European Monetary Policy under Jean-Claude Trichet

BRIEFING NOTE

Abstract

The change of the ECB's president is a moment to take stock. Since January 1999, the ECB has gone through three major phases: foundation, consolidation and financial crisis. Through all this period it has achieved its primary and secondary objectives with remarkable precision. We estimate a reaction function and find that under Trichet, increased credibility and a more stable macroeconomic environment allowed monetary policy to shift focus in favour of employment and financial stability. Handling the financial crisis was Trichet's master piece, although Member States have not made it easier for the bank. We conclude by saying:

Bravo et m*erci, Monsieur Trichet!* And *Buona fortuna, Presidente Draghi!*

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EXECUTIVE SUMMARY

On 1 November 2003, Jean-Claude Trichet took over as President of the European Central Bank (ECB) from Wim Duisenberg. Eight years later on 1 November 2011, he will now hand over to Mario Draghi. This is a good moment to take stock and review the performance of the ECB, since it started operating on 1 January 1999, and to assess the perspectives for the future. After a short overview of the monetary policy environment, I will evaluate the Bank's achievements with respect to inflation, growth and employment. I will then show how monetary policy under Trichet was different from the Duisenberg Era, and I will discuss the ECB's role in the crisis after 2008. I will conclude on some future perspectives.

1. OVERVIEW

Since European Monetary Union started on 1 January 1999, the ECB has gone through three major phases: foundation, consolidation and financial crisis. Wim Duisenberg presided over the first, Jean-Claude Trichet over the other two. However, one has to keep in mind that the composition of the ECB's directory has also changed, as Figure 1 reminds us.

Figure 1
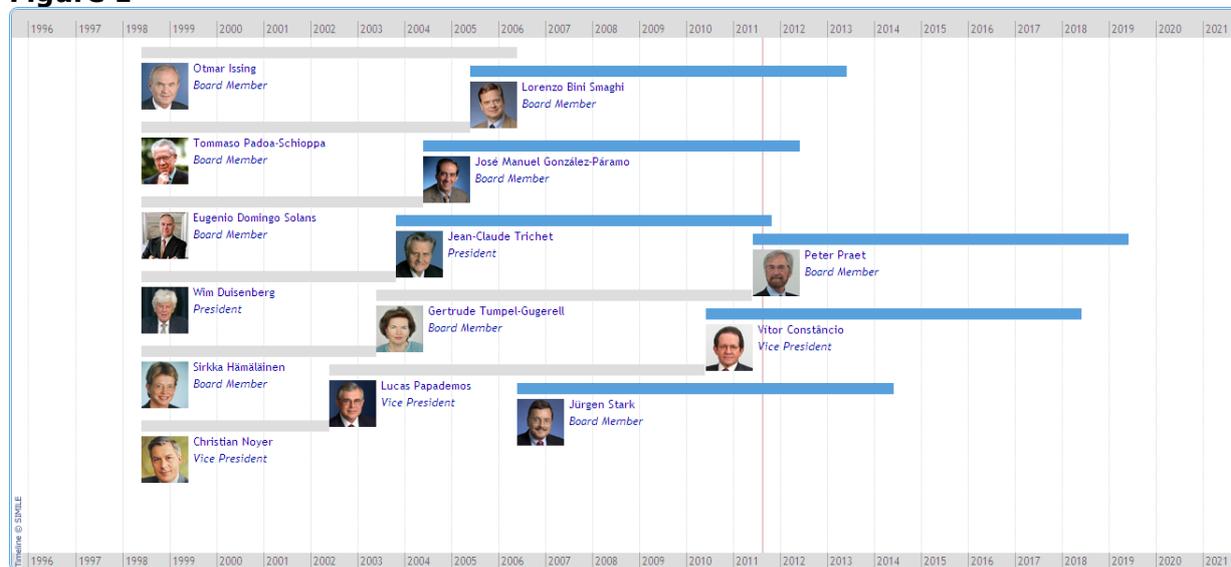
Source: ECB

1.1. Foundations

When the ECB started its operations in 1999, it was handicapped by large uncertainties. The new bank had no track record. No one knew whether people and financial markets would accept the new currency. Because monetary policy operates largely through communication and signals sent to financial markets, the ECB needed to build up a reputation that would allow it to conduct policies as effectively as any other central bank. Many observers judged the ECB against the standards set by the Bundesbank. The ECB and its President had to gain credibility as tough inflation fighters who were independent from European governments. On a technical level, there was significant heterogeneity in the functioning of national banking systems and uncertainty about how the combined monetary aggregates in the euro area would behave. Thus, it was not clear, how actors in different markets would respond to a given signal from the ECB.

The macroeconomic environment was also changing rapidly. It was hit by a series of shocks. Some economists had expected that the new currency would appreciate against the USD, while in fact it did actually weaken in the first two years. This was often seen as a lack of trust in the new currency. A weaker euro made imports more expensive, which added pressure on prices, especially from raw material imports. The oil price tripled in the first 20 months of the euro, raising fears that it could threaten price stability as it did in the 1970s. In 2000, the so-called dot.com bubble burst and monetary policy worldwide became accommodating. In this context, the ECB took a hard line to maintain its "conservative" reputation[1]. While this strategy seemed to have worked and achieved its purpose, the bank
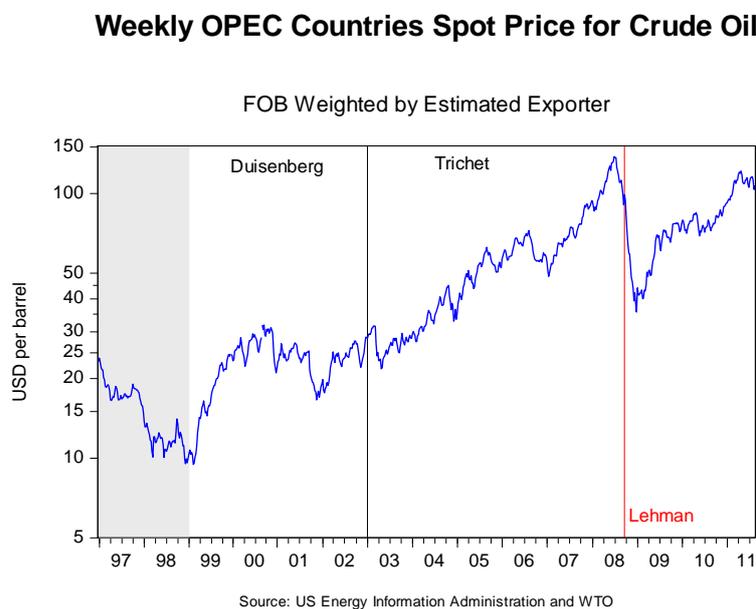
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[1] In an influential article, Rogoff (1985) had proposed the delegation of monetary policy to a central banker who is more averse to inflation than the government, in the sense that he places a greater weight on the loss from

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was coming under increasing criticism for stifling economic growth, especially when its policy was compared with the Fed under Chairman Greenspan's leadership. President Duisenberg was also frequently considered as clumsy in his communication; he was seen more often as a spokesman for the Bundesbank than as a leader in his own right and authority. Nevertheless, the introduction of euro bank notes had been a technical success, even if, due to framing problems, the impression of price rises due to the changeover exceeded reality (Sturm et al. 2009; Jemec, 2010). By the time Jean Claude Trichet took over office, the ECB was well established and had gained esteem and credibility. The ECB was increasingly seen as a central bank like any other and this perception was instrumental for making it actually so.

