appropriate monetary policy stance.

5.3 The role of the overnight interest rate, the smooth functioning of the payment system and the notion of a corridor

Because of the arguments just recalled, the overnight interest rate is hardly a plausible candidate for the role of "trigger transmission variable". In particular, because of its extremely short maturity and influence over a relatively narrow range of economic transactions, the overnight rate does not demonstrate the necessary effects on economic behaviour and the price level that are required of a key transmission variable.

This notwithstanding, it should be recognised that the overnight rate plays a pivotal role in the modus operandi of a central bank. For example, according to the expectation hypothesis of the term structure, any interest rate may be derived as an average of expected future overnight interest rates. The overnight interest rate is also the rate at which the payment system clears. Consequently, any financial transaction between two agents, irrespective of its nominal maturity, ultimately has an impact on the overnight interest rate. These simple considerations shed also light on the crucial link between the monetary policy and payment systems functions of a central bank. It would go far beyond the scope of this paper to analyse in detail the interrelations between these two functions. It may suffice to note here that in the case of the Eurosystem, the role of the payment system function is enshrined in Article 105 of the Treaty which includes among the basic tasks of the Eurosystem "*to promote the smooth operation of payment system*", next to the definition and implementation of the monetary policy (see Padoa-Schioppa (1999) for an overview of the historical links between the different central bank's functions).

The smooth functioning of the payments mechanism requires, inter alia, the existence of an equilibrium between the demand for and the supply of funds at the time the daily clearing procedure takes place. At the margin, this equilibrium is ensured through the conduct of monetary policy operations by the central bank. In a very simple setting the central bank could fulfil this function of marginal actor in the overnight money market by announcing its willingness to borrow and lend any amount of funds the commercial banks would require at a given interest rate. Clearly, in this extreme setting, the distinction between the policy instrument and the market rate would disappear and a proper overnight money market would not exist. Given the desirability of market–oriented implementation of monetary policy discussed briefly in Section 5.2, it is therefore customary for the central bank to operate its borrowing and lending activity at different rates, where the range defined by the lending and borrowing rates is referred to as the "central bank corridor".[7] The limits of this corridor may be formally announced, as is the case of the Eurosystem with the rates of its marginal lending and deposit facilities. Alternatively, the notion of a corridor may be less transparent if a central bank does not publicly announce the terms applied to the corridor (Goodhart (1995, p. 128) offers a description of the working of an unpublished corridor in the US). Finally, the central bank may renounce to withdraw the excess liquidity, in which case the floor of the corridor is the zero lower bound on nominal interest rates.

These different applications do not alter, however, the conceptual design of a central bank's corridor model, and, at the very heart, its functional relationship with the overnight market rate. Some simple algebra may help the presentation. The following notation is used: r^{OVN} is the overnight market interest rate; r^D is the lower limit of the corridor and D is the amount of funds the banking system invests (deposits) with the central bank at the rate r^D, while r^L is the upper limit of the corridor and L the corresponding amount.[8] As commercial banks operate in conditions of uncertainty (see Poole, 1968), in general they will not know in advance on which side of the market the central bank will eventually stand. In equilibrium, because of arbitrage considerations, the level of the overnight market interest rate ought to be equal to a weighted average of the rates r^L and r^D, with weights defined by the probability that, respectively, $D > 0$ and $L > 0$:

$$r^{OVN} = E(r^D) \times \text{prob}\,(D>0) + E(r^L) \times \text{prob}\,(L>0) \tag{1a}$$

$$r^{OVN} = E(r^D) + \text{prob}\,(L>0) \times [E(r^L) - E(r^D)] \tag{1b}$$

where E(x) is the mathematical expectation of variable x on the part of money market traders, and (1b) is derived by substituting prob(D>0) = 1 - prob(L>0) in (1a).[9] Result (1) can immediately be generalised to the case where an "effective" averaging mechanism is adopted.[10] In this case the expectation of the interest rates r^D and r^L is referred to the end of the reserve maintenance period, instead than the end of the business

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7 Often central banks conduct more than one type of monetary policy operations. For example, the Eurosystem provides liquidity on a regular basis through its regular main refinancing and longer-term refinancing operations, and, on request, through its marginal lending facility. In terms of the concept of the corridor, the relevant lending rate is always that of the monetary policy operation regulating the liquidity at the margin (in the case of the Eurosystem, the rate applied to the marginal lending facility).

8 The superscripts follow from the Deposit facility and the marginal Lending facility of the Eurosystem.

9 If, say, markets attribute a probability of 0.50 to the event that the central bank will eventually inject an amount $L > 0$ of liquidity at a rate r^L, the overnight market rate ought to lie at the mid-point of the corridor.

10 The averaging procedure is here understood as "effective" if the reserve requirements to which is applied exceed by a non-negligible amount the banks' working balances, and if the computation period (the reserve maintenance period) is relatively long. The first condition may be substituted by the application of the averaging procedure around the zero level, i.e. overdraft at the end of day is allowed.

day. Similarly, prob(L>0) and prob(D>0) refer to the probability that the central bank will, respectively, inject and withdraw liquidity in order to let the banking system square its requirements over the maintenance period.[11]

To complete this brief presentation of the so-called "model of the corridor", a central bank might consider to regulate the liquidity at the margin in a way that impinges directly on a maturity longer than overnight. This could be seen as a sensible approach because of the more direct link with the final objective of the central bank. In a simple example, the central bank could decide to stand ready to lend and borrow unlimited amounts of funds at, say, the three-month maturity. This, by itself, will lock the three-month nominal market rate at the level chosen by the central bank. However, a longer maturity also implies that the central bank freezes and / or lengthens its balance sheet and may take on more relevant risks (see the discussion in Section 5.2). Besides the higher credit risk assumed for funds transacted, the longer the maturity at which the central bank operates the "corridor", the bigger is the need for total outstanding credit granted by the central bank to the banking system for given net demand (this owes in turn to the day-to-day reversals of the liquidity needs of the banking system). Finally, only a corridor which is run at an overnight maturity is fully transparent from the point of view of the market assessing the costs associated with the clearing of the payment system.

5.4 The role of the central bank's dealing rate

In the sequence set out in Section 5.1, the third and last logical step a central bank needs to take is about the choice of whether it should express its rate preferences, if at all, by relying on its dealing rate or on a quantity expression. Note that the same conceptual problem would arise if – contrary to the current observed practice of central banks – an alternative "quantitative" approach is adopted, with a narrow monetary aggregate (e.g. M1) assigned the role of "trigger transmission variable" as might be justified by a "monetarist" view of the transmission mechanism. In that case as well, the central bank would need to decide whether to express its preferences about the chosen narrow monetary aggregate by relying on its dealing rate or on a quantity expression of its balance sheet.

The problem can thus be generalised in the following terms. It is appropriate for a central bank to think in terms of "matched pairs", e.g. its dealing rate and the short-term market rate, or, the commercial bank's deposits and M1? In fact, a central bank could also consider a "mixed couple", e.g. to announce a quantitative target for the level of commercial banks' deposits, while its aim is to achieve a certain level of the short-term market rate. In a deterministic world, this is a non-issue as a perfect equivalence exists between price and volume expressions of the central bank's balance sheet. However, in a stochastic world this may no longer be the case and, in concept, the central bank ought to choose the instrument to steer the money market interest rate depending on the relative size of the shocks of the demand for and supply of liquidity. In practice, the choice seems to depend on communication aspects. In light of the above discussion on the transmission mechanism and the role of interest rates, the argument is that is more direct

[11] In principle, whenever result (1) is not verified, there exists a profit opportunity which a money market trader could exploit until the wedge between the actual level of the overnight market interest rate and the level predicted by (1) is closed. From result (1) it also follows that the overnight market interest rate should follow a martingale within each reserve maintenance period. Although the available empirical evidence, at least for the US Federal funds market, tends to reject the martingale hypothesis (see Hamilton, 1996), result (1) can nevertheless be seen as a valid approximation in a fairly general presentation.

for a central bank to convey its preferences for the short-term market rates by emphasising the role of its dealing rate, rather than offering an indirect measure in terms, for example, of the preferred level of banks' reserves. It follows that, according to the above taxonomy, central banks tend to present their modus operandi in terms of "matched pairs".[12]

Hence, the previous conclusion that for most practical purposes the problem of the operational framework can today be described in terms of the use on the part of the central bank of its dealing rate to steer the short-term market interest rate identified as the "trigger variable" of the transmission mechanism, via the overnight interest rate.

