



EUROPEAN CENTRAL BANK

EUROSYSTEM

**WORKING PAPER SERIES**

**NO 742 / MARCH 2007**

**THE EUROSISTEM,  
THE US FEDERAL RESERVE  
AND THE BANK OF JAPAN**

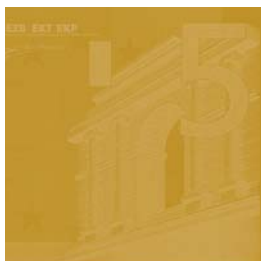
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# THE EUROSYSTEM, THE US FEDERAL RESERVE AND THE BANK OF JAPAN

## SIMILARITIES AND DIFFERENCES <sup>1</sup>

by Dieter Gerdesmeier,<sup>2</sup>  
Francesco Paolo Mongelli<sup>3</sup>  
and Barbara Roffia<sup>4</sup>



In 2007 all ECB publications feature a motif taken from the €20 banknote.

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<sup>2</sup> Principal Economist in the Directorate Monetary Policy of the European Central Bank and Honorary Professor at the Frankfurt School of Finance & Management (Germany). Correspondence: European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany. E-mail: [dieter.gerdesmeier@ecb.int](mailto:dieter.gerdesmeier@ecb.int); tel: +49-69-13447928; fax: +49-69-13445757.

<sup>3</sup> Senior Adviser in the Directorate Monetary Policy of the European Central Bank. Correspondence: European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany. E-mail: [francesco.mongelli@ecb.int](mailto:francesco.mongelli@ecb.int); tel.: +49-69-13447621; fax: +49-69-13447605.

<sup>4</sup> Senior Economist in the Directorate Monetary Policy of the European Central Bank. Correspondence: European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany. E-mail: [barbara.roffia@ecb.int](mailto:barbara.roffia@ecb.int); tel.: +49-69-13447432; fax: +49-69-13445757.

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**Address**

Kaiserstrasse 29  
60311 Frankfurt am Main, Germany

**Postal address**

Postfach 16 03 19  
60066 Frankfurt am Main, Germany

**Telephone**

+49 69 1344 0

**Internet**

<http://www.ecb.int>

**Fax**

+49 69 1344 6000

**Telex**

411 144 ecb d

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## Abstract

The paper provides a systematic comparison of the Eurosystem, the US Federal Reserve and the Bank of Japan. These monetary authorities exhibit somewhat different status and tasks, which reflect different historical conditions and national characteristics. However, widespread changes in central banking practices in the direction of greater independence and increased transparency, as well as changes in the economic and financial environment over the past 15-20 years, have contributed to reduce the differences among these three world's principal monetary authorities. A comparison based on simple "over-the-counter" policy reaction functions shows no striking differences in terms of monetary policy implementation.

*Keywords:* Monetary policy, central banks and their policies, monetary policy committees.

*JEL:* E40, E52 and E58



## Non-technical summary

This paper provides a systematic comparison of the Eurosystem, established in 1998; the US Federal Reserve System (Fed), established in 1914; and the Bank of Japan (BoJ), established in 1882. The structures and organisation of these three central banking systems reflect different historical conditions as well as national characteristics. While the legal status and several of their tasks differ somewhat, we find that there are fewer differences in their institutional structures, monetary policy frameworks, as well as the use of policy instruments. The paper analyses various factors that have played an important role in reducing the differences among these three world's principal monetary institutions.

One of these factors is represented by the fact that central banking practices around the world have evolved in the direction of, *inter alia*, greater independence, transparency and the adoption of monetary policy committees. This has helped to reduce the differences among the three institutions, which is a trend that can also be observed among other central banks. However, there remain some *de facto* differences in the way the monetary policy committees operate.

Some differences in terms of communication strategies also exist, although the financial markets seem very responsive to both the Eurosystem and the Fed's communication. However, the Fed does not quantify its definition of price stability, whereas the ECB and the BoJ do. Nor does it spell out a fully-fledged monetary policy strategy (again in contrast to the ECB and the BoJ). The ECB does not publish the minutes of its Governing Council meetings, unlike the Fed and the BoJ, although it should be noted that the ECB does provide extensive real-time information after interest rate decisions have been taken. The decision not to publish voting records has to be seen against the background of potential public pressures that the members of the Governing Council might face from their respective home countries. All these elements, however, seem to have little impact on the actual conduct of monetary policy.

Another factor that has also contributed to reducing the differences between the Eurosystem, the Fed and the BoJ is represented by the declining "internal" differentials in their economic and financial environment. Information on this can be obtained, for the US, by looking at data regarding the US Census Regions; for Japan by looking at the data for the 10 Japanese Districts and, for the euro area, from the national data for the 12 euro area countries (up to the time of the writing of the paper). From 1980 to 2004 inflation dispersion in the US remained within a considerably narrow range, whereas in the euro area it trended downward reaching levels comparable to those in the US just prior to the launch of the euro. Inflation differentials in Japan have remained at a very low level since the 1980s. Differentials in economic growth have all sharply declined over the last 15-20 years. Against this

background, the Fed and the BoJ still operate in a more harmonious economic and financial environment.

There are several caveats and limitations to our analysis. First, as the euro area did not start operating until 1999, synthetic euro area data for a large part of the sample period must be used. This obviously restricts our ability to interpret the results. Second, looking at developments in the main macroeconomic variables, it is notable that all the three areas have exhibited declining inflation and falling short-term and long-term interest rates; however, some of these phenomena are global and are not restricted to the three areas only. Third, the US, the euro area and Japan have faced a series of diverse challenges, some of them country-specific (as for Japan), and others more global in nature, which cannot be taken fully into account. In this respect, it should be mentioned that the euro area is a new monetary area, even though the process of European integration started as far back as the 1950s for a smaller subset of European countries. The sharing of a new single currency is deemed to engender “endogenous effects”, i.e. it may contribute to a further deepening of economic and financial integration. Indeed, it could be turning into a so-called optimum currency area (OCA). Therefore, the euro area may be witnessing some further transformation that the other two monetary areas have already experienced in the past.

More generally, in the past conditions differed considerably in the three currency areas, with a much higher dispersion among euro area Member States than within the US and Japan. Only in recent years have such differences diminished significantly, particularly within the euro area. Finally, a comparison based on a simple “over-the-counter” policy reaction function à-la-Taylor shows no striking differences in the actual implementation of monetary policy. The evidence from the analysis, therefore, would support the conclusion that, in practice, the monetary policies of the Eurosystem, the Fed and the BoJ (if we exclude the more recent challenging period for Japan) are not fundamentally very different.

# 1 Introduction

On 1 January 1999 the euro was established as the single currency of 11 European countries, which on 1 January 2001 increased to 12 when Greece joined the euro area. Since January 1999 the European Central Bank (the “ECB” hereafter) is responsible for the single monetary policy in the Eurosystem, which represents the central banking system of the euro area. As yet, there is no comprehensive comparison of the Eurosystem with the monetary authorities operating in the other two large currency areas in the world, namely the Federal Reserve System of the United States (henceforth the “Fed”), which was established in 1914, and the Bank of Japan (henceforth the “BoJ”), which was established in 1882.<sup>5</sup>

The structures of these three monetary institutions reflect different historical conditions as well as national characteristics. However, in recent years some widespread changes in central banking practices have taken place concerning, *inter alia*, a higher degree of independence, greater transparency as well as the adoption of monetary policy committees, which have since then been embraced by most central banks around the world (see among others Blinder 2004, Blinder and Wyplosz 2004, and Fujiki 2005).<sup>6</sup> This has contributed to reducing the differences among the Eurosystem, the Fed and the BoJ (as well as other central banks which are not the focus of this paper).

The main aim of this paper is to provide the first analytical comparison of the Eurosystem, the Fed and the BoJ, expanding the more descriptive analysis contained in Gerdesmeier, Lichtenberger and Mongelli (2005). We make three main original contributions. First, we illustrate some of the main similarities and differences in the actual behaviour of the three institutions, examining the different environments in which they carry out their tasks. Second, we evaluate the monetary policy rules for the three central banks using the framework developed by Taylor (Taylor, 1993a). The aim of this exercise is to ascertain whether the responses of these central banks to their contingent economic factors differ and, if so, by how much. Third, central banking practices have evolved around the world: we highlight some areas in which there might be some disparity between the legislative framework and the actual practices – i.e. the *de jure* aspects as well as the *de facto* aspects – for the three central banks.

Of course, this comparison has some limitations which should be taken into account. For example, regarding the ECB we use some “synthetic” euro area data that cover the period before the establishment of the ECB, which are constructed on the basis of national developments prior to 1999.

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<sup>5</sup> The Eurosystem itself became operational slightly before in 1998; however, the individual national central banks of the Eurosystem were of course established much earlier: the Banque de France for example in 1800, De Nederlandsche Bank in 1814, the Banque Nationale de Belgique in 1850, the Banco de España in 1856, the Banca d’Italia in 1893 and the Deutsche Bundesbank in 1957.

<sup>6</sup> Undoubtedly this followed the identification of the problem of dynamic inconsistency (i.e. the “inflation bias”) formulated by Kydland and Prescott (1977), and the solution by delegating monetary policy to an independent central bank postulated by Rogoff (1985). See also Barro and Gordon (1983) and McCallum (1989).



This paper is organised as follows. Section 2 firstly compares the institutional structures, monetary policy frameworks and objectives of the three central banks, and secondly discusses the issues of independence, accountability, transparency, communication and strategy. Section 3 contains an overview of the environment in which the three central banks operate. The economic and financial environment in which they carry out their tasks has also changed considerably over time. This represents one of the most important transformations undertaken during the sample period and must be taken into consideration in the analysis. As an example of this effect, there is a presumption that the introduction of the euro may foster further endogenous economic and financial integration in the euro area. Section 4 provides the results of a comparison of the reaction functions estimated for the three institutions. In this paper we scrutinise their policy reaction functions using a Taylor-rule framework with the aim of improving our understanding of the different roles and challenges that these central banks face. Such framework is also commonly used in the literature (e.g. in the annual monitoring of the ECB by the Centre for Economic Policy Research (CEPR), as well as in many empirical works on policy rules, especially for the US).<sup>7</sup> Section 5 provides some final remarks and qualifications.

## **2 The institutional structures and monetary policy framework**

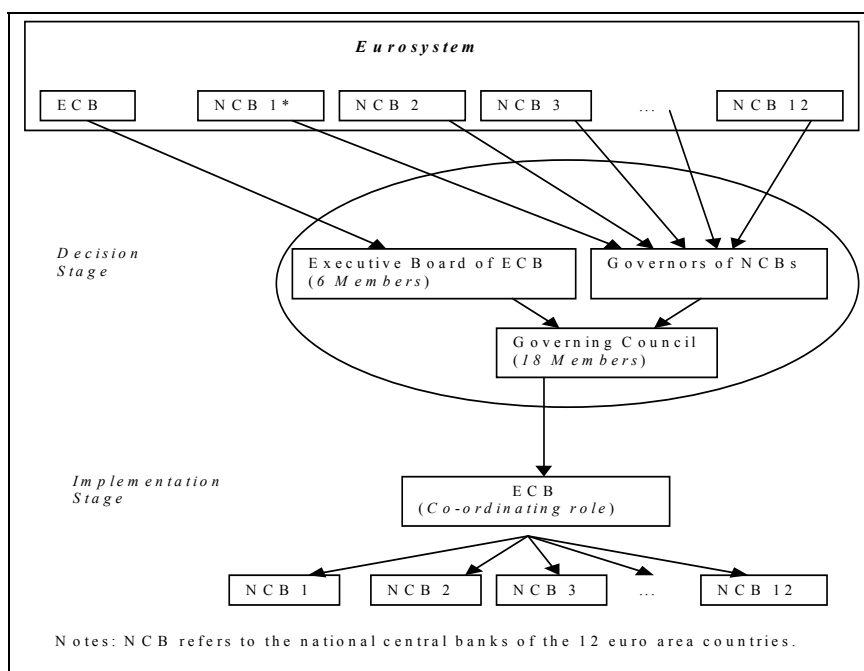
### ***2.1 Organisational framework and institutional features of the three central banks***

The Maastricht Treaty (henceforth the “Treaty”) contains the institutional arrangements for the conduct of monetary policy in Economic and Monetary Union (EMU) in Europe. The Treaty, which entered into force in November 1993, provides the legal basis for the formation of the European System of Central Banks (ESCB), which comprises the ECB and the national central banks (NCBs) of the 25 Member States of the European Union (EU). The term “Eurosystem” denotes a subset of the ESCB that comprises the ECB and the NCBs of those EU Member States that have adopted the euro. The governing bodies of the Eurosystem are the Governing Council and the Executive Board. The latter consists of the President, the Vice-President and four board members. Its main task is to implement the decisions of the Governing Council, which currently consists of the Executive Board members plus the 12 governors of the euro area NCBs (see Figure 1). While the members of the Executive Board are appointed for a non-renewable eight-year term, the terms of office for NCB governors range between five and eight years.