1.2. Consolidation

The first four years of Trichet's presidency were blessed with a fairly stable macroeconomic environment. Inflation was under control, unemployment on the way down. Oil price inflation did not spill over into "second round" wage increases as in the 1970s. On the foreign exchange markets, the euro had started to appreciate and the volatility was contained. See Figure 2 and 3. The communication management improved. As governor of the Banque de France Trichet had already established a personal reputation as a "conservative" Central banker and this reinforced his credibility at the ECB.

Figure 2

Weekly OPEC Countries Spot Price for Crude Oil

FOB Weighted by Estimated Exporter

Source: US Energy Information Administration and WTO

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inflation than the government does. While such a "weight-conservative" central banker will, in equilibrium, produce a lower inflation bias than the government, his stabilization of the real economy will be suboptimally low from the government's point of view. See also Herrendorf and Lockwood, 1997.

Figure 3

US Dollar per Euro

Hodrick-Prescott Filter (lambda=6812100)

Source: Bloomberg
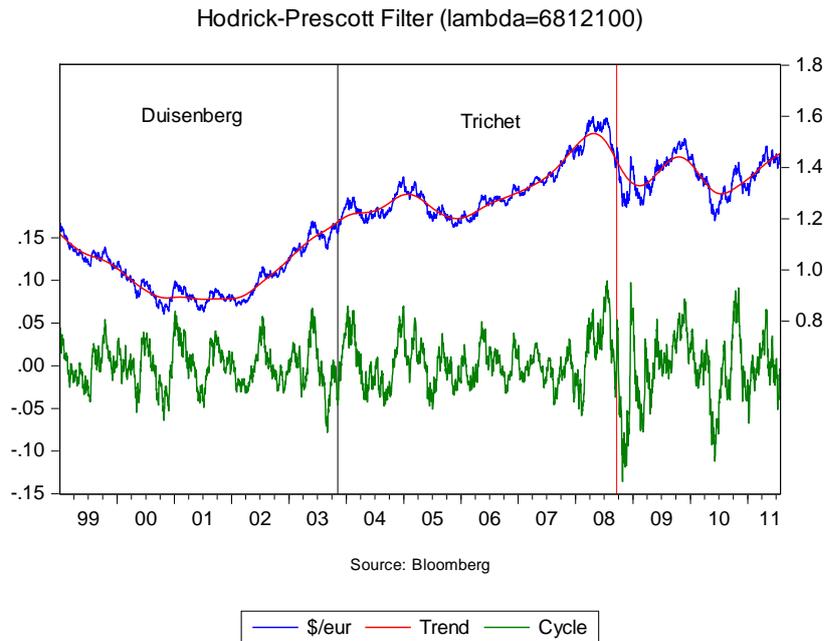
Most importantly, the new stable macroeconomic environment allowed the bank to marginally shift its policy focus. Monetary policy became more growth-oriented without losing its strong anti-inflation stance. This became an important asset in the second half of Trichet's tenure, when the financial crisis overshadowed everything and the ECB had to introduce new and non-standard monetary policies.

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1.3. Crisis management

In the second half of Trichet's tenure, the economic environment deteriorated dramatically. Inflation started to accelerate after 2005, and the ECB tightened its policy. In 2007, dangers in the US-credit markets became apparent; they exploded with the Lehman collapse in September 2008. Euro area GDP fell by 5.25 percent, unemployment shot up and public debt to GDP ratios increased everywhere. The handling of the crisis was Trichet's master piece. In line with all major central banks, the ECB slashed interest rates to levels close to zero and it provided unlimited liquidity to stabilize financial markets. The ECB was able to prevent a meltdown of the European Banking system and cooperates with other major central banks in order to avoid a global depression.

Yet, the crisis is not over. In 2009, after a change in government, the Greek debt crisis has destabilized financial markets massively. In May 2010, after the European Council had agreed to set up the European Financial Stability Facility (EFSF), the ECB responded by buying sovereign debt in the secondary market. While this is a banal open market operation for most central banks in the world, it was innovative in Europe because the ECB used to provide liquidity to banks through repo operations rather than outright purchases. This policy shift gave the ECB an additional tool for preventing disruption in financial markets and stabilizing the European banking system. Since 2010 it has made use of this procedure repeatedly, most recently to stabilize the bond markets for Spanish and Italian government debt. However, the operations have also made the ECB more vulnerable. Sovereign defaults could have serious consequences for the ECB's asset structure and own funds. Most importantly, however, the ECB has become involved in a power struggle with national governments, while some governments, especially in Germany, Slovakia and Finland, have resisted providing funds to overcome the liquidity crisis. The ECB under Trichet's leadership was able to ensure a minimum of European coherence, which national governments failed to do. Jean-Claude Trichet's speech in Aachen, where he called for a European Treasury and Finance Minister will remain his legacy.

2. ASSESSING THE ECB´S PERFORMANCE

The objectives for European monetary policy have been stipulated by all Treaties since Maastricht and are now part of the Lisbon Treaties. They are stated as asymmetric objectives.

According to Article. 127(1) TFEU: "The primary objective of the European System of Central Banks shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union".

In addition Article 127(5) TFEU states: "The ESCB shall contribute to the smooth conduct of policies pursued by the competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system."

These are the priority goals for the ECB. However, the overall economic objectives of the Union set in Article 3 of the TEU broaden the brief. Article 3(1) TEU states: "The Union's aim is to promote peace, its values and the *well-being of its peoples*. (…)" and in Paragraph 3 it is written "The Union shall establish an internal market. It shall work for the sustainable development of Europe based on *balanced economic growth and price stability*, a highly competitive social market economy, aiming at *full employment* and social progress, and a high level of protection and improvement of the quality of the environment".[2] In other words, provided price stability is assured, the ECB must support economic growth and employment and it must ensure the stability of the financial system. Hence it is not correct, as frequently claimed, that the ECB should *exclusively* focus on price stability. Under Trichet, the ECB took the Treaty more seriously with respect to all these objects.

2.1.   The ECB's primary objective: mission accomplished

Assessing the performance of the ECB must necessarily start with inflation, given that price stability is the primary objective of its monetary policy. Figure 4 shows the evolution of the inflation rate.

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[2] Emphasis added.