6. Steering the overnight rate

When surveying the various methods adopted by central banks to steer the overnight rate – the action which lies at the heart of the operational framework – one is immediately struck by the number and diversity of approaches.[13] Perhaps, a fair description is that there exists a different operational framework for each central bank. In most cases, the operational framework is the result of a slow historical evolution, and examples such as the one of the Eurosystem where the central bank has been forced to plan from scratch their framework are more the exception than the rule. Any taxonomy of the operational framework models will call therefore for some flexibility, in the sense that each basic model will in fact encompass a number of different sub-models.

Without therefore claiming to offer an exhaustive list, we argue that the steering of the overnight rate can take place along three basic models: (A) a "target rate model", where the central bank takes on the commitment to maintain the overnight rate (on average or at any point in time) at the level of the announced target; (B) a "dealing rate model", where the central bank does not take on such commitment, but it conveys anyway its interest rate preferences by assigning a prominent role to the dealing rate applied to its key open market operation; and (C) the "open mouth approach model", where the central bank does not offer any firm indication of its interest rate preferences.[14]

The features of these three models can be assessed by means of result (1). To keep the presentation simple, we will assume that the rates applied by the central bank to the limits of the corridor depend in a functional way from the target / key dealing rate of the central bank, denoted r^{CB}. In most circumstances, the rate r^{CB} lies strictly within the limits of the corridor, albeit it might also coincide with one of the two limits. In the simplest approach, $r^L = r^{CB} + \Delta/2$ and $r^D = r^{CB} - \Delta/2$, where Δ is the width of the corridor (which is assumed to be known to market participants ex ante), so that result (1) can be rewritten as

$$r^{OVN} - r^{CB} = [E(r^{CB}) - r^{CB}] - \Delta/2 \times [1 - 2 \times \text{prob}\,(L>0)] \qquad (2)$$

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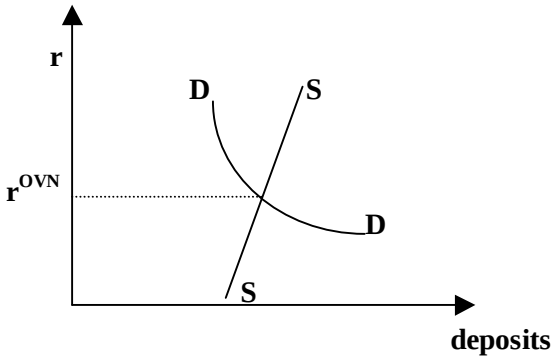
[12] In the internal decision-making process, the distinction between the roles of prices (dealing rates) and quantities (commercial banks' reserves) is often blurred, in the sense that central banks generally take their decision by looking at both price and quantity developments. This finding supports the view that the formal preference for "matched pairs" reflects mainly communication aspects. It is also in line with the Poole result that a mixed strategy is generally superior to any pure strategy in a stochastic world.

[13] The literature describing operational frameworks is quite vast. Two good recent surveys are Borio, 1997, and BIS, 1999.

[14] We drew the terminology used for this third approach by Guthrie and Wright (1999).

where the difference between the overnight interest rate and the running central bank key rate is expressed as the sum of an "expectation component" and of a "liquidity channel component" (respectively, the first and the second term of the right-hand side of (2)). To gain further insights, it may be useful to examine also a plot of the curves of demand (DD) for and supply (SS) of overnight funds in the interbank market for deposits held with the central bank (see Chart 2). The curve DD reflects the net demand for deposits from the banking system as a whole to meet its reserve obligations. This curve is subject to shifts with the changes of market rate expectations $E(r^{CB})$, while the slope of the curve depends on the distribution of the probability that the central bank will inject liquidity to let the banking system fulfil its obligations. Coming to the supply curve, its locus reflects the outstanding stock of credit granted by the central bank to the banking system as well as the net amount of the so-called "autonomous factors".[15]

Chart 2



Finally, before looking at the three models listed above in some more detail, the following additional considerations may be helpful. The day-to-day pattern of the overnight interest rate reflects to a great extent whether an effective averaging mechanism is in place or not.[16] This is because this mechanism reduces the impact of shocks to the autonomous factors and thus the shifts of the SS curve (it also makes the DD curve more elastic, i.e. flatter). Hence, the overnight interest rate will tend to be more stable, ceteris paribus. This holds irrespective of which model (A), (B) or (C) is applied. Pursuing this argument further, in principle the central bank may apply each of the three models with or without an effective averaging mechanism. Nonetheless, for reasons which will become clear shortly, the "dealing rate model" becomes a more viable option when an effective averaging mechanism is in place, while the opposite is probably true for the "target rate model" (no strong association can be established in a straightforward way for the "open mouth approach model"). In the following analysis, at least in a baseline scenario we will refer therefore to the combinations "dealing rate model / effective averaging mechanism" and "target rate model / no effective averaging mechanism".

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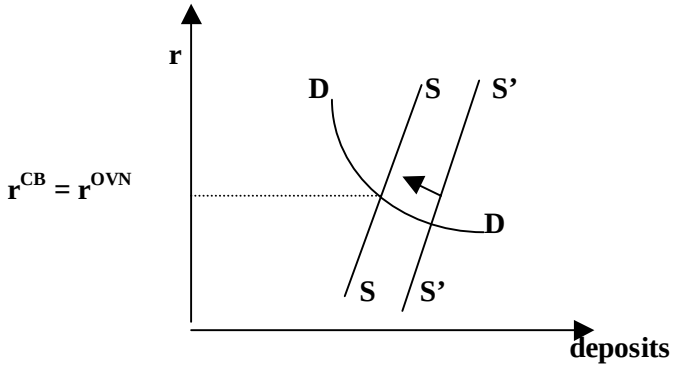
[15] If the overnight interest rate is defined as the rate which clears the payment system, this rate should be taken at the end of the business day. At that point in time, the aggregate supply of liquidity is no longer subject to interest-rate driven changes and the SS curve becomes vertical. In the course of the day, some autonomous factors may instead be interest rate sensitive (e.g. the government may shifts its funds out of the banking system to the central bank, or vice versa, depending on the level of the overnight market interest rate) and therefore the SS curve be positively sloped. With no loss of generality for the following analysis, the latter case was considered in Charts 2 to 4 since the available measures of the overnight market interest rate are generally referred to the point in time when the market activity is at its peak, i.e. in the course of the day.

[16] For a definition of "effective" in this context, see footnote 10. The issue is developed further in Sections 7.3 and 9.4.1 below.

Coming to the analysis of the three models, in model (A) the commitment binds the central bank to lend and borrow on request at the target rate. For example, the central bank may announce that $\Delta = 0$, so as to pin down the overnight market rate at the level of the (expected) target rate. In a looser and more frequent interpretation of this model, the commitment is understood to hold only on average, i.e. the central bank (implicitly) announces that prob(L>0)=0.50.[17] In other words, the central bank commits to offset those fluctuations of the liquidity provision which drives the level of the overnight interest rate away from the target rate (Chart 3 shows the case of a positive shock to the liquidity supply which shifts the SS curve to the right, and which is offset by a subsequent liquidity absorbing open market operation). In both cases, i.e. $\Delta = 0$ or prob(L>0)=0.50, the result is $r^{OVN} = E(r^{CB})$, and, if the commitment taken by the central bank is credible (i.e. $E(r^{CB}) = r^{CB}$), it follows $r^{OVN} = r^{CB}$.[18]

The stability of the overnight interest rate will, in turn, be reflected over the money market rates spanning a maturity corresponding to the residual duration of the commitment. This is why the "target rate model" represents a fairly direct way for the central bank to steer the money market interest rate(s) which is (are) deemed to be relevant in the early stages of the transmission mechanism.[19]

Chart 3



In model (B), the central bank does not take on any specific commitment about the level of the overnight interest rate. For example, if due to shocks to the so-called autonomous factors prob(L>0) drifts away from the mid-level of 0.50, the central bank may not intervene through open market operations to re-establish a "neutral" level of the liquidity supply. The central bank may even intentionally engineer a change of prob(L>0) to steer the overnight interest rate away from its key dealing rate. As regards the expectation

[17] The value of 0.50 reflects the assumption that r^{CB} lies at the mid-point of the corridor. In more general terms, the central bank will set prob(L>0) at the level which ensures $r^{OVN}=E(r^{CB})$.