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<sup>7</sup> It should, however, be noted that this is used only for illustrative purposes, as the ECB does not, for example, pursue any form of inflation targeting.

**Figure 1 Organisational Framework of the Eurosystem**



Source: Gerdesmeier, Lichtenberger and Mongelli (2004).

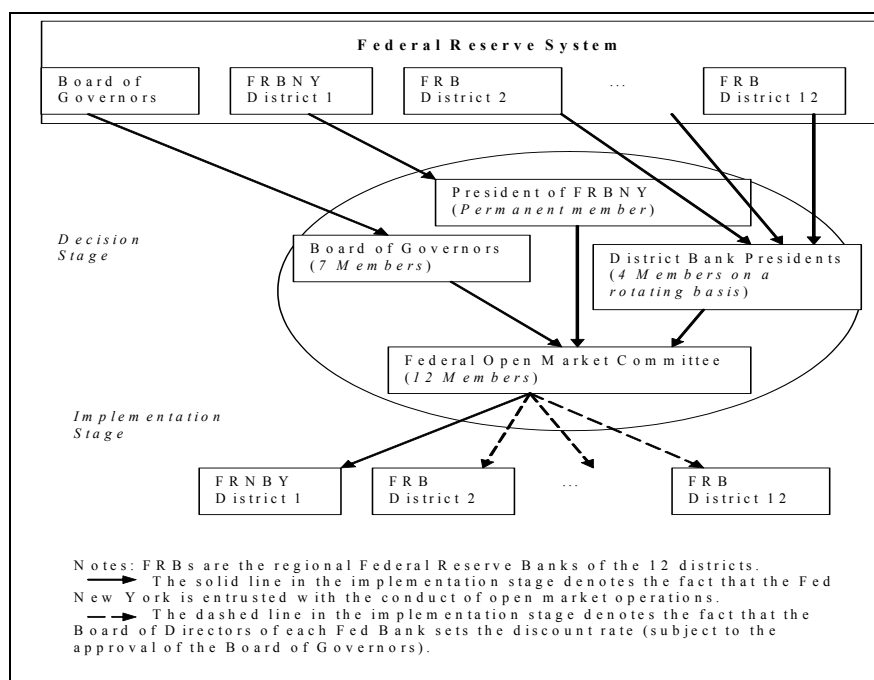
The institutional arrangements of the Eurosystem in some ways resemble those of the Fed (see Figure 2). Goodfriend (1999) observes that both the Fed and the Eurosystem are federal central bank systems. The Fed became more centralised with the Banking Act of 1935. For its part, the ECB has in principle a role similar to that of the Fed's Board of Governors, while the 12 NCBs of the Eurosystem play a role similar to the 12 regional Federal Reserve Banks in the US. In a similar fashion the President of the ECB chairs the Governing Council meetings in much the same way as the Chairman of the Fed's Board of Governors chairs the meeting of the Federal Open Market Committee (FOMC).

In the euro area, the Governing Council is responsible for formulating the monetary policy of the euro area, a task that is carried out by the FOMC in the US. The members of the Fed's Board of Governors are appointed for a fourteen-year term, i.e. nearly twice as long as the eight-year term foreseen for the members of the ECB's Executive Board. However, both terms are non-renewable. The Chairman and Vice-Chairman of the Board of Governors instead both serve for a four-year term. These terms may be renewed as long as their term within the Board has not expired. However, in practice the previous Chairman served over eighteen years as that he had originally been appointed to serve out the unexpired term of his predecessor.

While there are many similarities in the structures of the Eurosystem and the Fed, there are also some key differences. One difference concerns the voting rights. Currently all NCB governors have an equal vote in all policy decisions taken by the Eurosystem Governing Council. Participation in

FOMC voting, by contract, is more restricted: all seven members of the Board of Governors of the Federal Reserve System have a permanent voting right, as does the President of the New York Fed, whereas the Presidents of the Chicago and Cleveland branches alternate annually, and the other nine reserve bank presidents share only four votes on a rotating basis (however, they do attend all FOMC meetings and participate in discussions even when they cannot vote).<sup>8</sup>

**Figure 2 Organisational Framework of the Federal Reserve System**



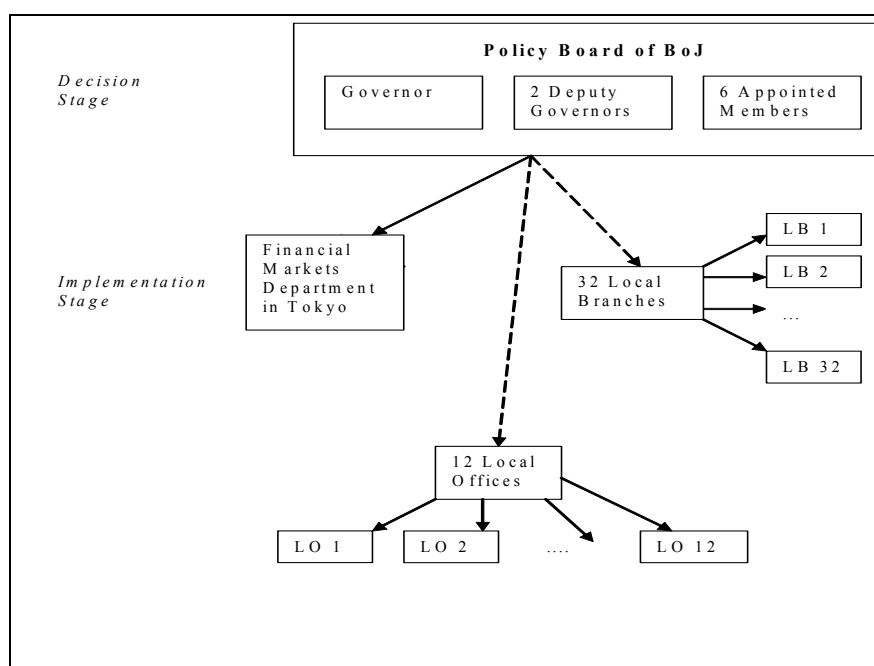
Source: Pollard (2003).

With regard to the BoJ, the highest decision-making body is the Policy Board (see Figure 3). The Board comprises the Governor, two Deputy Governors and six appointed members. Each of these nine members is appointed by the Cabinet for five years, and his or her appointment must be approved by the Diet. The board members elect the Chairman of the Policy Board among themselves. Since September 2006 the Governor of the Bank has also been appointed Chairman of the Policy Board. The Policy Board takes its decisions by a majority vote. The BoJ operates more as a head office than a federal system of central banks, and is in charge of 32 domestic local branches (LBs) and 12 local offices (LOs).<sup>9</sup>

<sup>8</sup> The voting system will change when more countries adopt the single currency, and the Governing Council has already made provisions for voting rights in an enlarged euro area. In 2003, the European Council approved an amendment to the Statute of the ESCB which provides for an adjustment of the voting modalities in the Governing Council (see ECB, 2003). According to the new voting scheme, the six members of the Executive Board will always maintain a permanent voting right, whereas the voting rights of NCB governors will be subject to a rotation scheme once the number of euro area countries exceeds 15. However, all governors will participate in all meetings of the Governing Council irrespective of whether they hold a voting right at that time.

<sup>9</sup> Originally, there were 33 branches, but the Otaru branch was closed in September 2002.

**Figure 3 Organisational Framework of the Bank of Japan**



Source: BoJ (2003a).

While monetary policies in all three areas are currently based on a collective decision-making system — i.e. by the respective (monetary policy) committees — there may be some more de facto differences in how these committees operate.<sup>10</sup> Blinder (2004) observes that not all committees are characterised by the same status. A *collegial committee* prizes solidarity and strives for group ownership of its decisions. The chairman forges consensus and, where possible, seeks to achieve unanimity in the decision-making process. Conversely, in an *individualistic committee*, differences of opinion (if any) are voiced and conclusions are reached by majority voting, if necessary. Hence, individual members are allowed to express their preferences and do not always have to embrace the group's decisions.

When taking monetary policy decisions, both the Governing Council and the Board of Governors officially act by simple majority voting. In practice, both the Governing Council and the FOMC operate as collegial committees. However, according to Blinder, the former functions as a genuinely collegial committee practising consensus voting, whereas, within the latter, the former chairman was able to steer the agenda very tightly. By contrast, the BoJ's Policy Board operates in a more individualistic manner than the other two committees.<sup>11</sup>

<sup>10</sup> The decision by the most important central banks to switch to a collective decision-making system by committee is itself the subject of current research. Blinder (2004), Blinder and Wyplosz (2004), and Fujiki (2005) analyse and survey the many facets of such an evolution. Among other factors, they note that monetary policy set by a committee is likely to be changed less frequently than monetary policy set by a single central bank governor. Furthermore, committee members bring different decision heuristics and preferences to the discussion. A committee then pools the views of its members, and is certainly less likely to adopt extreme positions than if it were individuals. There is also growing empirical evidence that group decisions — such as those by a monetary policy committee — outperform individual ones.

<sup>11</sup> See Blinder (2004), p. 29.



In addition to the monetary policy function, all three central banks perform a number of other functions and tasks (see Table 1). Most of these are common to all three central banks, although some vary on the grounds of other factors (some of which historical) that are not addressed here (for more information in this regard, see Gerdesmeier, Lichtenberger and Mongelli, 2004).

**Table 1 Selected Features and Tasks of the Eurosystem, the Federal Reserve System and the Bank of Japan<sup>1</sup>**

	Federal Reserve System	Eurosystem <sup>2/</sup>	Bank of Japan
Define and implement monetary policy	Yes	Yes	Yes
Issue banknotes	Yes	Yes	Yes
Conduct foreign exchange operations	Yes	Yes	Yes
Hold and manage official reserves	Yes	Yes	Yes
Act as the fiscal agent for the government	Yes	NCBs	Yes
Promote stability and financial system	Yes	Yes	Yes
Supervise banks	Yes	Some NCBs	On a contractual basis
Promote the smooth operation of the payments system	Yes	Yes	Yes
Collect statistical information	Yes	Yes	Yes
Participate in meetings of international monetary institutions	Yes	Yes	Yes

Sources: BoJ (2003a), ECB (2004), Gerdesmeier, Lichtenberger and Mongelli (2004) and Pollard (2003).

<sup>1</sup> Institutional structures: the Federal Reserve System comprises the Board of Governors (Washington DC) and 12 federal reserve banks (including their 25 branches); the Eurosystem comprises the ECB in Frankfurt am Main (Germany) and 12 NCBs (including regional branches); the BoJ, on the other hand, is not a federal system: it has a head office in Tokyo, and 32 local branches.

<sup>2</sup> The acronym NCBs here refers to the national central banks of the Eurosystem.