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Figure 4

Inflation in the Euro Area
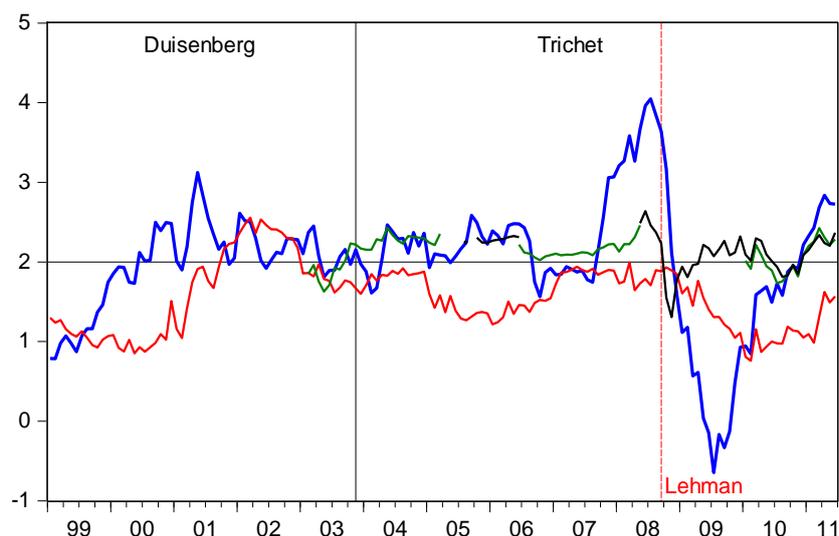
Source: ECB

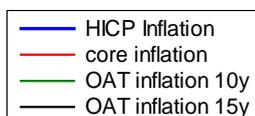The policy benchmark is the Harmonised Index of Consumer Prices (HICP), which, according to the ECB, should stay below 2% over the medium term. Table 1 shows that, over the full 150 months since Monetary Union started, the mean inflation rate was exactly 2%. For the Trichet period it was 0.2 percentage points higher, for Duisenberg equally 0.2 point lower. However, one cannot draw the conclusion that Trichet was less successful. During his tenure, the euro area went through much more dramatic shocks than under Duisenberg. This is clear from the huge swings in the inflation rate, visible in Figure 4, with a doubling of the inflation rate in the 12 months from July 2007 to July 2008 and then a dramatic fall after the Lehman collapse. This explosion and subsequent drop was due to prices in food and mainly energy as is clearly visible in Figure 2. The core inflation rate, which does not contain these items, has been much more stable with 1.55% for the whole 150 months and a lower rate with a negative differential of nearly 1 percentage point for Trichet when compared with Duisenberg. Quite a remarkable achievement.

We can also look at inflation expectations, as measured by OAT inflation indexed bonds. We find that inflation expectations are generally higher for the future. The 10 year forecast is on average 12 base points (bp) higher than the average of the last 150 months and the 15 year forecast increases by another 2 bp. The mean difference between Trichet and Duisenberg is 23 bp, which is small given the importance of price shocks that have occurred during the Trichet period.

Table 1 also shows estimates for the distribution of inflation rates. Not surprisingly, given the huge shocks in 2008 and 2009, the standard deviation from the mean is higher for the HICP during Trichet's years, but interestingly, it is lower for the core rate. Inflation expectations are more stable than actual performances. This is an indication that inflation expectation management by the ECB has been successful and improved under Trichet.

However, the question has frequently been raised, whether the ECB's inflation objective takes 2% as an *average* target or as a *top* ceiling. If it were a target, deviations from the

target should have a normal distribution; if it were a ceiling, we should expect to observe more points below than above the 2% line. The Jarque-Bera test rejects the null hypothesis of a normal distribution[3] for the HICP inflation rate and for expected inflation, but not necessarily for the core inflation. This would indicate that the ECB's actual target is closer to 1.5% than to 2%. But where is it? The skewness measure tells us on which side of the mean the observed inflation data are more frequent. A normal distribution has a skewness value of zero; a negative value implies that the distribution has a long left tail and the opposite if it is positive. We find that the skewness measure is always negative. Thus, we can conclude that there are significantly more months with less than the mean inflation rate than higher inflation. In other words, *the 2% overall achievement is conditioned on a few high outliers, without which the average inflation rate would have been lower.*

However, given the energy price shocks, this is not true for the core inflation rates. Here, the skewness indicates not only more values above the mean (which is what we would expect if the core inflation had a normal distribution), but also that there are more values than below the mean. Hence, we would *conclude that the ECB's effective inflation target is probably close to the median value of the core inflation*. Interestingly, the median is lower for Trichet than for Duisenberg. Thus, inflation expectation has fallen and confidence has increased under Trichet. Duisenberg's environment was less transparent than Trichet's. This is also supported by an analysis of the distribution of monthly inflation rates. The measure for Kurtosis indicates the peakedness or flatness of a distribution. A normal distribution has Kurtosis value of 3; if it is lower, the distribution is flat. We observe a significant increase of kurtosis during the Trichet years, which indicate that the *uncertainty around monetary policy has diminished despite the higher observed shocks.*

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[3] In other words, the probability of a normal distribution of inflation data around the mean is very close to zero (for the HICP it is 1.17 %).

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Table 1. Descriptive Statistics for Inflation

Inflation:	HICP	CORE	OATi -10Y	OATi -15Y
Total Period: 1.1.1999-30.6.2011				
Mean	2.00	1.55	2.12	2.14
Median	2.07	1.58	2.14	2.21
Maximum	4.05	2.56	2.46	2.64
Minimum	-0.65	0.76	1.63	1.31
Std. Dev.	0.789784	0.42876	0.183564	0.241389
Skewness	-0.579875	0.207338	-0.646389	-1.038265
Kurtosis	4.677911	2.327778	2.958903	4.834029
Jarque-Bera	26.00255	3.898992	4.740059	15.35128
Probability	0.000002	0.142346	0.093478	0.000464
Observations	150	150	68	48
Trichet Period: 1.11.2003-30.6.2011				
Mean	2.02	1.52	2.15	2.14
Median	2.09	1.56	2.17	2.21
Maximum	4.05	1.99	2.46	2.64
Minimum	-0.65	0.76	1.73	1.31
Std. Dev.	0.91907	0.321118	0.157553	0.241389
Skewness	-0.565936	-0.442641	-0.654117	-1.038265
Kurtosis	4.018013	2.136758	3.381216	4.834029
Jarque-Bera	8.883688	5.860831	4.564638	15.35128
Probability	0.011774	0.053375	0.102047	0.000464
Observations	92	92	59	48
Duisenberg period: 1.1.1999-31.10.2003				
Mean	1.98	1.61	1.92	
Median	2.05	1.67	1.91	
Maximum	3.12	2.56	2.23	
Minimum	0.79	0.85	1.63	
Std. Dev.	0.525711	0.553462	0.198931	
Skewness	-0.661935	0.192977	0.276371	
Kurtosis	3.074167	1.624261	2.140727	
Jarque-Bera	4.322073	5.018975	0.434947	
Probability	0.115206	0.08131	0.804549	
Observations	59	59	10	
Difference: Trichet - Duisenberg				
Mean	0.04	-0.08	0.23	
Median	0.04	-0.12	0.25	
Maximum	0.93	-0.56	0.23	
Minimum	-1.43	-0.09	0.10	
Std. Dev.	0.393359	-0.232344	-0.041378	
Skewness	0.095999	-0.635618	-0.930488	
Kurtosis	0.943846	0.512497	1.240489	

Source: own calculations

The overall image that emerges from these data is:

1. The ECB has achieved its primary objective of keeping price stability with impressive precision, despite an increasingly difficult economic environment during the later Trichet years.
2. The credibility and reliability of monetary policy has increased in the 8 Trichet years, compared to the 5 Duisenberg years.