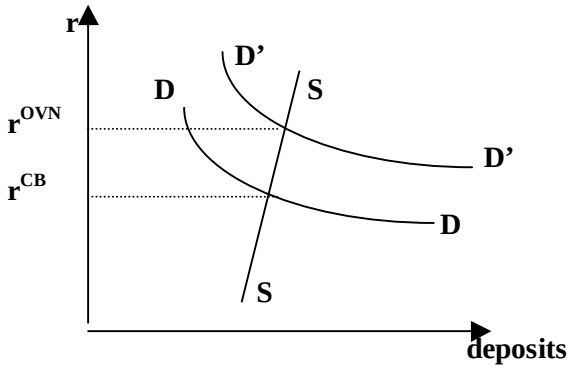
[18] If the target rate model is applied in the context of an effective averaging provision, the central bank ought to offset the impact of the expectation channel by means of an appropriate liquidity management policy to avoid breaches of its commitment. For example, if markets expect the central bank to increase its target rate in the course of the current reserve maintenance period, the central bank needs to ensure ample liquidity conditions. Alternatively, and possibly more effectively, the central bank may announce that it will review its interest rate target only at the beginning of each reserve maintenance period. In doing so, it clears any uncertainty on the level of the target rate prevailing at the end of that period.

[19] In practice, all major central banks review their monetary policy stance at least every quarter. It follows that even in the "target rate model", the three-month market rate, which is possibly the first rate relevant for the transmission mechanism, will fluctuate according to changes of market expectations of the future levels of the target rates.

channel, if markets expect the central bank change the level of its dealing rate in the course of the reserve maintenance period, the overnight interest rate will deviate from the running key dealing rate accordingly (see Chart 4 for an example of a upward shift of the DD curve reflecting market expectations of a rate increase).

At first glance, the "dealing rate model" may seem a less direct approach of implementing monetary policy, since the actual stance adopted by the central bank (here understood as the level of the overnight interest rate) may differ from the official one (the level of the running rate r^{CB}). However, if applied in a context where shifts of the SS curve are subdued (e.g. as a result of the averaging provision applied to non-negligible reserve requirements), the wedge between r^{OVN} and r^{CB} offers an immediate measure of market rate expectations. The central bank thus allows for a relevant role of market forces, and broadens its information set.[20] Conversely, in more ordinary circumstances where the market does not expect any change of the central bank interest rates in the short-term future, this wedge should be close to nil and model (A) and (B) would yield similar results.

Chart 4



Finally, in model (C) the central bank does not offer any firm indication of its interest rate preferences. This implies that the market expectation $E(r^{CB})$ could, in principle, fluctuate sizeably over time, and with it the market interest rates. The rationale underlying this model is that if the central bank is transparent enough as regards its reaction function and markets are efficient, market forces will bring short-term rates in line with the (undisclosed) central bank's preferences. Prima facie, it may not seem obvious why a central bank should renounce to one of its basic tasks, the signalling of its interest rate preferences, and in practice this model, at least in its strictest version, is only rarely applied. More frequent seems to be a milder version of this model, where the central bank communicates its rate preferences but only in an indirect way. For example, the central bank let the market set the dealing rate applied to its key open market operation, offered in the form of a variable-rate tender, but it provides anyway markets with some reference point (this may be the case, for example, of central banks which rely on the signalling power of their discount rates,

[20] If no effective averaging mechanism is in place, the time horizon of the expectation operator in (2) refers to the end of the business day, and will thus not include, in general, the time of next review of the monetary policy stance by the central bank. Since in that case $E(r^{CB})$ will not reflect market expectations about the result of that review, it follows that the application of model (B) in a context of no effective averaging mechanism brings no relevant information gains to the central bank.

although the discount window no longer has any direct operational importance). Besides the high degree of market orientation, a possible motivation for the use of model (C) is that this allows the central bank to transfer apparently to the market the responsibility for changes of short-term interest rates. In turn, this could put a central bank with relatively little independence in a better position to fend off external pressures on interest rate changes.

7. Further issues in the implementation of the monetary policy within the operational framework

7.1. The strength of the interest rate signal

The Concise Oxford Dictionary defines tactics as "*the plans and means adopted in carrying out a scheme or achieving some end*". In central banking, the choice of the strength of the interest rate signal (alternatively, base money signal) which is most appropriate in pursuing the final objective of price stability may therefore be viewed as an important tactical aspect.

A fairly strong signal on the part of the central bank would probably better convey the views of the central bank about the appropriate monetary policy stance, and thereby support these communication objectives. Notably, this could the case where the monetary policy strategies which lack other explicit references and the target rate would thus serve the scope of achieving some balance in the communication. In addition, it would provide an anchor to the money market, preventing undue volatility, which may blur communication. In some circumstances, however, a weaker signal may be preferable. This could be the case, for example, when the central bank has already expressed its preferences about an intermediate target. In that case, the strong interest rate signal could be perceived as introducing multiple objectives, which in the end might conflict and thereby harm the credibility and reputation of the central bank. Besides these more "fundamental" arguments, in certain occasions, the central bank may find it crucial to reduce any uncertainty in the market about its interest rate preferences. By contrast, a weaker signal may be preferable at times when the central banks wishes to test the market reaction in a fairly gradual way. The strength of the interest rate signal may thus need to be varied also to suit different economic circumstances.

It should be noted that in choosing the appropriate degree of strength of the interest rate signal, also legal or cultural constraints come into play. For example, if the central bank is not in the position of ensuring an effective averaging mechanism, e.g. because it is not able to prevent widespread circumvention of reserve requirements, the "dealing rate model" loses most of its appeal. Similarly, this could be the case when the central bank perceives the culture of its main financial place as very hostile to any non-negligible amount of minimum reserves.

Once the appropriate degree of strength of the interest rate signal has been decided, the central bank needs to tailor its monetary policy instruments accordingly. Probably, the strongest signal may be delivered by the announcement of an explicit interest rate target. Below it, one may rank the conduct of the key open market operation through a fixed rate tender in the context of the "dealing rate model". The signal becomes weak instead when the variable rate tender procedure is adopted and no target rate is announced. Even in that case, however, much depends on the use of the central bank of alternative means of communication. For example, official speeches could be just as explicit about the preferred monetary policy stance.

7.2 How many interest rate signals?

Central banks often have more than one "official rate" in their armoury of monetary policy instruments. This raises the issue of whether the central bank should use these official rates to offer separate monetary policy signals. For example, a central bank may have three official interest rates: a key rate within the corridor (identified by an operational target or a key dealing rate) and the rates defining the boundaries of the corridor. These rates could always be moved in a closely coordinated fashion so that the de facto they are perceived as one signal. However, a central bank could also choose to change the rates at different frequencies. For example, the rates defining the boundaries of the corridor could be changed at a relatively low frequency and thereby signal the medium-term orientation of the monetary policy stance, while the key rate within the corridor could be changed at a higher frequency and be assigned the role of short-term signal.

The choice of differentiating medium-term signals from short-term signals reveals the path of the monetary policy stance projected by the central bank. The issue could therefore be analysed in the context of the intense and ongoing debate about the appropriate degree of "interest rate smoothing" by the central bank. On the one hand, proponents of interest rate smoothing argue that it is the appropriate response to uncertainty about the nature of the monetary transmission mechanism, for the reasons identified by Brainard (1967). A cautious policy response to threats to price stability may be more appropriate when policy makers are uncertain about the implications of their actions for future price developments. On the other hand, proponents of an "activist" approach to interest rate setting argue that monetary policy should be preemptive and that interest rate changes should respond fully as soon as new information becomes available.

By employing a variety of interest rate signals, a central bank could attempt to balance these two factors, albeit at the risk of reducing the clarity of its interest rate signal. For example, while the corridor could be shifted quickly in response to new information as the "activist" line of argument would suggest, the main refinancing rate could be changed more gradually within the band to appropriately reflect the need for caution in the face of uncertainty. However, the debate about the appropriate amount of interest rate smoothing remains open.

7.3 What could be the role of minimum reserves?

In monetary textbooks, the motivation for the introduction of minimum reserves is based on four basic arguments. First, minimum reserves provide an "insurance" to banks' customers by ensuring that banks have a certain level of liquidity. Second, minimum reserves could help to improve the controllability of monetary aggregates. Third, minimum reserves may offer a secure and independent income to the central bank. Finally, minimum reserves may constitute a buffer of liquidity to absorb the day-to-day shocks of liquidity supply and thereby help to stabilise money market interest rates.