## 2.2 Monetary policy objectives

The Treaty states that “the primary objective of the ESCB<sup>12</sup> shall be to maintain price stability” and that “without prejudice to the objective of price stability, the ESCB shall support the general economic policies of the [European] Community with a view to contributing to the achievement of the objectives of the [European] Community”. The objectives of the Community are *inter alia* to ensure “a high level of employment [...], sustainable and non-inflationary growth, a high degree of

<sup>12</sup> The Treaty refers to the ESCB rather than to the Eurosystem, since it was drawn up on the premise that eventually all EU Member States would adopt the euro.

competitiveness and convergence of economic performance”. The Treaty thus establishes a clear hierarchy of objectives for the ECB and assigns overriding importance to price stability (see Table 2). Moreover, the ECB has made public its precise quantitative definition of price stability.

The ESCB’s mandate to pursue price stability contrasts with the Fed’s multiple-objective mandate. The latter’s mandate states that “the Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long-run growth of the monetary and credit aggregates commensurate with the country’s long-run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates” (Federal Reserve Act, Section 2A.1). Against this background, it is worth noting that Goodfriend (1999) finds that although the US Congress has not assigned an explicit mandate to pursue low inflation, the Fed seeks to educate the public about the benefits of low inflation and the need to pre-empt it. Hence, the Fed’s policymakers seem to assign at least an implicit ranking to these goals, although in the long run all three are compatible.<sup>13</sup> It has been argued that despite its multiple objectives, the Fed has traditionally placed more emphasis on achieving price stability and, in recent years, there have been calls for a clearer price stability mandate for the Fed (see Wynne, 1999 and Bernanke, 2003a).

As for the BoJ, its main objectives are first to maintain price stability in its conduct of monetary policy; and second, to ensure the smooth and stable operation of the payment and settlement system through measures such as acting as a lender of last resort. In both cases, the goal is to maintain financial system stability, thereby laying the foundations for sound economic development (BoJ, 2003a). On 9 March 2006, the BoJ introduced a new framework for the conduct of monetary policy, and additionally reviewed its thinking on price stability in order to secure that its decision to abandon quantitative easing is better understood.<sup>14</sup> In this respect, price stability was seen as being consistent with a change in the price index without a measurement bias of zero percent. In quantitative terms, however, an approximate range between zero and 2 percent was deemed to be consistent with the views of the Board members on medium to long-term price stability, although the median figures fell on both sides of 1 percent. Furthermore, the BoJ also stated that it regarded a consumer price index as an adequate measure for evaluating price developments.

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<sup>13</sup> Fed officials have repeatedly clarified that the Fed understands “maximum employment” as meaning “maximum sustainable employment”, i.e. non-inflationary employment: “The Fed’s dual mandate – full employment and price stability – is really quite unique. Actually, the specific language of the mandate is that the Fed should promote price stability and maximum employment. We presume that the Congress did not intend to give us contradictory objectives, so we interpret the objective as price stability and maximum sustainable employment. Maximum sustainable employment is sometimes also referred to as full employment, i.e. “the maximum level of employment sustainable without upward pressure on inflation” (see Meyer, 2001). In this regard, the Fed’s press statements refer to employment developments in terms of their upward or downward pressures on price stability, and not in terms of their absolute levels.

<sup>14</sup> See Press Release dated 9 March 2006.



**Table 2 Elements of the Monetary Framework of the Eurosystem, the Federal Reserve System and the Bank of Japan**

	<b>Eurosystem</b>	<b>Federal Reserve System</b>	<b>Bank of Japan</b>
<b>Monetary policy decision-making body</b>	Governing Council, comprising 18 members: the ECB Executive Board (6 members) and the governors of the 12 NCBs of the Eurosystem.	Federal Open Market Committee, comprising 12 members: the Board of Governors (7 members), the President of the New York Federal Reserve Bank and 4 other reserve banks presidents (on a rotating basis)	Policy Board (9 members)
<b>Monetary policy objective(s)</b>	Price stability is the primary objective. This is defined in precise quantitative terms.	Multiple objectives: to promote maximum employment, stable prices and moderate long-term interest rates.	Multiple objectives: price stability (now defined within a range) and the stability of the financial system.
<b>Independence from political influence</b>	Yes	Yes	Yes
<b>Accountability and transparency</b> <sup>1/</sup>	<ul style="list-style-type: none"> <li>• Immediate press conference with introductory statements following Governing Council meetings (scheduled at 2.30 pm);</li> <li>• Annual Report to EU institutions and presentations to the European Parliament;</li> <li>• Monthly Bulletin published.</li> </ul>	<ul style="list-style-type: none"> <li>• Immediate announcement and minutes following the FOMC;</li> <li>• Hearings before the Congress;</li> <li>• Monthly Bulletin/Report by the regional federal reserve banks.</li> </ul>	<ul style="list-style-type: none"> <li>• Immediate announcement after monetary policy meetings (generally around noon);</li> <li>• Governor's press conference (scheduled at 3.30 pm);</li> <li>• subsequent publication of minutes (generally one-month later, three days after the following monetary policy meeting);</li> <li>• Monthly Report of the Policy Board published;</li> <li>• Semi-annual report to the Diet.</li> </ul>
<b>Monetary policy strategy</b>	Preannounced strategy.	Risk management approach.	Approach focusing on the information content of a variety of economic indicators.
<b>Monetary policy implementation</b>	Decentralised (operations conducted by the Eurosystem).	Centralised (operations conducted by the New York Federal Reserve Bank).	Centralised.

Sources: BoJ, ECB and the Fed.

<sup>1</sup> See Gerdesmeier, Lichtenberger and Mongelli (2004) for a description and comparison of the independence, accountability and transparency of each of these three central banks.

### 2.3 Central bank independence

In many countries the gradual process of shifting responsibility from an individual central banker to a monetary policy committee has coincided with granting independence to the central bank (Blinder, 2004). Central bank independence is a multilayered concept with several elements,

including: *personal independence*, which pertains to the influence of the government in the appointment process, the duration of the terms of office, and dismissal procedures; *financial independence*, which concerns the separation between the finances of the government and of the central bank, as well as the setting of the bank's budget; and *functional independence*, which is also referred to as policy independence, and is related to the autonomy in formulating and executing monetary policy.<sup>15</sup> The latter is further articulated into independence in terms of goals and in terms of instruments.

Article 108 of the Treaty establishes that the Eurosystem is independent from any political influence. Four main provisions safeguard the independence of both the Eurosystem and its decision-making bodies. First, the ECB's financial arrangements are kept separate from the financial interests of the European Community. The ECB has its own budget, and its capital is subscribed and paid up by the euro area NCBs. Second, potential political influence on individual members of the ECB's decision-making bodies is minimised: the members of the Governing Council are endowed with relatively long mandates, while a rule stipulates that members of the Executive Board cannot be reappointed. Third, the Eurosystem's independence is strengthened by the prohibition laid down in the Treaty of any provision of central bank credit to the public sector. Finally, the Eurosystem is also functionally independent. The ECB has at its disposal all the instruments and competencies necessary to conduct its monetary policy and is authorised to decide autonomously how and when to use them.<sup>16</sup>

While the Fed enjoys significant independence, it has been argued that this is somewhat lower than that for the Eurosystem (see, for example, Wynne, 1999). The US Constitution grants the Congress the right to "coin money and regulate the value thereof". While the Congress has delegated this responsibility to the Fed, it could, in principle, revoke it at any time. The intent of the Congress in shaping the Federal Reserve Act was also to keep politics out of monetary policy. There are a number of provisions designed to safeguard the independence of the Fed. For example, the Fed is independent of other branches and agencies of the government. It is self-financed and is, therefore, not subject to the congressional budgetary process. The terms of the seven members of the Board of Governors, who are nominated by the President and confirmed by the Senate, span multiple presidential and congressional terms, as a full term lasts fourteen years. In practice this can be even longer as, although a member who has served a full term may not be reappointed, a reappointment is possible for a member who has completed an unexpired portion of a term. The Chairman and Vice Chairman of the

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<sup>15</sup> See, among others, Blinder (1998 and 2004), Cukierman (2001), Geraats (2004), King (2004) and Woodford (2003). Eijffinger and de Haan (1996) and Berger, de Haan, and Eijffinger (2001) provide an extensive analysis of the implications of the diverse aspects of central bank independence for economic performance (i.e. inflation levels, stability and economic growth): there is still considerable debate on the implications of central bank independence and the policy preference of central bankers.

<sup>16</sup> Moreover, the ECB has the right to adopt binding regulations to the extent necessary to carry out the tasks of the ESCB (as well as in certain other cases as laid down in specific acts of the EU Council).

Board are chosen by the President from among the sitting governors and must be confirmed by the Senate. They serve terms of four years and may be reappointed as Chairman or Vice Chairman until their terms as governors expire.

As for the BoJ, its law was revised in 1997 to secure independence of the central bank. The law states that “the Bank of Japan’s autonomy regarding currency and monetary control shall be respected”. To ensure such independence, members of the Policy Board cannot be dismissed for holding opinions at variance with the government, and the government cannot order the Bank to undertake any particular policy action or to conduct any particular business operation. At the same time, it is important that the Bank’s monetary policy is consistent with the government’s basic economic policy framework. Therefore, the BoJ shall “always maintain close contact with the government and exchange views sufficiently”. The Bank of Japan Law also allows representatives of the government to attend the Monetary Policy Meetings (MPMs) of the Policy Board in order to give their views and submit proposals, or to request that the Board postpones a vote on monetary policy measures until the next meeting. However, the government representatives cannot vote on monetary policy decisions.

Some further differences among the three central banks also exist in terms of exchange rate policies. In the US, foreign exchange policy is fully in the hands of the Treasury Department. In Japan, foreign exchange interventions are decided by the Ministry of Finance. The BoJ undertakes these interventions as an agent of the government, using government funds. As far as the euro area is concerned, Article 111 of the Treaty gives the Council – acting either on a recommendation from the Commission and after consulting the ECB, or on a recommendation from the ECB – the right to formulate “general orientations for exchange rate policy”. At the same time, the Treaty also contains provisions which ensure that the pursuit of the objective of price stability is fully respected by the single exchange rate policy (ECB, 2004).

Overall, the Eurosystem is one of the most independent central bank systems in the world. However, this must be set against the increasing desire on the part of the public for transparency (as Eijffinger and Geraats, 2002 observe). This brings us to our next point, namely the importance of institutional features for central banks.

#### **2.4 *Accountability, transparency and communication***

Goodfriend (1999) observes that in the early 1980s under the Chairmanship of Paul Volcker, the Fed realised that bringing down inflation and maintaining it at a low level would be easier if the Fed had the necessary credibility in terms of being committed to fight for low inflation. Fed officials considered communication with the public a useful tool for building credibility. In the same vein,

Woodford (2003) points out that transparency may help enhance the effectiveness of monetary policy. However, this may create a potential conflict for central banks: a maximum level of transparency may not be optimal and could lead to less clarity and common understanding (see also Kahnemann, 2003, Mishkin, 2004 and Ehrmann and Fratzscher, 2005). In this sub-section we briefly compare the three central banks with regard to accountability, transparency and communication.

### **2.4.1 Accountability**

To retain legitimacy, an independent central bank must be accountable to democratic institutions and to the general public for its actions in the pursuit of its mandate. The Treaty lays down a number of reporting requirements for the ECB – for example, the presentation of an Annual Report to the European Parliament, the Commission and the EU Council – and establishes the need to make regular presentations to the European Parliament to ensure accountability (see ECB, 2004).

Similar reporting procedures have been laid down in the US and Japan. The Fed is ultimately accountable to the Congress, which can amend the Federal Reserve Act legislation at any time. The Fed must report once a year on its activities to the Speaker of the House of Representatives, and twice a year on its plans for monetary policy to the Congress' banking committees. Fed officials also testify before the Congress when requested.

The BoJ has different reporting obligations and publishes an outline of its business operations (BoJ, 2004). Similarly to the Fed's semi-annual report on monetary policy to the Congress, the BoJ submits a report on currency and monetary control to the Diet twice a year, and the BoJ's Governor or a designated representative appears upon request before the Diet committees to explain the BoJ's policies, business operations and balance sheet conditions.<sup>17</sup> In addition, the BoJ Governor regularly holds a press conference after monetary policy meetings to explain the policy decisions taken. A transcript of the press conference is also made available, albeit only in Japanese.