2.2.   The second Treaty objective: supporting the real economy

Next we look at the other objectives of monetary policy. If the ECB has maintained price stability, it is obliged under the Treaty to support the other economic objectives of the European Union, in particular economic growth and high employment. How has it fared in this respect?

Figure 5

Souce: Centro Europa Ricerche
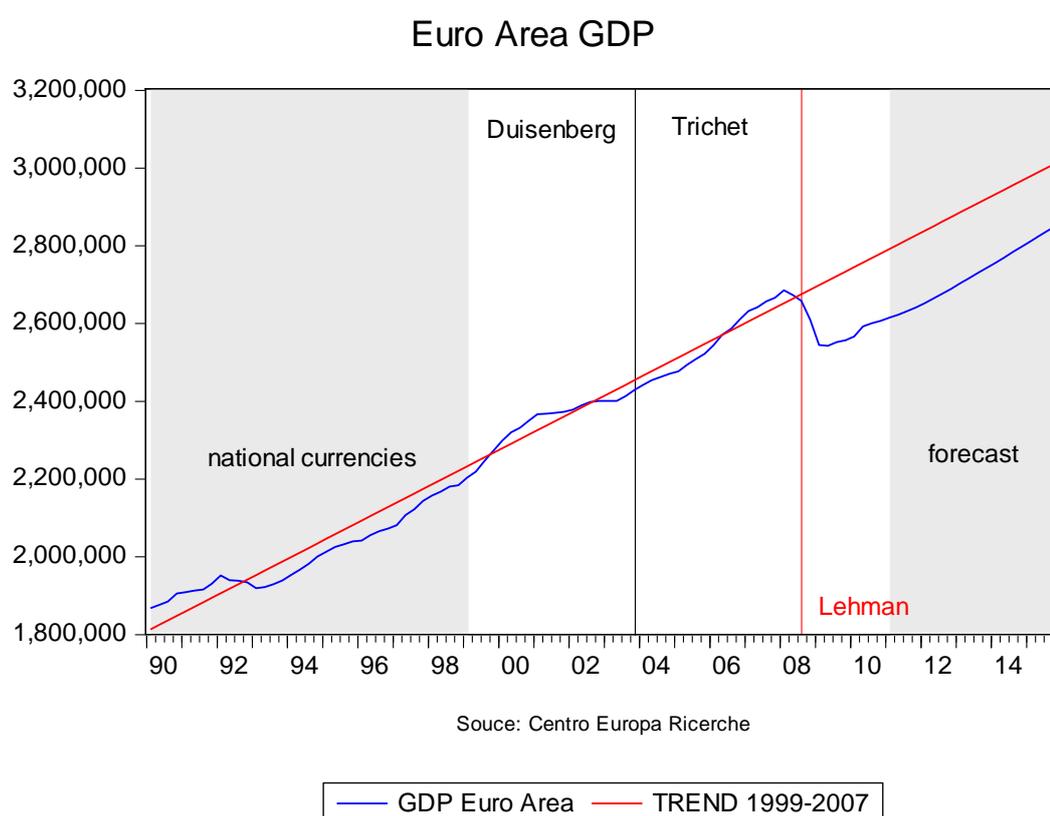
Figure 5 shows the time series for nominal GDP of the euro area. It also indicates the trend development based on the first decade of Monetary Union prior to the Lehman crisis. By taking a long term view back to the 1990s, we observe, first of all, that the crisis in the European Monetary System in 1992/93 caused output losses, which were not recuperated by higher growth in the following years. This is interesting, as it invalidates all those who believe an exit from the euro in the present crisis could solve the problems of Southern Europe. By contrast, we find, secondly, that with the start of European Monetary Union economic growth improves. No doubt this reflects the greater certainty for investment and the lower interest rates in the euro area and was especially important for the South. The rise in investment in 1999/2000 was also driven by the so-called dot.com bubble, i.e. by a global asset price inflation for new technological investment (see Figure 6). But when this

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bubble bursts with the crash of the Nasdaq in August 2000, it had serious consequences for firms' and banks' balance sheets and economic growth worldwide. This earlier financial crisis was, of course, not as toxic as the Lehman crisis, but it was prolonged by the uncertainties resulting in the US economy after 9/11, which further reinforced the global slowdown of growth, although it did not cause a recession in Europe.

Figure 6

NASDAQ Index and Trend Deviation
### Hodrick-Prescott Filter (lambda=14400)

Source: www.wrenresearch.com.
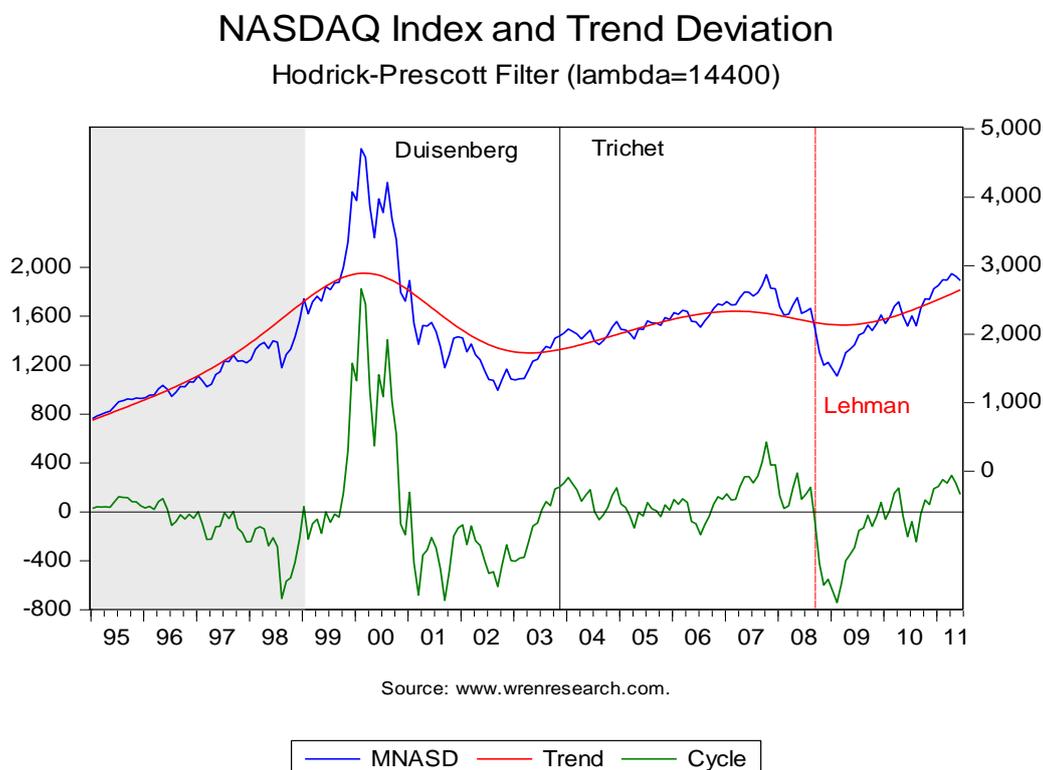
The period of contraction in the IT-sector took nearly 3 years to be cleaned out. Compared to the time it usually takes after property bubbles, this was short.[4] However, after the events of 9/11 in 2001, financial markets feared a recession and most central banks slashed interest rates. See Figure 7. The loosening of monetary policy was most pronounced in the United States, where interest rates fell to 1% in 2003. The UK did not lower interest rates to fall below 3.5 %, while the euro area stopped at 2%. Only after the Lehman crisis did the ECB allow interest rates below 2%, but at that time the inflation rate had already become negative. In other words, the ECB has always sought to keep expected real policy rates positive. This policy stands in sharp contrast to the United States, where real rates were permanently negative from mid 2002 to 2005. The three years of negative interest rates fuelled the American asset bubble, which started to destabilize financial markets in late 2007 and finally burst with the Lehman bankruptcy. During this period, the ECB was frequently attacked by economists for being too restrictive. However, the truth is that the ECB under Trichet pursued a more responsible course than the Fed under Greenspan. The only period, during which the charge of over-tightness might have been justified, was for the 12 months of 2002 under Duisenberg, as I will show in the next chapter. By contrast, the fall of the 3 month interest rate below the official (main