The first of these motivations is long since only a memory of the past. Prudential supervision and explicit deposit insurance has generally superseded this role.

The second motivation relates that minimum reserves may increase the interest rate elasticity of money demand and, on the supply side, may stabilize the money multiplier. By acting on both the demand for and the supply of money, minimum reserves may improve controllability. In fact, the mainstream view held today is critical about this approach also due to the lack of strong empirical evidence supporting it.

The importance of the third motivation very much reflects the institutional environment in which the central bank operates. The provision of the central bank with adequate own resources and/or seignorage from notes in circulation often provide sufficient income to ensure the fiscal, as well as institutional, independence of the central bank. In this context, deriving income from less than fully remunerated minimum reserves becomes a weak motivation for the existence of a minimum reserve system.

By default, the main motivation for implementation of a minimum reserve system must therefore be the fourth of those listed above. As was discussed in Sections 5 and 6, the application of an averaging provision to non-negligible reserve requirements contributes to the stabilisation of the short-term interest rates. This reduces in turn the need for the central bank to intervene frequently in the money market, and leaves therefore the task of the distribution of liquidity very much to market forces. It should also be emphasised that this motivation for the minimum reserve system – in contrast to the third and (more arguably) the second of those listed above – does not require that minimum reserves become a "tax" for the minimum reserves, i.e. the minimum reserve system may be applied at zero-cost to the banking system through a system of full remuneration. Hence, with the above qualifications, the use of minimum reserves may be perceived as highly market oriented.

Part B: THE CHOICES OF THE EUROSYSTEM

8. The Eurosystem's stability-oriented monetary policy strategy

The design of Eurosystem's monetary policy strategy can be illustrated on the basis of the discussion of the transmission mechanism presented in Section 4. Of course, it should be emphasised that understanding of the transmission mechanism is highly imperfect. This is always the case, but – because of the novelty of the single currency – it may be particularly important for the Eurosystem at the outset of Monetary Union. It is likely that economic behaviour will have been changed by the regime shift associated with the introduction of the euro and the related establishment of price stability throughout the euro area.[21]

As emphasised by Chart 1, this view of monetary transmission places short-term nominal interest rates at centre stage. The Eurosystem's strategy describes how the Governing Council selects a level of short-term interest rates that, in its judgement, best serves the maintenance of price stability according to the Eurosystem's published definition over the medium term.

In taking monetary policy decisions, the Governing Council relies on the information about the economic situation and the threats to price stability that is revealed by a thorough analysis of monetary, financial and other economic indicators. To impose some structure on this information and thereby allow it to be

[21] Estimates of the transmission mechanism based on aggregated national data prior to the implementation of Monetary Union are therefore suspect, although in the absence of other hard information they may provide some guidance relevant for policy makers.

understood and presented more clearly, these indicators are analysed and presented in the context of the strategy's two "pillars".

The first pillar assigns a prominent role to money, reflecting the fundamentally monetary origins of inflation over the medium to longer term. The prominent role of money has been signalled by the announcement of a reference value for the annual growth of a broad monetary aggregate, M3. The reference value has been derived so as to be consistent with, and serve the maintenance of, price stability.

The reference value has been derived by the Eurosystem in a manner that should lead sustained and / or prolonged deviations of M3 growth from the reference value normally to signal risks to price stability. However, the Eurosystem has argued that the single monetary policy will not react mechanically to such deviations (ECB, 1999). The ECB claims that interest rate decisions made are not geared towards controlling the evolution of M3 growth over relatively short horizons, as might be required by (an admittedly simplistic interpretation of) an intermediate monetary target. Rather the ECB intends to use the information revealed by (inter alia) monetary analysis in order to determine what is the appropriate interest rate level required to maintain price stability over the medium term. This description of the reference value implies, consistent with the views expressed by the ECB, that the Eurosystem should not be held accountable for the evolution of M3 in relation to the reference value at relatively short horizons or at a specific point in time (such as end-year). Rather, on this basis, it appears that the reference value should be viewed as a visible commitment on the part of the Eurosystem to explain its monetary analysis and the role this plays in policy decisions to the public. The reference value therefore imposes a discipline on the Eurosystem's communication and explanation of monetary policy decisions.

Consequently, from the perspective of the Eurosystem, it is crucial that the first pillar is not understood solely in terms of deviations of M3 growth from the reference value. Analysis under the first pillar extends to the components and counterparts of M3 and always takes place in the context of other indicators. The Eurosystem intends that this analysis will extract information contained in the monetary and credit data that is required by monetary policy makers to take decisions that serve the maintenance of price stability. The analysis thus naturally focuses on the information content of money regarding the outlook for price developments. The first pillar therefore represents a view of the world within which monetary developments determine the evolution of the price level over the medium term.

As discussed in Section 4, interest rate changes influence the demand for money and therefore the evolution of the monetary aggregates. Consequently, monetary growth is affected by changes in the monetary policy stance. Monetary developments may affect the evolution of the price level directly (e.g. through liquidity channels) or they may simply be a good indicator of price developments because of their association with other macroeconomic indicators. Consequently, the prominent role of money within the Eurosystem's strategy does not conflict with the view expressed in Sections 4 and 5 that short-term market interest rates should be seen as the key transmission variable that characterises the monetary policy stance.

The second pillar of the strategy is associated with a different and more eclectic view of the world, which implies that a wide range of indicators is of relevance for monetary policy. While inflation is a monetary phenomenon over the medium term, at shorter horizons it will be influenced by many other variables. Consistent with the view of the transmission mechanism outlined in Section 4, the Eurosystem's strategy

recognises that the monetary aggregates alone normally do not provide all the information required to take appropriate monetary policy decisions. Policy makers will generally need to tailor their actions to the prevailing economic circumstances, since the impact of monetary policy on the future evolution of the price level at any specific time will depend on a host of factors which are not adequately summarised by monetary data. Analysis under the second pillar is intended to reveal this information, giving policy makers greater insight into shorter-run price dynamics and their implications for monetary policy.

As illustrated in Chart 1, one of the most important indicators will be the evolution of aggregate demand in relation to the productive potential of the economy. The components of GDP and estimates of the output gap are therefore prominent indicators within the second pillar. By the same token, asset prices, through their impact on wealth and financial conditions, will also affect consumption and investment decisions and ultimately the evolution of the price level. Moreover, the evolution of asset prices can offer insights into the private expectations about future price and macroeconomic developments. Therefore also need to be carefully assessed within the second pillar.

Within the analysis undertaken as part of the second pillar, the Eurosystem produces its own assessment of the economic outlook, including forecasts for price developments. However, it should be emphasised that these inflation forecasts do not comprehensively summarise all the information required to take monetary policy decisions. This represents an important difference from a direct inflation targeting strategy, where a published inflation forecast is typically assigned this encompassing role. The Eurosystem's forecast can be viewed as an analytical tool which helps to organise the underlying economic data and reveal its implications for monetary policy in the context of the eclectic second pillar view of the world. The strategy does not imply a mechanical response of monetary policy to developments in the forecast in relation to an inflation objective.

It is also important to recognise that the strategy does not embody an exchange rate target. Attempting to maintain such a target may, on occasion, lead to conflicts with the primary objective of price stability, particularly in a large, relatively closed economy such as the euro area. In the context of the Eurosystem' strategy, the euro exchange rate should be seen as the outcome of macroeconomic policies and developments, and expectations of these policies and developments, in the euro area and elsewhere. That is not to say that policy makers ignore exchange rate developments. On the contrary, the euro exchange rate is one of the more important indicators under the second pillar of the strategy and influences monetary policy decisions to the extent that it has implications for the outlook for price stability over the medium term.

Against this background, the strategy has a number of broad implications for the operational framework. First, the operational framework should allow policy makers to influence rather closely the level of short-term market interest rates and contain their volatility. This is consistent with the conclusions of Part A. Second, although the Eurosystem assigns money a prominent role, its strategy does not incorporate an intermediate monetary target. Consequently, the short-term controllability of monetary aggregates – a central concern for the operational framework of a central bank pursuing an intermediate monetary targeting strategy – is not crucial for the Eurosystem. Third, in the absence of an exchange rate target, the operational framework does not need to be geared towards managing daily developments in the foreign exchange market. Fourth, and perhaps most importantly, the absence of mechanical responses to indicator

variables implies that the Eurosystem's strategy is neither simple nor simplistic. As experience in Monetary Union since January 1999 has demonstrated, this honest approach to the presentation of policy decisions places a premium on effective and open communication. In this respect, it is particularly important that implementation of monetary policy within the operational framework offers clear signals about the monetary stance to the public and financial markets.