Since the introduction of a new framework for the conduct of monetary policy (as mentioned in sub-section 2.2), the BoJ examines economic activity and prices from two perspectives. The first focuses on the economic outlook and price expectations one to two years ahead. The second perspective is oriented more to the long term and examines those risks that are most relevant to the conduct of monetary policy (see BoJ, 2006). The outcome of this analysis will also be reflected in future periodical publications, such as the *Outlook for Economic Activity and Prices*.

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<sup>17</sup> Although the full version of the report is only available in Japanese, a summary of the report is available in English.

## 2.4.2 Transparency

Transparency is a concept that is closely related to, yet distinct from, accountability. The transparency of monetary policy can be defined as the extent to which central banks disclose information related to the policymaking process. In the words of Blinder (2004), such information should be clear, have a substantive content and be open to public scrutiny.<sup>18</sup> The boundaries of transparency vis-à-vis accountability and communication vary according to authors. Eijffinger and Geraats (2002) distinguish between five types of transparency, namely:

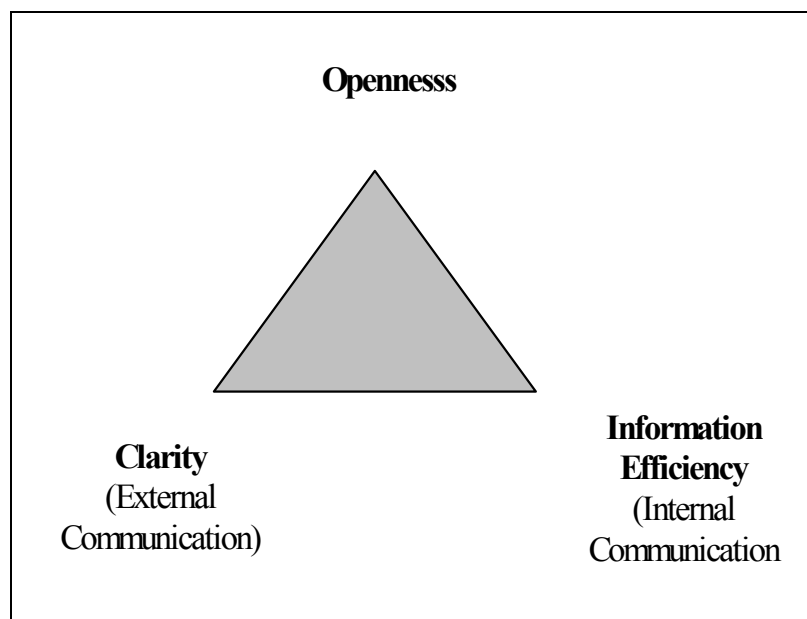
- *political transparency*, which refers to openness about policy objectives and consists of being clear about the formal objectives of monetary policy (this aspect is discussed in sub-section 2.5);
- *economic transparency*, which focuses on the economic information that is used for monetary policy (including economic data, policy models and forecasts);
- *procedural transparency*, which reflects the way monetary policy decisions are taken. This involves an explicit monetary policy rule or strategy that describes the monetary policy framework (see sub-section 2.5);
- *policy transparency*, which means that policy decisions should be promptly announced. In addition, it includes an explanation of the decision together with a policy inclination or indication of likely future policy actions; and finally,
- *operational transparency*, which concerns the implementation of the central bank's policy actions.

Concerning the Eurosystem, Winkler (2002) notes different aspects of transparency that have been receiving greater attention, including openness, clarity and information efficiency (see Figure 4). He, however, warns that an effective approach to communication requires a balance to be struck between being open about the complex nature of policymaking, and simplifying the presentation of this process in the interest of greater clarity. Blinder (2004) also notes that monetary policy decision-making cannot be conducted in a completely open fashion.

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<sup>18</sup> Ultimately, transparency aims at ensuring that monetary policy is better understood by the public and by the various institutions to which central banks are accountable. This would foster both the credibility and effectiveness of monetary policy.

**Figure 4 Aspects of Central Bank Transparency**



*Source:* Winkler (2002).

According to Trichet (2004), both the Eurosystem and the Fed place strong emphasis on ensuring the transparency of the decision-making process and the transparency of the analyses made by the responsible decision-making “college”. Moreover, transparency also characterises both institutions in terms of the explanations of the economic diagnosis provided to the public and to market participants, with all the decisions being released in real time.

Concerning clarity, the publication of a precise quantitative definition of price stability by the ECB – as opposed to the Fed’s practice – may be seen as a component of both transparency and accountability, as it provides the public with a yardstick against which the performance of the ECB can be measured.

For the ECB, the Introductory Statement at each ECB press conference shortly after the first Governing Council meeting each month represents a means of almost instantaneously announcing and explaining the most recent monetary policy decision. Similarly, the current practice of the FOMC is to announce policy changes as soon as they are made. Immediately after each meeting, the FOMC issues a statement to the effect that a decision has been taken to lower or raise rates, or, in case the decision was to leave rates unchanged, merely noting that the meeting has ended. The FOMC also publishes the minutes of each meeting three weeks later.

The Bank of Japan Law requires the BoJ to “endeavour to clarify to the public the content of its decisions, as well as its decision-making process”. In accordance with this provision, after each MPM,



the Policy Board makes public any decisions reached, including the guidelines for money market operations and the Bank's assessment of economic and financial developments. The BoJ – like the Fed – releases the minutes of the MPMs around one month after the meeting, and publishes a detailed record of the discussions ten years after each meeting. Other matters decided at the Policy Board meetings are disclosed in the Monthly Report of the BoJ's Policy Board.

It has been argued that the publication of minutes makes the Fed and the BoJ more transparent than the ECB. The main reasons why the ECB currently abstains from publishing minutes are twofold. First, the ECB intends to communicate to the public that the entity which decides is not a personality – or a group of personalities – but rather a college (i.e. a united team which benefits from its collegial wisdom). Second, the ECB does not want to convey the impression that it is a place where various national interests, as represented by various NCB governors, can be reconciled. In fact, the Treaty clearly requires decisions to be taken in the interest of the euro area as a whole, and thus any kind of reasoning on the basis of a national vision is excluded. This makes the situation in the euro area somewhat different from those of the US or Japan. In any case, the ECB publishes its “diagnosis” in real time, so that all the arguments that led to the decision are presented in full to the public. Several recent studies have shown the ECB to be highly predictable in its decisions, which is one of the ultimate goals of transparency.

Furthermore, as several authors have pointed out, decision-making by committees also implies that statements by individual committee members is increasingly relevant (see Amato et al., 2002, Blinder 2004 and Chappel et al., 2004).<sup>19</sup>

Ehrmann and Fratzscher (2005) analyse the communication strategies of the Fed and the ECB/Eurosystem along three aspects: the content, timing and consistency of communication concerning the inclination of monetary policy and the economic outlook (see Table 3).<sup>20</sup> Concerning the content of communication, they show that individual FOMC members exhibit a higher degree of dispersion in what they say than the members of the ECB's Governing Council, which suggests that the Fed follows a more individualistic communication strategy than the ECB. However, the decision-making process of the FOMC is collegial in that most decisions are unanimous. Hence, the ECB is more collegial in both its approach to decision-making and in its communication strategy.

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<sup>19</sup> In fact, the analysis of communication by individual committee members – and the weighing of their clout -- has become an important branch of central banking watching (for a review, see Ehrmann and Fratzscher, 2005).

<sup>20</sup> Unfortunately, no comparable analysis has yet been carried out for the BoJ.

**Table 3 A Comparison of Communication Strategies and Their Effectiveness**

	Communication strategy			Market responsiveness	
	Communication dispersion by individual members	Communication consistency with policy decisions	Voting Dispersion	Area of most effective communication: 1. MP inclination 2. Economic outlook	Market responsiveness and to whom
<b>Eurosystem</b>	Low	High	None	MP inclination	High (only to some members, e.g. Fed Chairman)
<b>The Fed</b>	High	Medium	High	Both	High (uniform to all members)

*Source:* Adapted from Ehrmann and Fratzscher (2005).

*Note:* No comparable analysis has yet been carried out for the BoJ.

Ehrmann and Fratzscher (2005) further analyse whether these differences in communication strategies have an impact upon the effectiveness of communication.<sup>21</sup> They find that the predictability of policy decisions is high for the FOMC and the Governing Council. However, the reaction of US markets to the statements by Chairman Greenspan was significantly stronger than to the statements made by other FOMC members; this differs from the euro area, where the markets respond similarly to communication by the ECB President and other Governing Council members. The two authors conclude that the policies of both the ECB and the Fed are equally effective, despite the fact that they pursue different communication strategies.

## 2.5 *Monetary policy strategies*

The main elements of the ECB's monetary policy strategy are a quantitative definition of price stability and a comprehensive analysis of the risks to price stability (Issing et al., 2003 and ECB, 2003a). In the pursuit of price stability, the ECB aims to maintain year-on-year increases in the Harmonised Index of Consumer Prices (HICP) of below, but close to, 2 percent over the medium term. This clarification can be seen as an attempt by the ECB to reduce disinflationary effects to a strict minimum and to keep inflation expectations within a rather narrow margin. As Issing stated in 2003, "this 'close to 2%' is not a change, it is a clarification of what we have done so far, what we have achieved – namely inflation expectations remaining in a narrow range of between roughly 1.7%

<sup>21</sup> Such effectiveness contains two interlinked elements: the ability of financial markets to predict future monetary policy decisions, and the ability of policymakers to influence financial markets by moving asset prices.

and 1.9% – and what we intend to do in our forward-looking monetary policy” (Issing, 2003). The different risks to price stability are assessed by integrating monetary analysis with economic analysis into a unified framework. The *economic analysis* – focusing on the most immediate causes of inflation, such as cost developments and demand-supply imbalances – primarily helps to assess short to medium-term economic developments and consequently risks to price stability over that horizon. The *monetary analysis* – focusing on the ultimate monetary determinants of inflation – mainly contains information for assessing price trends at medium to long-term horizons. In this context, the monetary analysis predominantly serves as a means of cross-checking, from a medium to a long-term perspective, the short to medium-term indications stemming from the economic analysis.

ECB officials have on various occasions explicitly referred to the advantages of the ECB’s monetary policy strategy. For instance, it was stated that “the combination of commitment and flexibility that characterises the ECB’s strategy allows for some ‘constrained discretion’ on dealing with cyclical output fluctuations in a way consistent with the preservation of price stability” (Papademos, 2003). Similar statements have also been expressed by Fed officials: “The approach to monetary policy that I call ‘constrained discretion’ can be defined by two simple and parsimonious principles. First, through its words and (especially) its actions, the central bank must establish a strong commitment to keeping inflation low and stable. Second, subject to the condition that inflation is to be kept low and stable, and to the extent possible given our uncertainties about the structure of the economy and the effects of monetary policy, monetary policy should strive to limit cyclical swings in resource utilization” (Bernanke, 2003b). These quotes seem to show some similarities in the interpretation of the respective monetary policy strategies.

After the stability of money demand broke down in the early 1990s, the Fed started to pursue a multi-indicator approach (Ruckriegel and Seitz, 2002), attaching less importance to monetary aggregates, but utilising a broad range of financial and economic indicators in assessing its policy stance (Greenspan, 1993). While some commentators have labelled this approach a “just-do-it strategy” (Mishkin, 2003), Fed officials prefer to term it a “stitch-in-time strategy” (Blinder, 1995). In the second half of the 1990s, the Fed was confronted with an increasing number of studies which claimed that relatively simple monetary policy rules (linking interest rates to inflation and the output gap) can reasonably well describe the way monetary policy was actually carried out over the last decade (Taylor, 1993a). Such rules also seemed to coincide with the special emphasis that some Fed officials put on the real equilibrium interest rate (Meyer, 1998) – and indeed, Fed officials had discussed inflation targeting as a strategy option on various occasions (Bernanke, 2003a).