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[4] In Japan and Germany, it took over ten years until markets normalized after the real estate bubble burst. It is likely that it will takes as long in the USA, Ireland and Spain.

refinancing operations) rate in 2009/10 indicates that the ECB provided excess liquidity to banks to a degree that was not necessary in the USA or the UK.[5]

Figure 7

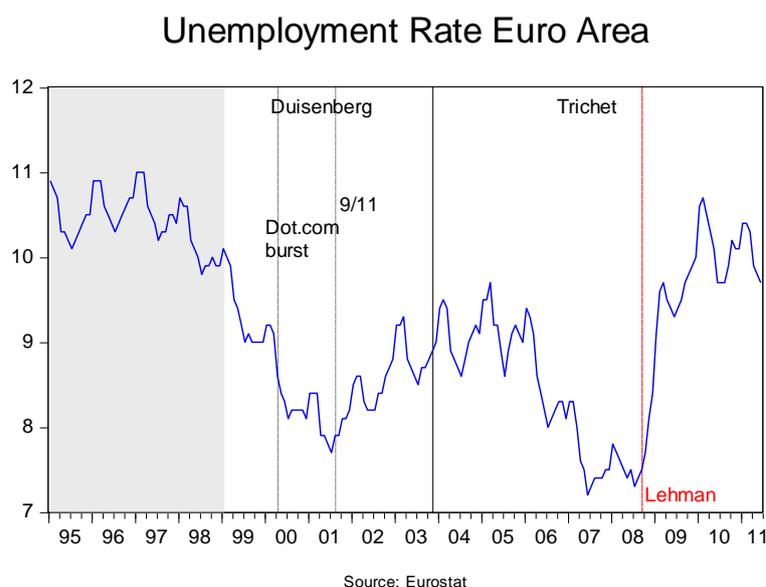## Monetary policy short term rates

Source: Bloomberg

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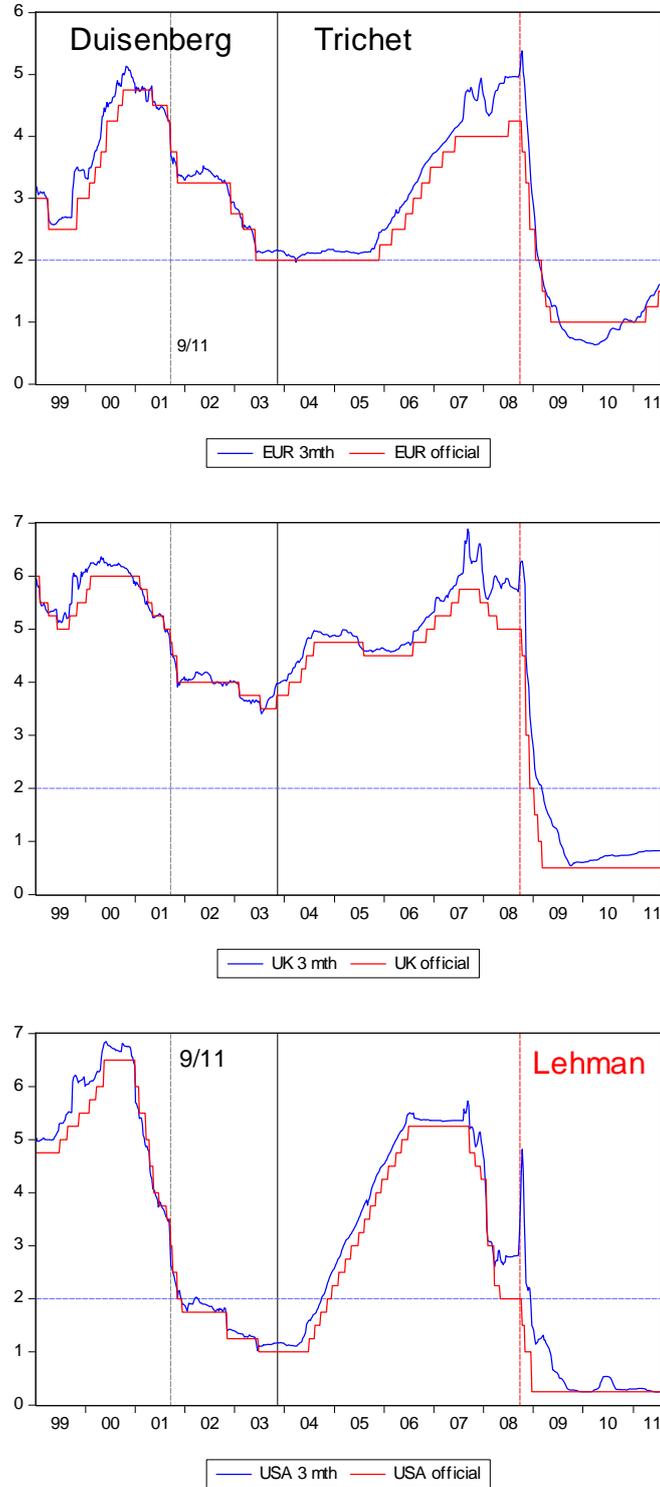
[5] For a more detailed explanation see, European Central Bank, Monthly Bulletin 7.2011: 55-69

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What were the consequences of this policy for unemployment? Figure 8 shows the monthly unemployment rate for the euro area. In the first decade of the euro, approximately 15 million new jobs were created net; most of them in the South, especially in Spain (3 million) (CER, 2011). However, 5 million jobs were lost again in the financial crisis. Nevertheless, the dynamic job creation has contributed to a fall of the unemployment rate. This came as a surprise. In the 1980s and 90, when member states had their national currencies, Europe used to be attacked for its structural rigidities in the labour market, which were thought to generate a ratcheting effect: an economic shock, like a sudden increase in oil prices, would push unemployment up, but in subsequent periods it would come down less than before, so that unemployment rates were continuously rising and creating long term joblessness. Since Monetary Union began, this ratcheting effect seems to have been reverted, at least until the Lehman crisis broke.