9. Designing the operational framework

9.1 Introduction

In this section, we describe the features of the Eurosystem's operational framework in terms of the basic design outlined in Sections 5 and 6. Such a description requires a number of basic questions to be addressed: How are the boundaries of the interest rate corridor defined? What is the key dealing rate? How are interest rates steered within the corridor?

Before answering these questions, a number of other constraints on the design of the operational framework should be mentioned. The discussion and preparation of the operational framework followed the theoretical background presented in the earlier sections of this paper. However, it should also be recognised that the final decisions were also influenced by the actual practices pursued by national central banks (NCBs) prior to Monetary Union. Moreover, the Treaty added another important condition to the design of the operational framework, namely the need for a high degree of decentralisation.

Against this background, a number of functions and general guiding principles were agreed upon for the design of the operational framework. Several of these principles derive from the strategic considerations summarised at the end of Section 8. For example, the operational framework was designed to signal clearly monetary policy intentions through steering (and containing the volatility of) money market interest rates. Other principles reflected more technical issues and concerns, e.g. providing basic refinancing, absorbing liquidity and influencing the structural liquidity position vis-à-vis the central bank, all of which are relevant of the control of market rates.

In addition of these two broad sets of functions, which may be subsumed under the heading "operational efficiency", the framework is expected to be consistent with the guiding principles of conformity with market principles (reflecting the argumentation in Section 5.2), equal treatment of counterparties, decentralisation, harmonisation, simplicity and transparency, continuity with the practices of NCBs in the euro area prior to Monetary Union, and cost efficiency (see EMI, 1997). However, whenever conflicts between these principles arise, operational efficiency has always been given overriding importance. These principles were reflected in the design of the Eurosystem's operational framework, as described in ECB (1998) (henceforth, the "General Documentation").

9.2 What defines the boundaries of the interest rate corridor?

As discussed in Section 6, all central banks have an implicit or explicit corridor for the market overnight interest rate which defines when they intervene to supply or withdraw liquidity from the market. In the case of the Eurosystem, the boundaries of this corridor are defined very transparently and explicitly by the rates applied to the marginal lending and deposit facilities. The goals of the standing facilities are defined in the

General Documentation as follows (page 5): *"Standing facilities aim to provide and absorb overnight liquidity, signal the general stance of monetary policy and bound overnight market interest rates"*.

On the basis of the experience gained since January 1999, the last of the three goals may be considered as being fulfilled, since average overnight interbank deposit rates have always been well within the corridor (see Chart 5). A similar remark can be put forward also for the first of the three goals, by looking in particular at the role played by the standing facilities in absorbing liquidity imbalances towards the end of reserve maintenance periods. Less straightforward is instead the assessment of the rates of the standing facilities as a monetary policy signal. Except early 1999, changes of these rates have followed suit the changes of the main refinancing rate. For this reason, they have not normally been perceived as an independent signal. However, nothing impedes the Eurosystem from switching to a stance where the standing facility rates are moved in an independent way, and thus acquire a specific signalling content.

Looking in more detail at the functions of provision and absorption of liquidity, Chart 6 shows the recourse to standing facilities in the 14 maintenance periods running from 1 January 1999 to 23 March 2000. Excluding the first maintenance period, counterparties' average daily accumulated recourse to the deposit facility was EUR 0.6 billion, as opposed to EUR 0.5 billion for the marginal lending facility. However, if only the last days of each reserve maintenance period are considered, a clear difference in the recourse to the two facilities appears, with average daily recourse to the marginal lending facility of EUR 0.8 billion and a concentration of the average daily recourse to the deposit facility by an amount of EUR 4.0 billion. These figures show that during the reserve maintenance periods the recourse to the standing facilities is subdued, signalling a smooth functioning of the money market and an efficient management by counterparties of their liquidity positions. The higher and more differentiated levels of recourse towards the reserve maintenance periods are a reflection instead of the liquidity management policy adopted by the Eurosystem, which, on the whole, has been geared so far towards a provision of relatively ample liquidity conditions.

9.3 What operation offers the main signal of the Eurosystem's monetary policy stance within the corridor?

The Eurosystem conducts main refinancing operations and longer-term refinancing operations.[22] As is stated in the General Documentation (page 14), the main refinancing operations play "*a pivotal role in pursuing the aims of steering interest rates and signalling the stance of the monetary policy*". In contrast, in the longer-term refinancing operations "*the ESCB does not, as a rule, intend to send signals to the market and therefore normally acts as a rate taker. In order for the ESCB to act as a rate taker, longer-term refinancing operations are usually executed in the form of variable rate tenders*". Consequently, the main signal of the monetary policy stance is offered in the former type of operations which, thus far, have been always conducted through fixed rate tenders, while a variable rate tender procedure with pre-announcement of the allotment ration has so far been adopted for the latter type of operations (see Chart 7). These assignments have been perceived as consistent with the relative role played by each refinancing operation

[22] The design of the operational framework also makes provision for structural transactions. According to the General Documentation (page 15), *"(t)he ESCB may execute structural operations … aimed at adjusting the structural position of the ESCB vis-à-vis the financial sector"*. So far the euro money market has experienced a structural liquidity deficit, additionally ensured by the reserve requirement system, which has made it unnecessary to consider these types of transactions.

and the relative merits of each tender procedure, together with the overriding aim of defining a clear signalling of the monetary policy stance at the outset of Stage Three.

There is a broad consensus that the use of fixed rate tender procedures is a convenient form of signalling the stance of the single monetary policy. This has been particularly important at the start of Stage Three, given the process of convergence of short-term interest rates which took place in the period beforehand and the diversity of instruments and procedures used by NCBs prior to Monetary Union.

The weekly frequency of the main open market operations has also proved adequate. This assessment is again borne out by the smooth and stable conditions of the observed euro money market and the virtual lack of need for any fine-tuning operation so far (see below).

Longer-term refinancing operations have been used, as envisaged in the General Documentation (page 14), with the aim of representing "*only a limited part of the global refinancing volume*". From the experience gained so far, it is possible to conclude that this type of operation has not blurred the signalling function of the main refinancing operation, as the existence of two different terms of intervention in the money market yield curve might have potentially implied. It seems, in fact, that market participants have not derived any policy implication from the longer-term refinancing rates. Some evidence of this is presented in Table 1 where these rates are compared with the three-month EURIBOR rate on the days around the allotment day. There is a positive spread between the unsecured transaction referred to by the three-month EURIBOR and the three-month secured transaction with the Eurosystem, which is consistent with the differences between the two types of financial transactions. Moreover, the spread on the days before and after the execution of the operation is fairly stable. This suggests that EURIBOR rates are little affected by the result of the tender on the following day.

9.4 Implications of the framework for the developments of the overnight rate within the corridor

As discussed in Section 6, developments in the overnight rate within the corridor defined by the standing facilities are determined, in part, by various aspects of the design of the operational framework. Two aspects are particularly noteworthy. First, the design of the minimum reserve system. Second, the magnitude and frequency of so-called fine tuning operations.

9.4.1 The minimum reserve system

According to the General Documentation (page 52), the Eurosystem's minimum reserve requirements *"primarily* pursue[s] *the following monetary functions: First, stabilisation of money market interest rates. The averaging provision of the ESCB's minimum reserve system aims to contribute to the stabilisation of money market interest rates by giving institutions an incentive to smooth the effects of temporary liquidity fluctuations. Second, Creation or enlargement of a structural liquidity shortage. The ESCB's minimum reserve system contributes to creating or enlarging a structural liquidity shortage. This may be helpful in order to improve the ability of the ESCB to operate efficiently as a supplier of liquidity."*

The definition of the minimum reserve system was, therefore, driven by these two policy goals. The following may be considered the most relevant aspects in the definition of the reserve requirement system: the reserve ratio, the definition of the reserve base, the existence of averaging provisions, the remuneration

of required reserves, the length of the reserve maintenance period and the lag between the date of determination of the reserve base and the starting date of the reserve maintenance period.