More recently, however, representatives of the Fed stressed again that the Fed should not be understood as an inflation-targeting central bank, and nor does the Fed regard simple rules as adequate (Greenspan, 2004). Instead, a risk management paradigm was introduced into the monetary

policy-making, i.e. a strategy directed at “maximizing the probabilities of achieving over time our goals of price stability and the maximum sustainable economic growth that we associate with it”. It was also emphasised that such a cost-benefit analysis was seen as an ongoing part of the monetary policy decision-making process. This approach actually coincides with the fact that the Fed – like the ECB – has repeatedly stressed the importance of uncertainty for monetary policy decision-making (Issing, 2002 and Greenspan, 2004).

Like the ECB and the Fed, the BoJ has also refused to adopt an inflation-targeting strategy. This does not denote a rejection of such a framework per se, but rather reflects doubts about the appropriateness of such a strategy in the current extraordinary state of the Japanese economy (Okina, 1999). Indeed, in recent years, the BoJ has certainly faced a series of historically unprecedented economic challenges. Since the second half of the 1980s, the Japanese economy has experienced an extremely large swing following the emergence, expansion and finally the bursting of the asset price bubble. This led to instability in money demand in the mid-1990s, a fact which is generally attributed to dramatic changes in firms’ borrowing and financial institutions’ lending behaviour. Following the BoJ’s application of an increasingly aggressive monetary easing policy and the related extremely low short-term interest rates, fund shifts between various financial assets occurred, thus catalysing further instability in the relationship between the money stock and economic activity, and consequently causing the importance attached to monetary aggregates to decline. This so-called “zero-interest rate policy” was adopted with a view to avoiding further recession, putting a stop to deflation and preventing the spread of anxiety throughout the financial system.<sup>22</sup> Given these distortions, the BoJ deemed it appropriate to look rather closely at the prices of various financial assets, real economic variables, price developments and also at the fund-raising behaviour of firms and households (BoJ, 2003a). Nevertheless, against the background of the relative “uniqueness” of money as an indicator variable, the money stock is still regarded as an important and useful information variable and continues to be monitored carefully by the BoJ (BoJ, 2003a).<sup>23</sup> At present, one issue for discussion is how to deal with asset price movements in an appropriate way (Okina and Shiratsuka, 2001). Various studies have investigated this question, sometimes against the background of a Taylor-rule framework.<sup>24</sup> Starting in March 2006, the BoJ will also review on an annual basis the underlying fundamentals of the definition of price stability, as their development may be subject to structural changes. The level of inflation that the Policy Board members currently understand as denoting price

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<sup>22</sup> Some observers have termed this situation a “liquidity trap”; it remains unclear whether the BoJ itself would concur with this description.

<sup>23</sup> More specifically, the term “money” refers to the aggregate comprising M2+CDs.

<sup>24</sup> It remains uncertain, however, whether a more appropriate policy judgment would have been possible had the BoJ also explicitly taken asset price developments into account. A variety of analyses have been produced on the situation in Japan in the literature (see Bernanke, 2003c for a recent assessment of this issue).

stability from a medium to long-term viewpoint is a year-on-year change in the Consumer Price Index (CPI) between zero and 2 percent. Furthermore, from now on, economic activity and prices are to be analysed based on two assessments of the risks to price stability: first at a shorter horizon of up to two years, and second for a longer horizon.

### 3. Some stylised facts of the economic and financial environment

This section compares some features of the economic and financial environment in which the three central banks have been operating over a period starting in the 1980s and ending in 2004. This sample allows us to capture some important developments, although the comparison only has an illustrative purpose, given that the euro area did not start operating until 1999. This entails two important limitations. The first is that, in order to carry out a meaningful analysis, we are forced to use synthetic euro area data for a large part of the sample period, which obviously restricts our ability to interpret the results.<sup>25</sup>

The second limitation stems from the fact that the euro area is indeed a new monetary area, even though the process of European integration started as far back as the 1950s for a smaller subset of European countries.<sup>26</sup> The sharing of a new single currency among a group of countries is deemed to engender “endogenous effects”, i.e. it may contribute to a further deepening of economic and financial integration. This builds on the seminal contributions of Frankel and Rose (1998) and Rose (2004), who discuss how the euro area could indeed turn into a so-called optimum currency area (OCA), even if this was not the case before.<sup>27</sup> Therefore, the euro area may be witnessing some rapid transformation that the other two areas have already experienced.

Looking at developments in the main macroeconomic variables, it is notable that all the three areas have exhibited declining inflation and falling short-term and long-term interest rates (see Figure 5) since the early 1980s, a process that only temporarily reversed between 1987 and the early 1990s (for more details on the worldwide shift in the inflation process towards a low inflation environment, see Cecchetti and Debelle, 2006). The Japanese economy then fell into a deflationary regime from

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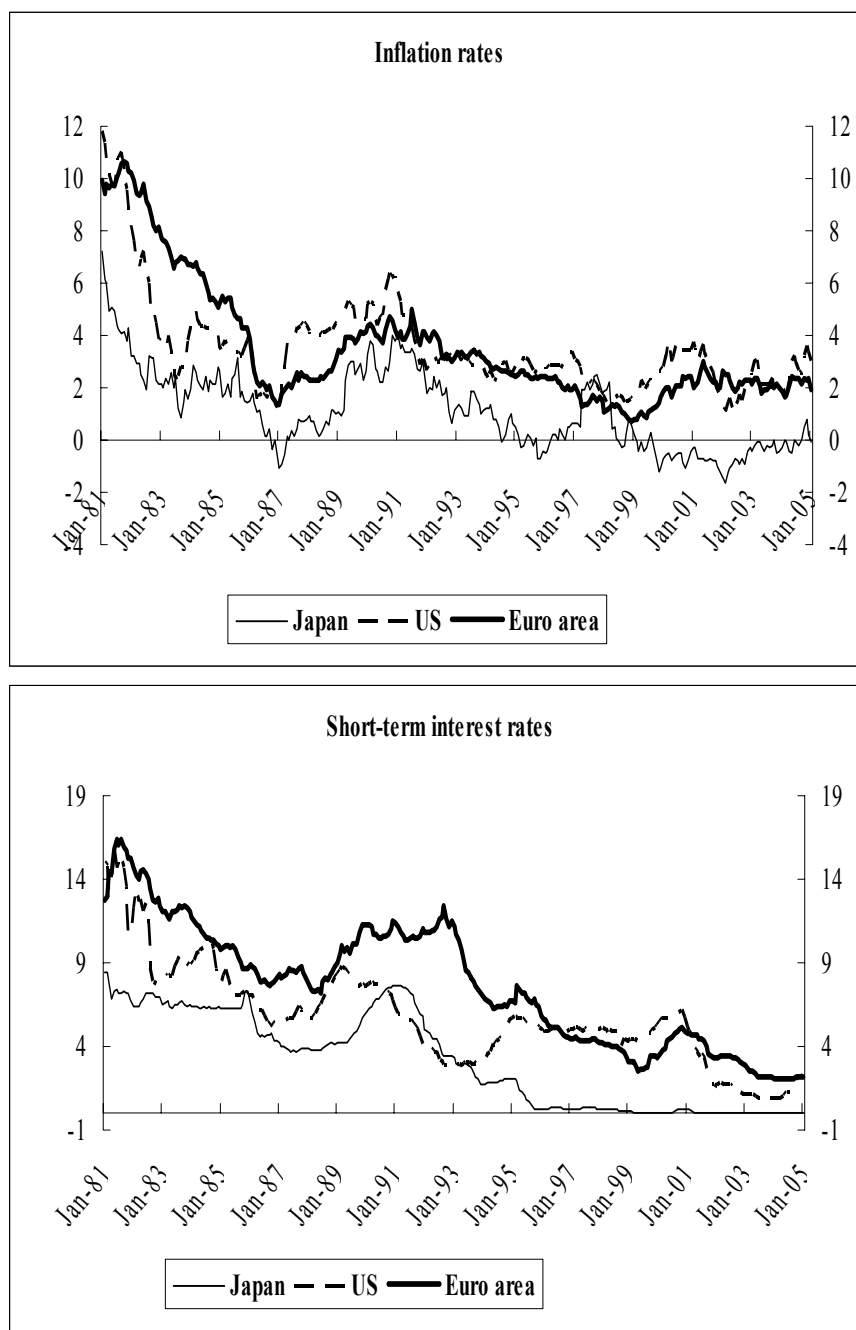
<sup>25</sup> The euro area data are compiled using national data (see also Gerdesmeier and Roffia, 2003).

<sup>26</sup> See De Grauwe (2005) and Dorrucchi, Firpo, Fratzscher and Mongelli (2004).

<sup>27</sup> See also De Grauwe and Mongelli (2005) for a survey of the drivers of endogeneity and ECB Working Papers Nos from 594 to 599 for a review of the effects of the euro so far.

1999 onwards.<sup>28</sup> The last chart illustrates real growth in the three areas, as represented by the annual changes in industrial production.<sup>29</sup>

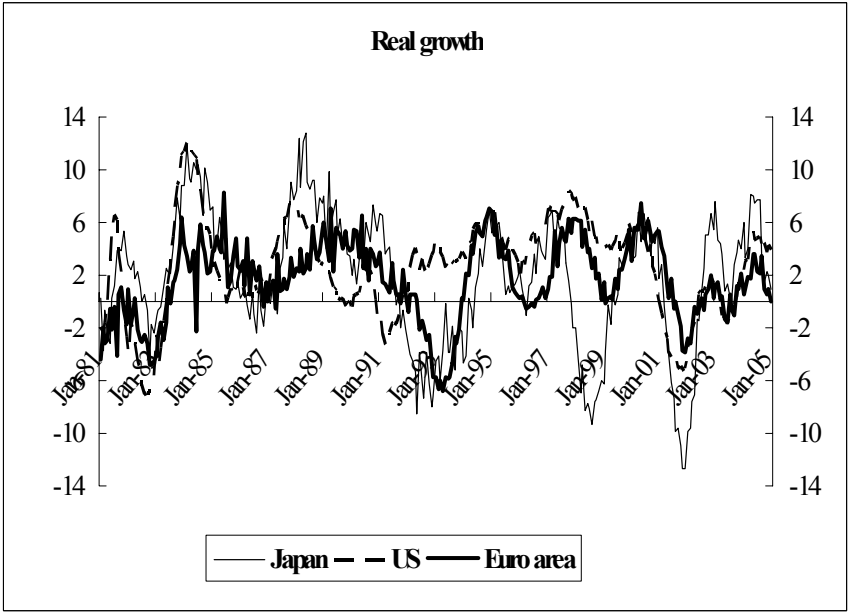
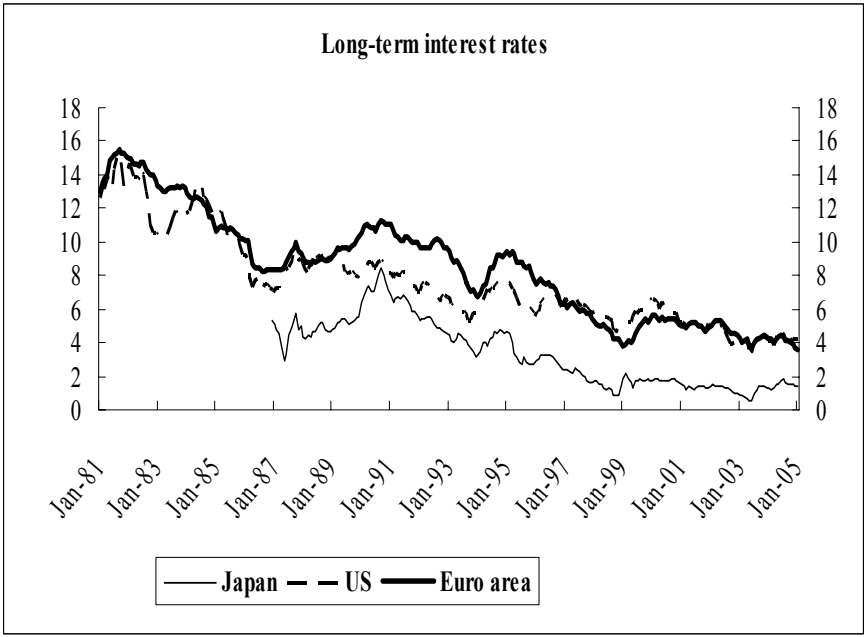
**Figure 5 Some Economic Developments in the Euro Area, the US and Japan**