In 2002, when monetary policy was tight, unemployment started to rise, but we have seen that the ECB then lowered interests and kept them relatively low which stabilized unemployment again. Given that price stability was maintained over time, we must interpret this as a sign that the ECB responded to developments in the labour market. Thus, the actual policies of the ECB were in reality more flexible than the sometimes dogmatic martial public discourses given by the bank. However, the question is legitimate whether there this more accommodating policy stance was related to the change in leadership from President Duisenberg and Trichet. To find evidence for answering this question, we estimate a monetary policy reaction function for the ECB and test if we can observe any structural break at the time Trichet took over.

Figure 8

Unemployment Rate Euro Area

Source: Eurostat

3. HOW THEY DID IT: THE ECB´S POLICY REACTION FUNCTION UNDER DUISENBERG AND TRICHET

It is nowadays widely accepted in economics that monetary policy should adjust the nominal interest rate in response to divergences of actual inflation rates from *target* inflation rates and of actual Gross Domestic Product (GDP) from *potential* GDP. The idea goes back to a famous paper by John Taylor (1993) and since then a rich literature has developed on different formulations of the *Taylor rule*.[6] We use this methodology to assess whether there as been a change in the ECB's policy reaction under Duisenberg compared to Trichet. The Annex to this paper gives the technicalities of the econometric estimate.[7] Here we will summarize the results and insights.

The starting point is the standard specification of the Taylor rule:

$$r_t = r* + k(\pi_t - \pi*) + \beta x_t + \varepsilon_t$$

Where r* and п* are the equilibrium values for the nominal interest rate and the inflation target and x is a measure for the output gap; *k* is the reaction of the interest rate to inflation changes and ε_t are shocks. A value of k>1 indicates stabilizing monetary policy as the increase in the nominal interest rate is higher than that of inflation, resulting in a rise of the real interest rate. On the contrary, k<1 means that the central bank is accommodating inflation movements. In line with the literature, a smoothing factor of the interest adjustment can be put into the model and the details are explained in the Annex.

The econometric evidence can be summarized as follows:

- If we neglect interest rate smoothing, monetary policy from 1998 to 2008 was accommodating;
- If we introduce a smoothing parameter, monetary policy was stabilising during Duisenberg's presidency but became accommodating with Trichet.
- A level shift suggests a break in the equilibrium values for inflation and interest rates, implying a more favourable macroeconomic environment for Trichet.
- The results from the forward looking specification are similar to those of backward looking results, indicating that the ECB has achieved a high degree of credibility as an inflation fighter, even if it has become slightly more accommodating under Trichet.

The overall picture is that the ECB initially took a very tough policy stance to establish its reputation as an independent central bank that is fully committed to maintaining price stability. Once this was achieved by President Duisenberg, the bank under the leadership of President Trichet could start to focus on the other objectives under the Treaty of the European Union.

How much of a break was the shift from one president to the next? We can assess this by comparing the actual interest rate with what it would have been, had the alternative policy rule been applied. Figure 9 therefore draws the actual EONIA money market rate against what this rate should have been under Duisenberg, had the ECB responded as it did under Trichet, and inversely, what the EONIA would have been, had the Duisenberg regime continued. The deviations are small, but not insignificant. Table 2 shows that on average the EONIA rate would have been 22 bp lower in the first 5 years of EMU; but had the Duisenberg regime continued, interest rates would only have been 12 bp higher than what they actually were under Trichet. The error distribution indicates that during the Trichet

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[6] See Clarida, et alt. 1998; Gerlach-Kristen, 2003; Sauer and Sturm 2007.
[7] I acknowledge Piero Esposito for his contribution.

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years, this new policy rule was applied even during the turbulent years after the Lehman crisis. During the Duisenberg years, there were some distorting irregularities particularly in reaction to the post-9/11 period in 2002, when the Duisenberg policy appeared excessively tight. Given that monetary policy impacts the real economy with significant lags, it might be reasonable to conclude that the 2002 regime contributed to the relatively slow growth (see Figure 5) and rising unemployment under Duisenberg, while the low rate policy during Trichet's first two years helped to accelerate growth and to lower unemployment. In this respect it is also interesting that the Duisenberg rule would have already tightened monetary policy in 2010, while the actual ECB policy has kept interest rate increases low. The increases of key rates in April and July 2011 simply reflect the monetary policy rule that has guided the ECB since Jean-Claude Trichet had been its president.[8]

Figure 9

Monetary policy rates

EONIA against counterfactual

Source: ECB and own calculations

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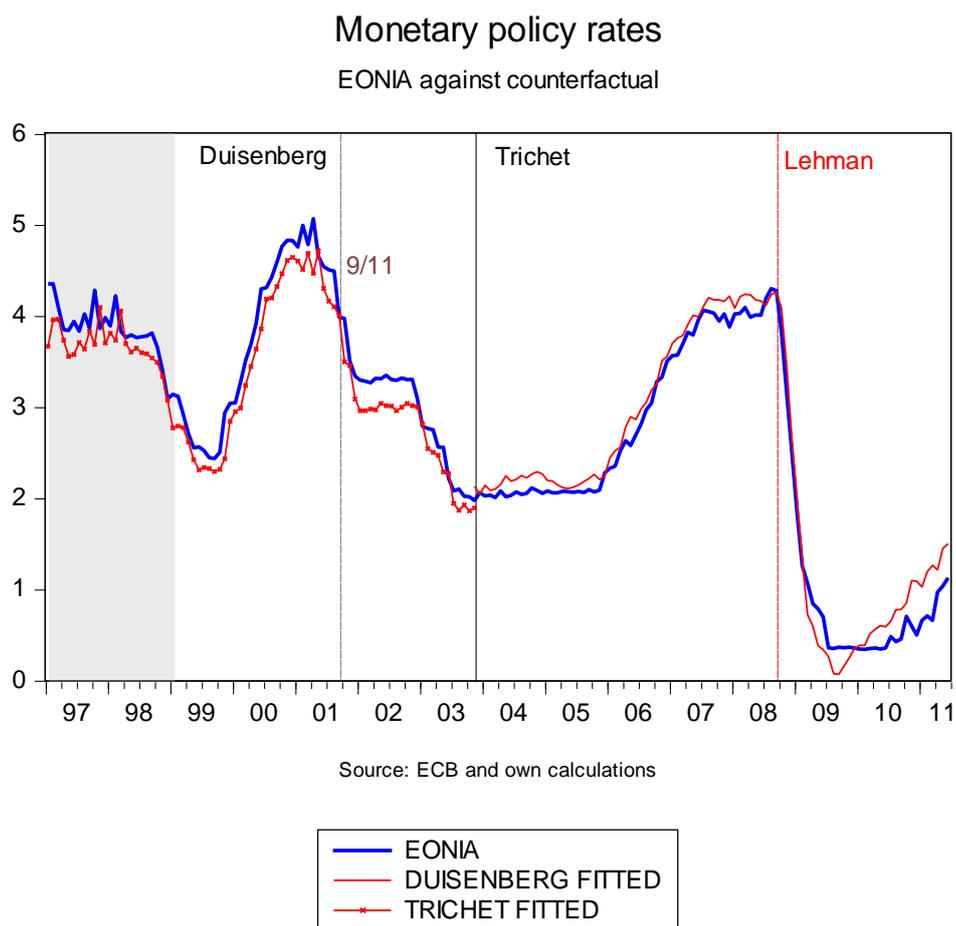
[8] Figure 7 shows that the key rates are closely matched by the short term market rates and Figure 9 shows that they are more accommodating than the Duisenberg rule.