The level of minimum reserve requirements plays a crucial role in the achievement of both functions. The creation or enlargement of a structural liquidity shortage is determined by the level of reserve requirements, while the stabilisation of money market interest rates requires that the level of reserve requirements is significantly above the working balances necessary for payment systems purposes.

The reserve ratio of 2%, together with a broad definition of the reserve base, has yielded an amount of required reserves in the order of EUR 100-110 billion so far. The creation or enlargement of the liquidity shortage may be easily quantified by comparing the amount of reserve requirements with the total liquidity needs of the banking system: normally more than half of the total outstanding amount of regular open market operations may be attributed to required reserves.

The averaging provision mechanism may also be considered a crucial factor, not only in the definition of the Eurosystem's reserve requirement system but also within the monetary policy framework as a whole. On the basis of the experience since January 1999, its contribution to maintaining smooth money market conditions may be assessed as very positive. The best proof thereof is the low volatility experienced by overnight interest rates and the virtual absence of fine-tuning operations. However, the averaging mechanism and its related inter-temporal arbitrage incentives are phased out at the end of the reserve maintenance period, when credit institutions can no longer defer the fulfilment of their reserve requirements. On these days, money market conditions and overnight interest rates are driven mainly by the difference between the actual excess of reserves in the market and the demand for excess reserves by credit institutions (see Chart 8).

Other aspects of the minimum reserve requirements definition which may have contributed to the smooth functioning of the averaging provision mechanism are the length of the maintenance period (one month) and the lag between the determination of the reserve base and the beginning of the maintenance period (23 calendar days). The relatively long maintenance period was of prime importance in order to allow for strategic inter-temporal arbitrage on the part of credit institutions and therefore for the market to "self-correct" disturbances in money market conditions. Moreover, the long lag between the determination of the reserve base and the beginning of the reserve maintenance period has allowed both individual credit institutions and the Eurosystem to know the required reserves at an early stage during the reserve maintenance period and has therefore contributed to improving the planning of the treasury management by the former and the supply of liquidity by the latter.

9.4.2 Fine tuning operations

Referring once more to the General Documentation (page 15), the scope of fine tuning operations is "*to manage the liquidity situation in the market and to steer interest rates, in particular in order to smooth the effects on interest rates caused by unexpected liquidity fluctuations*". Although "unexpected liquidity fluctuations" did occur at times, the working of the averaging mechanism largely absorbed their impact on short-term interest rates. For this reason, the ECB generally deemed not necessary to intervene in the market through fine-tuning operations. One operation of this type was carried out, however, on 5 January

2000 replacing a cancelled main refinancing operation in order to reabsorb some excess liquidity which the Eurosystem had purposely injected in the run up to the century date change to assuage potential market fears.

9.5 Other issues in the design of the operational framework

The preceding sections have outlined the main features of the corridor model. A number of other important features of the design of the operational framework also need to be mentioned for completeness, in particular, the eligibility of counterparties for participation in the Eurosystem's operations and the eligibility of assets for use as collateral.

A significant aspect in the functioning of the regular open market operations is the participation of eligible counterparties. The eligibility criteria were defined, according to the General Documentation (page 10) *"with a view to giving a broad range of institutions access to ESCB monetary policy operations, enhancing equal treatment of institutions across the euro area and ensuring that counterparties fulfil certain operational and prudential requirements*". The main eligibility criteria which institutions must fulfil are that they should be subject to the Eurosystem's minimum reserve system, be financially sound and, by means of contractual or regulatory arrangements, be compliant with the operational criteria specified by the NCBs. The criteria relating to the fulfilment of reserve requirements and financial soundness imply, in practice, that the group of potential counterparties basically coincides with the group of credit institutions[23].

The Eurosystem's lists of eligible assets which are accepted as collateral for monetary policy operations is also relatively broad. This can be seen as an important benefit in view of the needs to collateralise both intraday and monetary policy operations with these assets. The downside of these broad lists is that the range of eligible assets is rather diverse.

In the General Documentation, the following is stated (page 39): *"(i)t is recognised that the harmonisation of eligibility criteria throughout the euro area would contribute to ensuring equal treatment and operational efficiency. At the same time, due attention has to be paid to existing differences in the financial structure across Member States"*.

In this respect, it may be worth recalling that the risk control measures applied by the Eurosystem aim at protecting it "*against the risk of financial loss if underlying assets have to be realised owing to the default of a counterparty"* (General Documentation, page 44) (in line with the discussion in Section 5.2). In general, the risk control measures applied are defined to prevent only interest rate risks. In addition, some ad hoc special haircuts are applied to equities and non-marketable assets. But no consistent methodology for the calculation of haircuts has yet been set up to cater for differences in the credit quality of the issuer and, particularly, differences in the degree of marketability or liquidity of the assets, from which derive the potential differences in the opportunity cost of collateral. A reason which prevented a more systematic treatment of this problem was the need to avoid cumbersome procedures for valuing eligible assets.

[23] The total number of institutions subject to reserve requirements as at 29 February 2000 was 7,868. Of these institutions, only 2,533 fulfilled the requirements necessary for participating directly in monetary policy operations. Finally, the level of actual participation in the regular operations is even lower: normally below 1,000 for the main refinancing operations and ranging between 200 to 500 for the longer-term refinancing operations.

10. Concluding remarks

In the light of the uncertainties about the transmission of monetary policy following the introduction of the euro, it was desirable that the design of the operational framework allowed for flexibility. Indeed, all three basic models described in Section 6 can easily be accommodated within the framework designed for the Eurosystem's operations (as described in the General Documentation). Consequently, implementing monetary policy within the Eurosystem's framework requires choices to be made.

Since the outset of Monetary Union the Eurosystem has offered its key main refinancing operations in the form of fixed-rate tenders, without however giving to the applied rate the role of "target rate". Consequently, in terms of the taxonomy presented in Section 6, the current procedure adopted by the Eurosystem should be classified under the "dealing rate model". The Eurosystem may, however, also start offering the main refinancing operation in the form of variable-rate tender, with no explicit interest rate announcements as in the form of a minimum or maximum accepted interest rate. In those circumstances, one would classify the Eurosystem as much closer to the "open mouth approach". By the same token, nothing impedes the Eurosystem from announcing an interest rate target, while conducting the open market operations at prevailing market conditions through variable-rate tenders.

It follows that the Eurosystem is endowed with considerable flexibility as regards operational framework. This flexibility calls however for internal consistency among the choices made with regard to the various parameters, such as the type of auction adopted at its main refinancing operations, the decision of whether to announce an interest rate target or not, the size of reserve requirements (by varying within certain limits the reserve ratios and / or the reserve base). For example, in order to become a viable option, a "dealing rate model" not only requires a fixed-rate tender, but also the possibility to enforce an effective averaging provision through, in the case of the Eurosystem, non-negligible reserve requirements. By contrast the "target rate model" can more easily be implemented with no or close to zero reserve requirements.

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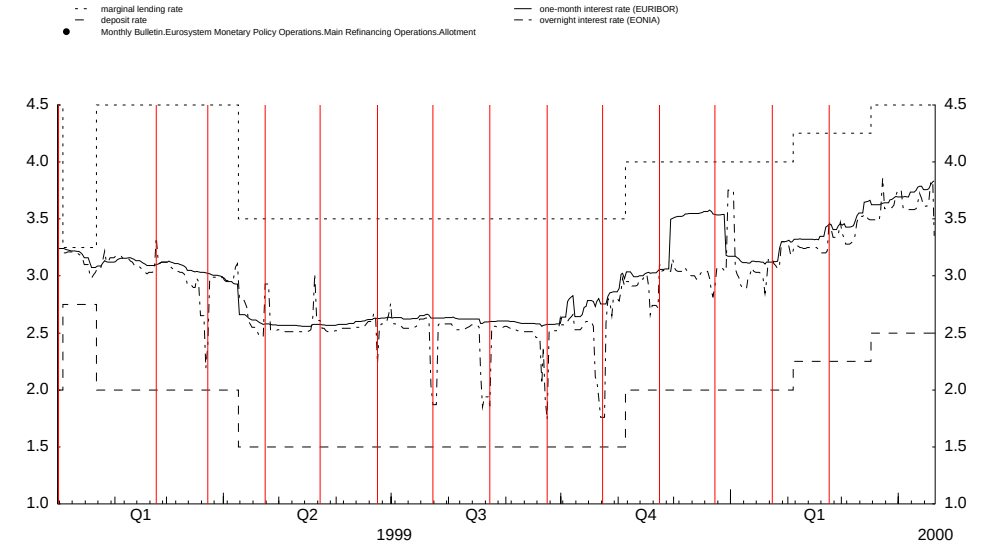
Table 1 Long term refinancing operation rates and 3-month market rates