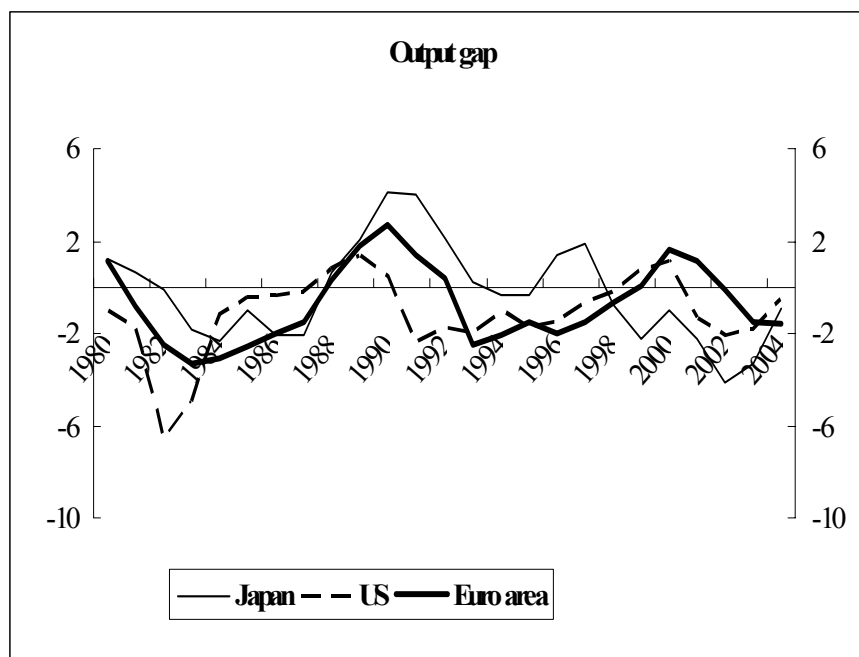


<sup>28</sup> Since the early 1990s, the process of disinflation has been accompanied by significant fiscal consolidation in the euro area (not shown). Furthermore, when considering the euro area, the most recent period is also characterised by the disappearance of the nominal exchange rate and, to a large extent, of inflation risk premia; a slowdown in productivity and population growth; and increasing credibility of the convergence process (although at different speeds across national economies).

<sup>29</sup> All data used are on a monthly frequency; therefore, the changes inevitably exhibit some volatility.





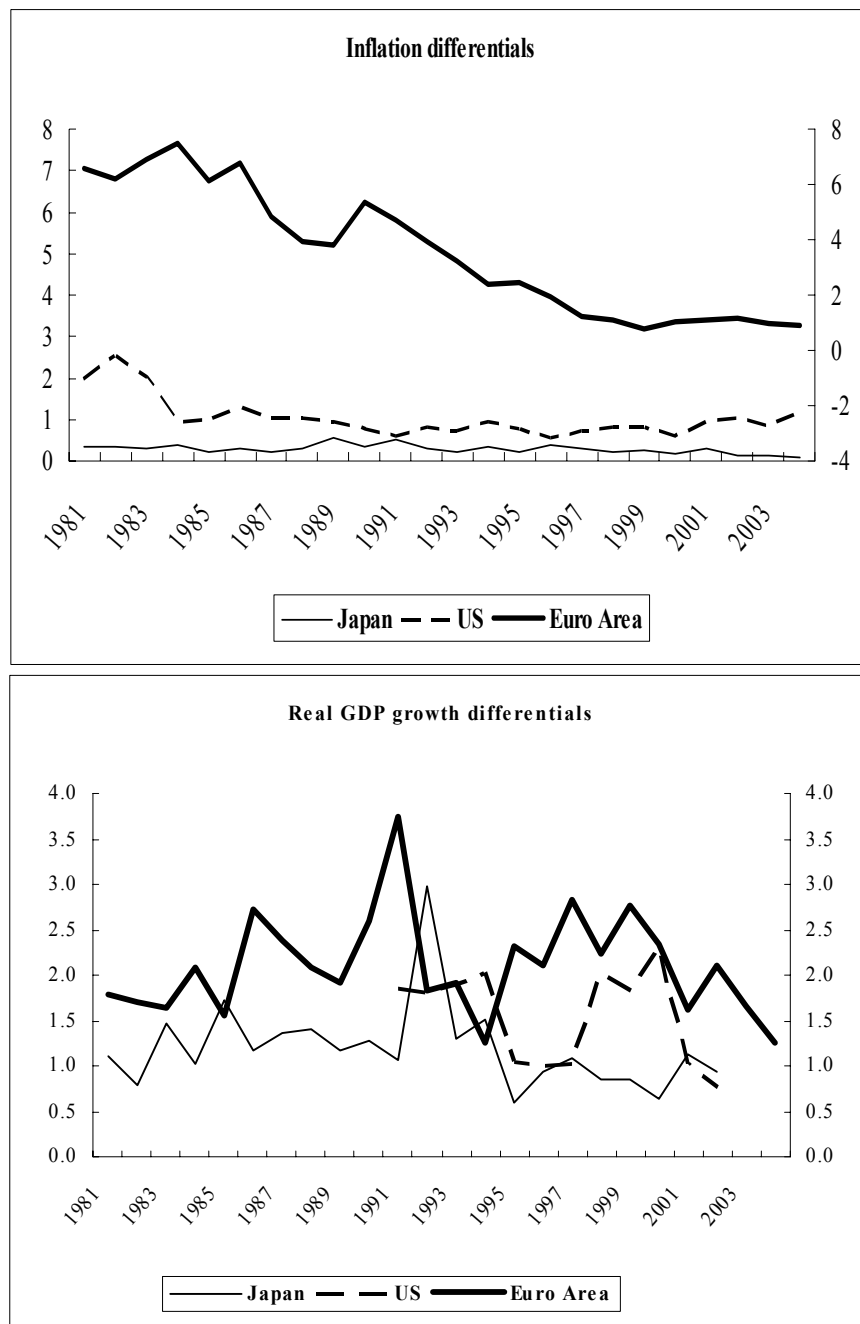


Sources: Bank for International Settlements (BIS), Eurostat, the Organisation for Economic Co-operation and Development (OECD).

Note: Short-term and long-term interest rates are in percentages per annum; real growth and inflation rates are calculated as annual percentage changes; the output gap is in percent.

We now focus on illustrating some differentials within the three geographical areas. For the US we use data regarding the US census regions; for Japan we use data for the 10 Japanese districts; and for the euro area, we consider the data for the 12 euro area countries. The data refer to the main macroeconomic variables which are readily available for all three geographical areas. However, just looking at inflation and growth differentials within the three areas (as measured by the standard deviation, see Figure 6), an important phenomenon is worth noting with regard to the inflation dispersion: with the exception of the early 1980s, inflation dispersion in the US has remained within a considerably narrow range, whereas in the euro area it has been on a downward path (like the developments in the euro area inflation rate), and has reached levels comparable to those for the US just prior to the launch of the euro. Inflation differentials in Japan have remained at a very low level since the 1980s. The second chart in Figure 6 also illustrates a decline, albeit uneven over the sample period, in real growth differentials among euro area countries. Data for the US census regions are only available starting in 1991.

**Figure 6 Inflation and Growth Differentials in the Euro Area, the US and Japan**



Sources: BIS, Eurostat, US Bureau of economic analysis.

Note: Unweighted standard deviation, annual data for the US census regions, the 12 euro area countries, and the 10 Japanese districts.

In summary, these few stylised facts seem to suggest that, during the 1980s and the 1990s, the future euro area exhibited more significant, albeit declining, internal differentials across its future Member States than was the case with the US census regions and the ten Japanese districts. However,

these differentials in inflation and growth have all sharply declined over the last 10-15 years. To some extent, the Fed and the BoJ still operate in a more harmonious economic and financial environment which is also characterised by a high degree of central policymaking (federal versus state fiscal policies).

Some further differences are worth noting regarding the policy environment in which the ECB conducts monetary policy vis-à-vis the Fed and the BoJ. In the euro area, monetary policy is delegated to a new supranational European institution, the Eurosystem. However, while the so-called “transfer of sovereignty” in the monetary field has been completed successfully, other areas of economic policy, such as fiscal and structural policies, still remain decentralised.<sup>30</sup> This puts the Eurosystem in a unique position compared to the other actors in the euro area as well as the EU and its various institutions. In particular, a single European monetary policy is compatible with responsibilities for many other policy areas, remaining firmly rooted at the national level, as long as the minimum set of common objectives, principles and rules established in the Treaty are followed in letter as well as in spirit. The Fed and the BoJ, by contrast, do not face such challenges.

## **4. Estimation of simple monetary policy reaction functions**

We now turn to the similarities and differences in the actual implementation of the monetary policies of the three central banks. While the previous sections have largely focused on a descriptive methodology, we now have to examine some more objective elements in order to corroborate our previous findings in order to gain a deeper understanding of the similarities and differences between the central banks.

This section analyses the differences with respect to actual monetary policy in practice, using information derived from Taylor rules. Sub-section 4.1 contains a general discussion of the use of Taylor rules, while sub-section 4.2 estimates the monetary policy reaction functions within this framework for each of the three central banks.

### ***4.1 A brief presentation of the Taylor rule***

The use of this monetary policy reaction function is quite well established in the literature in order to describe how a central bank sets its policy instruments in response to economic circumstances. The Taylor rule is a simple rule which has become rather popular both in the academic literature and among professional central bank watchers in recent years, ever since Taylor (1993a) showed that the policy actions of the US monetary authorities could be closely replicated using a

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<sup>30</sup> Although fiscal policies are subject to the provisions of the Stability and Growth Pact (SGP).

simple reaction function based on a small number of variables. This rule specifies that the central bank sets its instrument — the interest rate — in order to react to two key goal variables: the deviations of contemporaneous (forecast) inflation from an inflation target, and the deviations of real output from its long-run potential level.<sup>31</sup>

Therefore, by focusing on policy responses to these key variables, the Taylor rule implicitly captures policy responses to economic factors that affect the evolution of these key variables. This rule is simultaneously very simple and capable of capturing the essential elements of regimes in which the central bank looks at a wider range of variables and relates the policy instrument to current economic conditions.<sup>32</sup>

Notwithstanding the simplicity and elegance of the Taylor rule and its popularity in the literature, three general criticisms have to be kept in mind when using Taylor rules to assess monetary policy. First, it cannot be assumed that all relevant information needed to conduct monetary policy is encapsulated in the current inflation rate and the output gap. Other variables may indeed be highly indicative of macroeconomic developments and could help interpret the current economic situation, such as monetary and credit aggregates, private sector expectations, fluctuations in exchange rates, stock valuations, fiscal indicators, variations in international commodity prices, and wage agreements.

Second, different sources of shocks call for very different policy responses. The need for monetary policy to react to incoming new evidence may depend on whether shocks arise from the supply or the demand side of the economy, and whether they represent temporary disturbances to an unchanged underlying structure or a lasting alteration in the economic parameters. From this perspective, Taylor rules, in restricting the information which triggers policy decisions, are not a reliable guide for policy-making. Therefore, the assumption that the decision-making body of any central bank could base its decisions exclusively on the information content of inflation and the output gap is a gross simplification.<sup>33</sup>

Third, it is well-documented in the recent literature that Taylor rules can themselves be a source of genuine economic instability, by leaving the real economy without an anchor (this issue is, however, not dealt with in this paper).<sup>34</sup> To sum up, quoting Orphanides, “[the] historical analysis

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<sup>31</sup> Despite its simplicity, the academic literature has shown that Taylor rules have to be interpreted with a grain of salt. It is easy to show that, *inter alia*, the fitted parameters represent a convolution of parameters describing the central bank’s preferences and those describing the structure of the economy (see Favero, 2001).