Table 2. Deviation of Duisenberg and Trichet rule from actual

	1999m1-2003m11 *Trichet rule*	2003m11-2011m6 *Duisenberg rule*
Mean	-0.220913	0.122004
Median	-0.227313	0.144459
Maximum	0.230705	0.601625
Minimum	-0.685169	-0.404027
Std. Dev.	0.163071	0.180926
Skewness	-0.067944	-0.384246
Kurtosis	3.855569	4.529128
Jarque-Bera	2.595352	11.22711
Probability	0.273166	0.003648
Observations	83	92

Source: own calculations

4. CRISIS MANAGEMENT AND NON-STANDARD MONETARY POLICY

4.1. The banking crisis

Our analysis has revealed so far that under Duisenberg and under Trichet the ECB has responded to threats to economic growth by reducing interest rates. This has happened after the dot.com bubble burst and when the world economy was negatively affected by 9/11; it happened, of course, again after the Lehman crisis, when rates were slashed from 4.25 to 1 percent. However, the global financial crisis, which Jean-Claude Trichet faced, was infinitely more dangerous than the series of shocks with which Duisenberg was confronted, because the crisis hit the world economy at its inner core and threatened a meltdown of the global banking system. Banks lost trust in each other and had a high preference for liquidity. This liquidity had to be provided by central banks in large quantities. This fact required unusual policy measures. When money markets froze, only the ECB was able to preserve the stability of the financial system by acting as the lender of last resort in the euro area.[9]

Loss of trust was particularly dangerous because of the relatively important heterogeneity in the euro area's banking and financial structures. There is a populist image of banks as greedy monsters that suck the wealth out of the "real" economy. Nothing could be further from the truth. Even if there may always have been crooks who seek a shortcut to wealth, the system could not work and reproduce itself over time if its constitutive principle were "*grab and run"*. Without the financial sector, there would be no "hard working real economy" and we would still live in the Stone Age. Since early days of the Italian Renaissance, the purpose of banks has always been to make and facilitate payments on behalf of their clients, and in the course of doing so they have developed the capacity to make loans and grant credit. Banks function as intermediaries that bring together those who are in the possession of excess liquidity and those who need to borrow. The counterpart to credit is debt, which is a promise of future payment, and the two are held together by trust. Financial assets are simply certified forms of promises. If debtors do not honour their promises, creditors' wealth is impaired and trust disappears. As intermediaries, it is the job of banks to asses and minimize risk of loss. Modern financial markets have therefore specialised agents to deal with risk through all kinds of products, including derivatives, but in the end the system only works because there is trust. However, the integration of European financial markets has a history of, at best, 25 years, while national banking systems have grown over centuries. As a consequence, trust in non-national financial institutions within the euro area has been fragile during the crisis. Banks would no longer lend to other banks in the money market. Instead they relied increasingly on the ECB for borrowing and depositing their excess liquidity. Thus, only the institutional safeguards and the non-standard policy measures by the ECB were able to hold the system together.[10]

Over the last 200 years it has become clear, that the stability of the financial system requires a lender of last resort that ensures that solvent debtors can make the payments they have promised to make. For if creditors, including those who have deposited their

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[9] Kindleberger2005 has called the concept of lender of last resort "the hallmark in the development of the 'art of central banking', which has developed over the last 200 years."

[10] This argument underscores the importance of a single currency in a single market. The economic distortions which would have occurred without the institutional backup of monetary union would have been dramatic, given the small size of national markets and national currencies in Europe. The overvaluation of the Swiss franc is only a small example of such developments, because uncompensated shocks in the European single market would have cumulated and reinforced negative externalities.

cash with banks, loose trust and the confidence that they will get their money back, they will rush to withdraw their cash or liquefy their assets and this can cause a cascade of liquidity problems which could turn into solvency problems. This is called the systemic risk in financial systems. The function of a lender of last resort is to stand ready to halt a run out of real assets or illiquid financial assets into money, by supplying as much money as may be necessary to forestall the run. It must provide an elastic supply of base money (Kindleberger, 2005).[11]

In such financial crises, low interest rates become a powerless policy tool. The academic discussion has often blamed monetary impotence on the fact that nominal interest rates cannot be lowered below zero. However, the ECB has emphasized that the aim of non-standard measures is to maintain the transmission mechanism of monetary policy in otherwise dysfunctional financial markets.[12] In other words, without the non-standard measures the central bank could no longer do its job in the present environment. The ECB could not pursue its primary objective, i.e. price stability, unless it ensures and preserves the stability of the financial system. As Kindleberger (2005:226) pointed out, historically "the development of the lender of last resort evolved from the practice of the market rather than from the mind of economists." In Europe's monetary Union this is no different.

The first step in the crisis was the provision of liquidity to the banking system that was required to prevent a bank run after the Lehman bankruptcy. A special tool was the Covered Bond Purchase Program (CBPP), under which nearly EUR 100 billion were pumped into the banking system (see Table 3). Under the CBPP, the Eurosystem made outright purchases of covered bonds in the primary and secondary market.[13] In recent months, the ECB has started to carefully withdraw some of these non-standard operations, but the sovereign debt crisis has become an additional risk factor for the banking system.

4.2. The sovereign debt crisis

The different non-standard interventions of the ECB were highly effective in the money market during 2009 and the ECB has now started to exit at least some of them. However, when the sovereign debt crisis developed in late 2009, the European Central Bank faced a new dilemma. On the one hand, there was the principle that in European Monetary Union, fiscal policy remained under national responsibility. Bailing out Member States[14] could then create a *moral hazard* and undermine fiscal discipline.[15] Why would a member state consolidate its public finances, if it could count on getting finance from other Member States that markets would deny? On the other hand, there was the need to avoid a self-

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[11] It is sometimes argued that such "unlimited" supply of money could cause inflation. However, in a liquidity crisis this is unlikely to happen, because the high liquidity preference only increases demand for base money, while the broad money aggregate, which affects prices it likely to stagnate. This is precisely what we have observed in the euro area over the recent crisis. For evidence see S. Collignon 2010, *How to avoid currency wars*; IP/A/ECON/FWC/2009_040/C10, 17 November 2010. Download from:
http://www.stefancollignon.de/PDF/How%20to%20avoid%20currency%20war_Nov10%20(3).pdf
[12] See ECB, *Monthly Bulletin* 7.2011: 55-60.
[13] For a detailed analysis see Beirne et alt. 2011.
[14] According to Article 125 TFEU, "The Union shall not be liable for or assume the commitments of central governments, regional, local or other public authorities, other bodies governed by public law, or public undertakings of any Member State, without prejudice to mutual financial guarantees for the joint execution of a specific project." This article is often called the "no-bail out clause" in the Treaty. However, it is clear from the text that *giving credit cannot be the same as being liable*, for credit given are an asset and not a liability. A bailout according Article 125 TFEU would imply that one Member State's liability becomes another Member State's liability.
[15] *Moral hazard* is a situation in which a party insulated from risk behaves differently from how it would behave if it were fully exposed to the risk. Moral hazard arises because an individual or institution does not take the full consequences and responsibilities of its actions, and therefore has a tendency to act less carefully than it otherwise would, leaving another party to hold some responsibility for the consequences of those actions. See: http://en.wikipedia.org/wiki/Moral_hazard

fulfilling vicious circle, whereby lack of liquidity would turn into insolvency.[16] This is the well-known problem of *collective action* or *fallacy of composition*:[17] in a panic, welfare augmenting individual actions can become detrimental to general welfare.