	LTRO Rates			Spread with appropriate money market rates (a)		
Day of LTRO allotment	marginal	average	Running for […] days	Euribor t-1	Euribor t	Euribor t+1
1999						
13 Jan.	3.13	.	42	.	.	.
13 Jan.	3.10	.	70	.	.	.
13 Jan.	3.08	.	105	0.11	0.10	0.08
24 Feb.	3.04	.	91	0.04	0.04	0.05
24 Mar.	2.96	2.97	98	0.05	0.04	0.03
28 Apr.	2.53	2.54	91	0.05	0.05	0.05
26 May.	2.53	2.54	91	0.04	0.04	0.04
30 Jun.	2.63	2.64	91	0.03	0.03	0.01
28 Jul.	2.65	2.66	91	0.02	0.02	0.03
25 Aug.	2.65	2.66	91	0.03	0.03	0.03
29 Sep.	2.66	2.67	84	0.03	0.41	0.42
27 Oct.	3.19	3.42	91	0.06	0.08	0.08
24 Nov.	3.18	3.27	98	0.18	0.18	0.17
30 Dec.	3.26	3.29	98	0.06	0.05	0.05
2000						
26 Jan.	3.28	3.30	91	0.02	0.03	0.13
01 Mar.	3.60	3.61	91	0.02	0.02	0.03

(a) The difference between the 3-month Euribor rate and the weighted average rate on Long Term refinancing operations (except 13 January and 24 February where the spread is calculated using the marginal rate).

Chart 5 ECB interest rates and money market rates

(percentages per annum; daily data)



Source: ECB and Reuters.
Note: Vertical lines indicate the end of a maintenance period.

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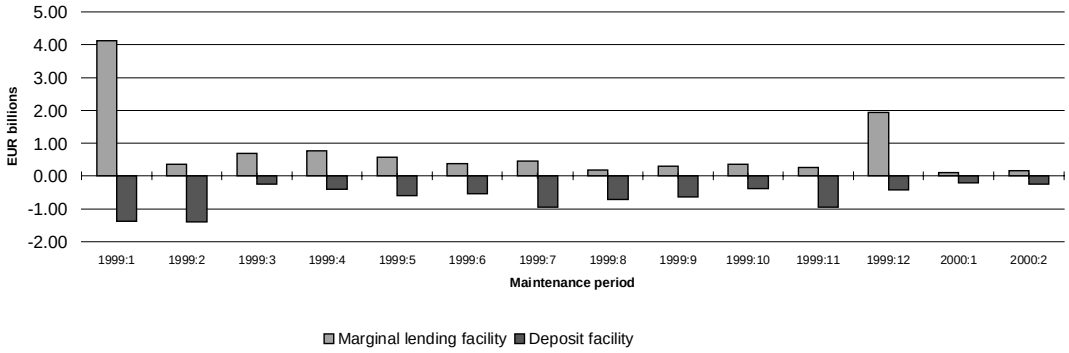
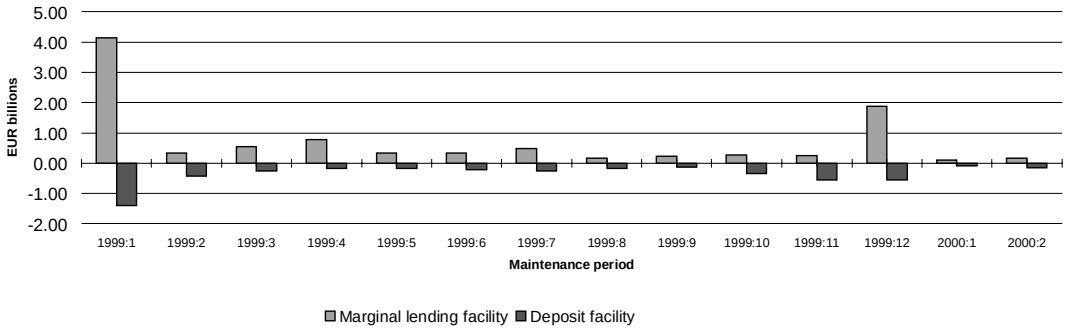
Chart 6 **Recourse to the marginal lending and deposit facility**

(averages of periods as described in each chart's title)

A. Covering the whole of each maintenance period



B. Covering from the first day of each maintenance period until the Tuesday before the last Wednesday



C. Covering from the last Wednesday until the end of each maintenance period

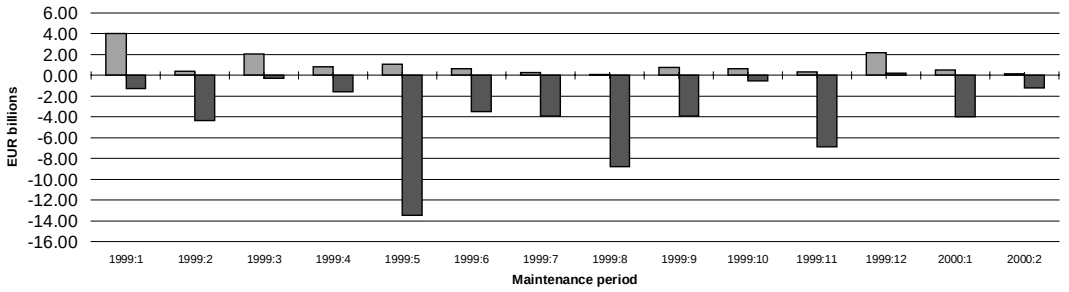
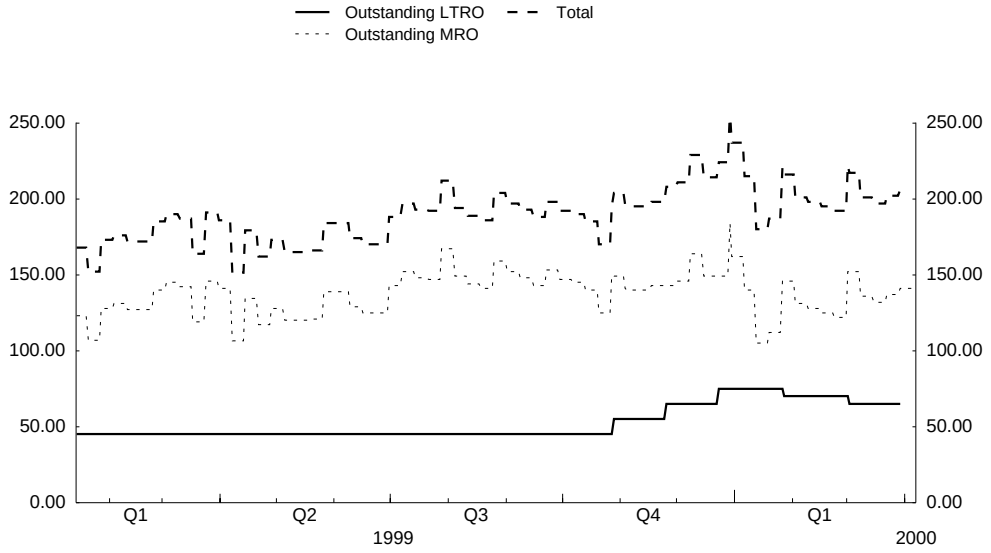


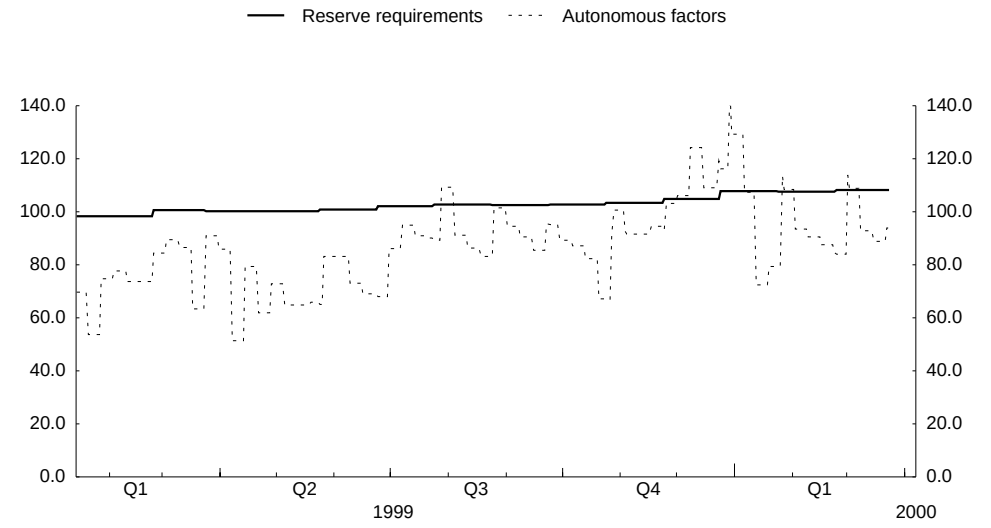
Chart 7

(a) Volume of Main and Long-term refinancing operations



Source: ECB.