<sup>32</sup> According to Taylor (1993a), the success of such rules in replicating past behaviour would make it possible to define reaction functions that the authorities could follow in order to achieve their targets.

<sup>33</sup> As Orphanides (2001, p. 965) points out, “...retrospectively, the ‘appropriate’ policy setting for a particular quarter may appear different with subsequent renditions of the data necessary to evaluate the rule for that quarter”.

<sup>34</sup> These pathologies can even occur when a stabilising Taylor rule (i.e. a rule characterised by an inflation response higher than unity) is followed. Christiano and Rostagno (2001) have shown that monetary monitoring (i.e. a policy that includes a commitment to switch to a monetary growth target in the event that the economy slips into deflation) might be helpful in such a case.

suggests that the Taylor rule appears to serve as a useful organising device for interpreting past policy decisions and mistakes, but adoption of the Taylor-rule framework for policy analysis is not insurance that past policy mistakes would not have occurred.”<sup>35</sup> Notwithstanding these caveats, a comparison of Taylor rules across the ECB, the Fed and the BoJ might, to some extent, help in understanding whether the responses of these central banks to their contingent economic factors differ and, if so, by how much.

Following a specification widely used in the literature, central bank behaviour can be described by a version of the Taylor rule, with an interest rate smoothing specification as follows:

$$i_t = (1 - \rho)\alpha + (1 - \rho)\beta\pi_t + (1 - \rho)\gamma(y_t - \bar{y}) + \rho i_{t-1} + \varepsilon_t \quad (1)$$

where  $i$  is the measure of the interest rate,  $\pi_t$  is the annual inflation rate at time  $t$  and  $y_t - \bar{y}$  is the output gap at time  $t$ . This specification of the Taylor rule contains the interest rate smoothing term,  $i_{t-1}$ , on the basis that central banks appear to adjust interest rates in a gradual fashion, slowly bringing the rate towards its desired setting or “target” level.<sup>36</sup> With an inflation parameter larger than unity, the rule indicates that the short-term real interest rate should be increased whenever inflation rises, thus exerting a stabilising effect on inflation (this is usually denoted as “Taylor principle”). In addition to the standard Taylor rule (with and without interest rate smoothing), we also investigate an extended version of the Taylor rule, which includes in the feedback list of the baseline Taylor rule (which is typically very restricted in terms of variables) other potential additional explanatory variables for the interest rate path. Among these variables, we consider the importance of monetary aggregates (especially in the euro area) as well as the cross-influence of the monetary policy in each country. In this case, using  $x_t$  to denote the additional explanatory variables, equation (1) can be rewritten as follows:

$$i_t = (1 - \rho)\alpha + (1 - \rho)\beta\pi_{t+n} + (1 - \rho)\gamma(y_t - \bar{y}) + (1 - \rho)\delta x_t + \rho i_{t-1} + \varepsilon_t. \quad (2)$$

## 4.2 Some Taylor rule estimations for the three central banks

We can now estimate monetary policy reaction functions for the three central banks, starting with the baseline specification. The sample (based on monthly observations) over which the estimates are made is initially for the period from January 1993 to December 2004. This allows us to take into

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<sup>35</sup> Orphanides (2003), p. 984.

<sup>36</sup> Of course, the dynamics of adjustment of the interest rate with respect to its recommended level can assume different forms (see, for instance, Judd and Rudebush, 1998).

account for the euro area the period after the Maastricht Treaty entered into force and the convergence period among the euro area countries started. The following variables are used: the interest rate is the three-month interest rate<sup>37</sup>, while inflation is calculated as the (annual) change in CPIs. In addition, we model the output gap as the difference between real GDP (converted from quarterly into monthly data using cubic interpolation) and the corresponding equilibrium measure.<sup>38</sup>

To take potential simultaneities into account, we estimate the equations using the Generalised Method of Moments (GMM). Table 4 contains the results of the estimations of equation (1).

**Table 4 Standard Taylor Rules with Interest Rate Smoothing for the Euro Area, the US and Japan**

<i>Country</i>	$\alpha$	$\beta$	$\gamma$	$\rho$	$R^2$	<i>J-Stat.</i>
<b>Euro area</b>	0.94 (0.58)	1.50 (0.32)	0.83 (0.46)	0.90 (0.03)	0.99	0.04
<b>US</b>	3.54 (1.85)	0.26 (0.71)	2.45 (1.43)	0.97 (0.02)	0.99	0.08
<b>Japan</b>	0.55 (0.71)	1.83 (1.70)	0.18 (1.12)	0.99 (0.02)	0.99	0.04

*Note:* Standard errors in brackets. Sample period: January 1993-December 2004. In the case of Japan, a dummy variable has been introduced to take into account the effects of the increase of the consumption tax in April 1997, which is assumed to last one year.

The following conclusions can be drawn from the table. In all cases, the coefficient of determination is around 0.99, while the J-statistics indicate the validity of the instruments. As has been widely documented in the literature, all three central banks show a high degree of interest rate smoothing. The only central bank that shows a significant response to real growth seems to be the Fed, which includes potential output growth in its objectives. As indicated by the high and above-unity coefficient, the ECB places special emphasis on inflation, and is thus the only case where the so-called ‘Taylor principle’ has been fulfilled since 1993. In the case of Japan, the insignificance of all coefficients with the exception of the lagged interest rate shows that our simple framework does not seem to capture very accurately the special challenges faced by the BoJ. The high degree of inertia

<sup>37</sup> However, it should be noted that the three-month interest rate also embodies market expectations. Nevertheless, this choice is made for reasons of comparability (the EONIA only exists since 1999).

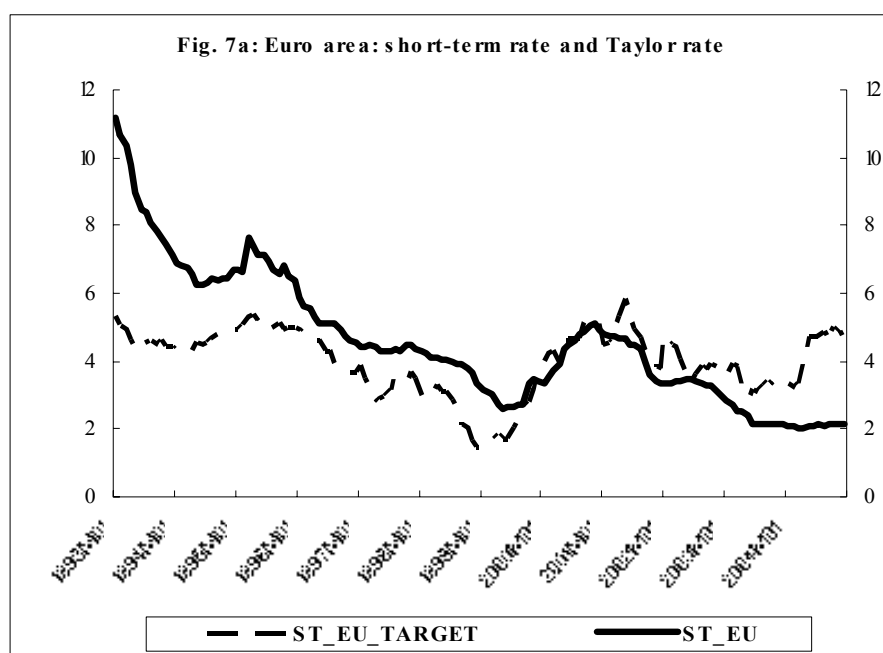
<sup>38</sup> The output gap has been modelled as the difference between the (log of) real GDP and the value derived by applying a Christiano-Fitzgerald band pass filter. The latter was chosen in the light of the widely documented deficiencies of the Hodrick-Prescott filter at the end of the sample.

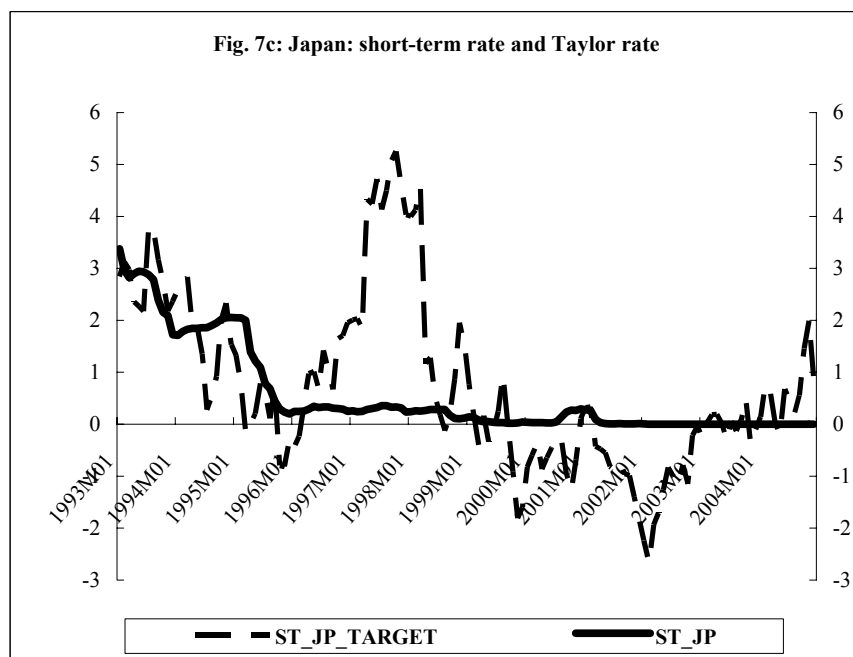
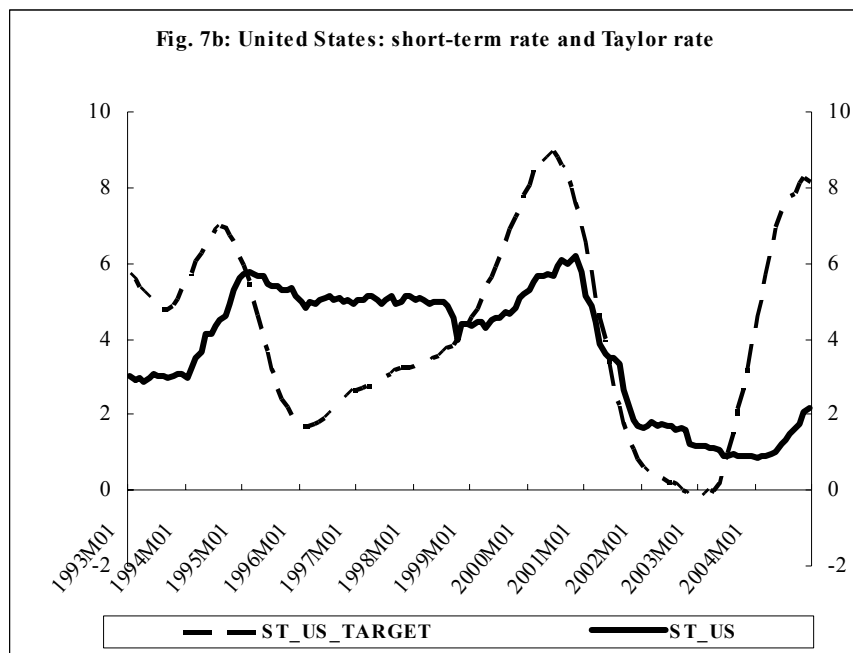


confronting Japan is, however, in line with the zero-interest rate policy followed by the BoJ for a considerable time period.

The latter finding is also confirmed by a closer inspection of three-month interest rates for the respective areas and the rate implied by the Taylor rule, which may also help to explain the behaviour of the three central banks. Figures 7a, 7b and 7c seem to show that, with the exception of some marked, and sometimes even protracted, periods of notable temporary deviations, the short-term interest rates and rates implied by the Taylor rule seem to have followed a broadly similar pattern, especially for the euro area and the US. Substantial deviations are, however, notable since mid-2003 in the euro area, which marked the beginning of the constant low interest rate period, while for the US, deviations are more widespread throughout the sample. For Japan, the figures show that in 1995 the country basically entered a different regime, a fact that is again clearly reflected by the introduction of a zero-interest rate policy.

**Figure 7 The Taylor Rule and Actual Interest Rates**





This notwithstanding, some considerations should be taken into account. First, for some countries such as the US, a longer sample might be more of interest, as the US's commitment to fight inflation dates back to the late 1970s. At the same time, given the zero-interest rate policy followed since 1995 in Japan, it would be interesting to exclude the following years when Japan embarked on a different monetary policy regime. Finally, it would be interesting for the euro area, on the basis of the two-pillar strategy, to add an additional variable (namely the stock of M3, under the form of the deviation

of the annual M3 growth rate from its reference value)<sup>39</sup> to the reaction function. We also test the possible influence of US monetary policy on the euro area. Table 5 contains the results of these estimations.

**Table 5 Variants of Taylor Rule Estimations for the Euro Area, the US and Japan**

Country	$\alpha$	$\beta$	$\gamma$	$\delta$	$\rho$	$R^2$	J-Stat.
<b>Euro area (with money)</b>	6.45 (0.70)	1.55 (0.17)	-0.02 (0.28)	-1.01 (0.12)	0.90 (0.02)	0.99	0.09
<b>Euro area (with US interest rate)</b>	0.14 (0.58)	0.64 (0.23)	-0.86 (0.17)	0.62 (0.10)	0.91 (0.01)	0.99	0.13
<b>US (1980.01-2004.12)</b>	0.43 (1.19)	1.40 (0.35)	0.40 (0.44)		0.95 (0.03)	0.98	0.03
<b>Japan (1980.01-1994.12)</b>	3.25 (0.32)	1.03 (0.13)	0.42 (0.24)		0.73 (0.13)	0.96	0.02

*Note:* Standard errors in brackets. In the case of Japan, a dummy variable has been introduced to take into account the effects of the introduction of the consumption tax in April 1989, which is assumed to last one year.

It is striking that, in the case of the euro area, while the Taylor principle continues to be satisfied, the change in money exhibits the opposite sign that one would expect. However, this might be attributable to the fact that, prior to 1999, the ECB did not exist, and that the countries that now comprise the euro area had different policies with regard to money. Conversely, the US federal rate turns out to be positively significant, while the inflation coefficient decreases below one.

Moreover, the results for the US now more closely resemble those for the euro area over the shorter sample. This confirms the early findings of Clarida, Gali and Gertler (1998), according to which the Fed had maintained its reputation of aggressively combating inflation. With regard to Japan, all the variables enter now with the right sign, although the response of inflation is relatively small and not statistically significant. However, when using industrial production along the lines of Clarida, Gali and Gertler, the Taylor principle is satisfied.

In the remainder of this section, the Taylor rule analysis is extended to allow for the time-varying nature of the implicit equilibrium real interest rate, instead of assuming a constant term in the

<sup>39</sup> More detailed information on the calculation of the money growth gap before 1999 can be found in Gerdesmeier and Roffia (2003).

equation.<sup>40</sup> More precisely, the equilibrium real interest rate is derived within a Kalman filter framework. In this context, it is assumed that, in the baseline specification of the Taylor rule (see equation (1)), the constant (from which the equilibrium real interest rate is derived) follows a random walk, whereas the other coefficients are assumed to be constant across the sample period. In order to derive the equilibrium real interest rate, the following procedure is adopted. We first estimate equation (1) by means of GMM, and afterwards re-estimate it using a Kalman filter approach, where – in order to avoid potential simultaneity biases – we restrict the equation coefficients apart from the constant to their GMM parameter values. The Kalman filter algorithm provides *a posteriori* estimates of the coefficient vector by means of expression for the expectation of this vector constrained by the information set up to the period  $t$  and the hyperparameter vector.<sup>41</sup> This conditional mean provides an estimator for the coefficient vector in that it minimises the mean square error.<sup>42</sup> This yields:

$$i_t = (1 - \rho)\alpha + (1 - \rho)\beta\pi_{t+n} + (1 - \rho)\gamma(y_t - \bar{y}) + \rho i_{t-1} + \varepsilon_t, \quad (3)$$

where  $\alpha_t = \alpha_{t-1} + \eta_t$  and  $\varepsilon_t \sim N(0, \sigma^2)$ ,  $\eta_t \sim N(0, Q)$  and  $\vartheta_0 \sim N(a_0, \Sigma_0)$ .<sup>43</sup>

We then calculate the equilibrium real interest rates using the following formula:<sup>44</sup>

$$\bar{r}_t = [(\beta - 1) \cdot \bar{\pi} + \alpha_t] \quad (4)$$

where  $\bar{\pi}$  denotes the time-varying inflation objective.<sup>45</sup> Figure 8 shows the respective estimates for the equilibrium real interest rates in the euro area (from 1993 to 2004), the US (from 1980 to 2004) and Japan (from 1983 to 1994).<sup>46</sup> While all three measures seem to show plausible magnitudes, there seems to be more volatility for the US and Japan than for the euro area.<sup>47</sup> Moreover, it is interesting

<sup>40</sup> See also Okina and Shiratsuka (2002) for a similar attempt. Modelling the original constant term ( $\alpha$ ) as time-varying is equivalent to assuming a time-varying equilibrium real interest rate and a time-varying inflation objective. Such a procedure prevents changes in the equilibrium real interest rates from being offset by changes in the inflation objective of the same size; the latter fact clearly cannot be assumed for Japan in the 1990s. Besides, assuming a time-varying  $\alpha$  is consistent with our definition of the output gap, i.e. the deviation of output from the Christiano-Fitzgerald band pass filtering trend.

<sup>41</sup> For a more detailed discussion of the state-space modelling framework in econometrics, see Hamilton (1994).

<sup>42</sup> See Harvey (1990) for a more technical description of the properties of the Kalman filter.

<sup>43</sup> We further assume the errors of measurement and transition equations to be mutually and serially uncorrelated.

<sup>44</sup> When comparing the value of the equilibrium real interest rate obtained with the GMM method with the respective average value obtained with the Kalman filter framework, it turns out that for the euro area and Japan the difference is negligible, whereas for the United States the average Kalman filtered value lies above the respective GMM value, possibly due to its downward trend (which is more pronounced than in the case of the other two areas) over the last two decades.

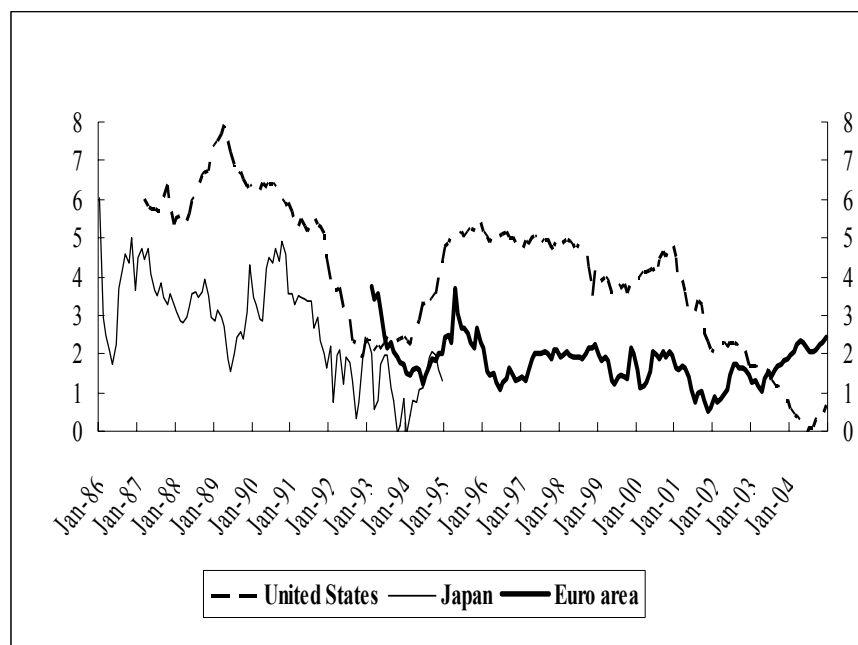
<sup>45</sup> For the euro area, we use the measure derived in Gerlach and Svensson (2003). For the US, we assume an inflation objective of 2 percent, as advocated by Taylor (1993a, 1993b). For Japan, we assume 1 percent as an inflation objective, as this was conveyed as being in line with most board members' views of stable prices (see BoJ, 2006).

<sup>46</sup> The series derived for the equilibrium real interest rate are shown starting a few months after the beginning of the sample.

<sup>47</sup> It should be noted, however, that the results do not – in qualitative terms – greatly differ from some of those obtained by Clark and Kozicki (2005, p. 402), for instance.

how close the neutral rates for the US and the euro area are at the end of the sample period. Overall, the results seem to warrant further exploration, especially with respect to alternative frameworks and tools which could be adopted in this type of analysis.<sup>48</sup>

**Figure 8 Estimates of the Time-Varying Equilibrium Real Interest Rates**



## 5. Conclusions

This paper has analysed the similarities and the differences among the Eurosystem, the Fed and the BoJ. It finds that, while several of their tasks and their respective legal statuses differ somewhat, there are fewer differences in their institutional structures and monetary frameworks, as well as the use of instruments. Central banking practices around the world have also evolved in the direction of greater independence, transparency and the adoption of monetary policy committees, among other developments. This has contributed to reducing the differences among the three institutions, a trend that can also be observed among other central banks.

There are, however, some *de facto* differences in the way monetary policy committees operate. For example, when taking monetary policy decisions, both the Governing Council of the ECB and the Board of Governors of the Fed officially act by simple majority voting. In practice, both the Governing Council and the FOMC operate as collegial committees. Yet, while the former functions as

<sup>48</sup> See, for example, Laubach and Williams (2003).

a genuinely collegial committee practising consensus voting, in the latter the chairman has scope to steer the agenda very tightly. The Policy Board of the BoJ, by contrast, operates in a much more individualistic manner than the other two. In early 2006 the BoJ revised its framework by quantifying its price stability objective in the medium and long term, and by setting a yearly revision of a more precise target by the Policy Board members.

There are also some differences in terms of communication strategies, although, overall, the responsiveness of the financial market seems high for both the Eurosystem (concerning monetary policy inclinations) and the Fed (regarding monetary policy inclinations and views on the economic outlook). However, the Fed does not quantify its definition of price stability, whereas the ECB and the BoJ do. Nor does it spell out a fully fledged monetary policy (again in contrast to the ECB and the BoJ). The ECB does not publish the minutes of its Governing Council meetings, unlike the Fed and the BoJ, although it should be noted that the ECB does provide extensive real-time information after interest rate decisions have been taken, and that the decision not to publish voting records has to be seen against the background of potential public pressures that the members of the Governing Council might face from their respective home countries. All these elements, however, seem to have little impact on the actual conduct of monetary policy, and might mainly be explained by institutional factors.

As for the economic and financial environment, over the past two decades all three central banks have faced a series of diverse challenges, some of them country-specific (as in the case of Japan), and others more global in nature. Early in the sample period, conditions differed considerably in the three currency areas, with a much higher dispersion among euro area Member States than within the US and Japan.<sup>49</sup> However, these differences have abated in recent years.

A comparison based on a very simplistic policy reaction function framework à-la-Taylor shows no striking differences in the implementation of monetary policy. It can, therefore, be concluded that, in practice, the monetary policies of the Eurosystem, the Fed and the BoJ (if we exclude the more recent challenging period) fundamentally do not differ that much.

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<sup>49</sup> The economic and financial environment is likely to continue to change for the euro area due to the effects of the euro, which should foster further economic and financial integration among euro area Member States.

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