(b) Required reserves and autonomous factors



Source: ECB.

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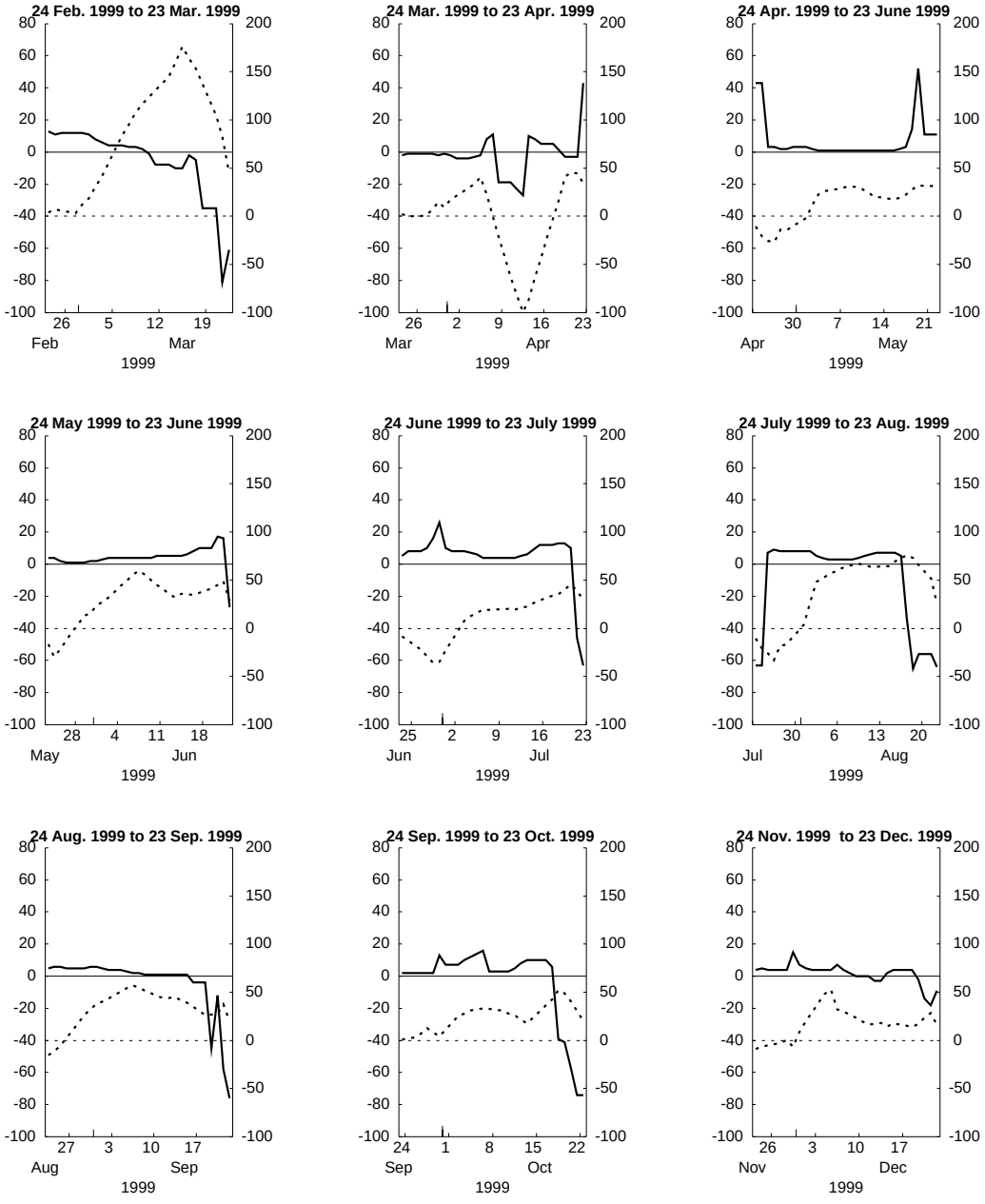
Chart 8 Liquidity policy, Reserve requirements and EONIA rates.

1999

Left-hand axis (solid line): spread between the EONIA and ECB tender rate (in basis points).
Right-hand axis (dotted line): average daily reserve surplus (in EUR billion). a)



Source:ECB.
a) Average daily reserves are adjusted for reserves held by banks with ECB for reasons related to target payment systems.
b) The average observations for each ordinal day of the maintenance period.

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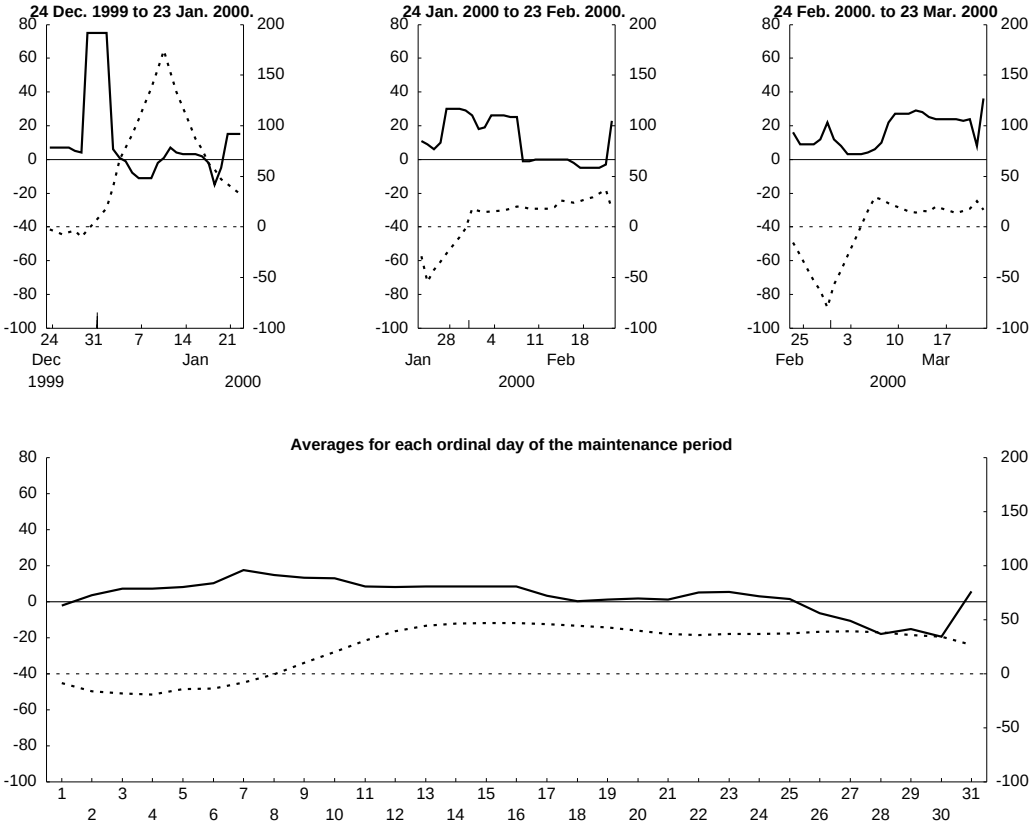
Chart 8 continued

Liquidity policy, Reserve requirements and EONIA rates.

1999

Left-hand axis (solid line): spread between the EONIA and ECB tender rate (in basis points).
Right-hand axis (dotted line): average daily reserve surplus (in EUR billion). a)



Source:ECB.
a) Average daily reserves are adjusted for reserves held by banks with ECB for reasons related to target payment systems.
b) The average observations for each ordinal day of the maintenance period.

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