Thus, the logic of the sovereign debt crisis is similar to a banking crisis: distrust between nations and their governments prevents them from dealing with liquidity issues. Furthermore, because sovereign bonds represent an important share in private banks' portfolios, the drop in bond prices will destabilize their balance sheets and impair banks' capacity to lend. A major recession would follow. This is in fact, what has happened to Greek, Irish, Spanish, and Portuguese and recently Italian government bonds; the painful impact on growth is only too obvious. For these reasons, a lender of last resort is necessary that provides sufficient liquidity in the sovereign bond market to essentially solvent states, for otherwise a run to liquefy bond holdings can occur when investors lose trust (De Grauwe, 2011).[18] In fact, this is one reason, why the so-called principle of market discipline, whereby markets force governments to restrain borrowing, has not worked. The problem resembles the prisoner's dilemma. The central bank should lend freely to halt the panic, but leaves governments to their own devices to reduce the likelihood of future panics. But governments do not have incentives to do so if they know they will get bailed out by the central bank. This is a dilemma, where *today* always wins over *tomorrow* (Kindleberger, 2005:228), or as in the European case, where the partial interests of national governments always win over the general interest of all Europeans.

In their famous book about monetary policy and the American depression, Milton Friedman and Anna Schwartz wrote: "The detailed story of every banking crisis … show how much depends on the presence of one or more outstanding individuals willing to assume responsibility and leadership. … Economic collapse often has the characteristics of a cumulative process. Let it go beyond a certain point, and it will tend for a time to gain strength from its own development… Because no great strength would be required to hold back the rock that starts the landslide, it does not follow that the landslide will not be of major proportions."[19] First in the European banking crisis and then especially during the sovereign debt crisis, Jean-Claude Trichet provided that leadership against the resistance of some of the most powerful chiefs of government. He has ensured that the ECB was willing to venture unbeaten paths.

The dilemma between welfare-detrimental moral hazard and welfare-increasing liquidity bail outs is old and has no easy answer. Historically, policy makers have often dealt with it by creating a *flou artistique* by setting up rules of which they knew that there were times when they could not be adhered to with safety.[20] European policy makers have also tried this lane although, in the European case, such ambiguity is counterproductive. For in traditional nation states, a unified government was able to act in an emergency and get legitimacy from Parliament to regulate markets. As anyone knows, this is not the case in the European Union and under these conditions ambiguity does not prevent moral hazard;

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[16] For a clear, although one-sided, description of the moral hazard logic, see Bundesbank, *Monatsbericht* August 2011. For an equally clear outline of the lender of last resort problematic in the euro area for banks and sovereign debtors, see de Grauwe 2011.

[17] The *fallacy of composition* arises when one infers that something is true of the *whole* from the fact that it is true of some *part* of the whole. See: http://en.wikipedia.org/wiki/Fallacy_of_composition.

[18] I have argued that applying the rules of the Treaty (excessive deficit procedure) are sufficient to ensure that member states remain solvent, including Greece. See Collignon 2011 for the theoretical foundation and my last Briefing Paper for the European Parliament: Debt Restructuring is no Free Lunch; (http://www.stefancollignon.de/PDF/Debt%20Restructuring_Collignon_MoD_June%202011.pdf).

[19] Milton Friedman and Anna Schwartz, 1963:418-9 (quoted on Kindelberger, 2005)

[20] This was the insight by Thomas Joplin, *Case for Parliamentary Inquiry into the Circumstances of the Panic, in a Letter to Thomas Gisborne, Esq., MP*; London: James Ridgeway & Sons, n.d.|after 1832 (quoted by Kindelberger, 2005:227,N.13)

instead, it encourages and therefore fuels financial panics. Europe's economic governance is not able to "hold back the stone" from starting a landslide.

The ECB has tried to solve this dilemma by pushing member states to commit to fiscal discipline prior to starting its Securities Markets Program (SMP). In May 2010, the euro area stood at the brink of collapse. It was avoided in the last minute by an agreement whereby the Member States set up the European Financial Stability Facility (EFSF) and the ECB would buy Greek (and later other) government bonds outright, thereby providing the urgently required liquidity. Since then the ECB has done similar operations in other government bond markets.

In principle, this was a good deal. It saved the euro. It avoided the Hellenic Republic turning from being illiquid into insolvent. Two-thirds of the Greek liquidity needs resulted from refinancing maturing debt. By turning the EFSF into a future European Stabilization Mechanism (ESM), the Union has potentially a new policy tool. However, the SMP was also criticized. Many commentators, especially in Germany, Finland or Slovakia, thought that it meant that taxpayers had to pay "for the sins committed by other countries". Yet, even if we ignore the religious connotation, this is not correct. As the concept of a *lender* of last resort indicates, the funds given to Member States in distress are *credits*. In other words, lending Member States have claims against Greece. This means that lenders have exchanged their short term liquid assets (cash) for long term less liquid assets (namely claims against another government). In principle, *there is no change in the net asset position of lenders*. Hence taxpayers are not "losing money". In fact, they will become richer, because the credit will be remunerated by interest. To make it clear: not German or Finnish tax payers are paying for Greece, but Greek taxpayers are paying Germans and Finns. However, this would change if a Member State would default or if its debt would be restructured, for then the money is lost, indeed.

For the European Central Bank, the commitment by Member States to provide loans to Greece, Ireland and Portugal and the implementation of a consolidation program in these countries was the basis on which it could justify to intervene in the market and buy sovereign bonds with minimal risk, because it could be seen as an insurance against the risk of moral hazard. However, the conditions, under which Member States were lending to distraught governments, were so draconian that economic growth has not yet returned. This has aggravated the liquidity situation. More liquidity was needed. However, under populist pressures from public opinion, governments have hesitated to go to the end of the logic they had already embarked upon. Instead, a debate started about debt restructuring and private sector involvement in loss sharing. Yet, this government withdrawal of the lender of last resort function is a self-defeating policy, which has severely aggravated the operating conditions for monetary policy

It is important to understand that Europe's debt crisis is first of all a liquidity crisis. The insolvency of Greece or, as a matter of fact of any other Member State, is neither inevitable nor automatic. Provided governments play by the rules of the Treaty and the Excessive Deficit Procedure, public debt in Europe is sustainable.[21] It is the coordination failure among nation state governments that has exacerbated the European debt crisis and pushed a sovereign debtor like Greece over the cliff. Precisely as described by Friedman and Schwartz, holding back the rock could avoid the landslide. This is what the ECB under Trichet attempted to do. Unfortunately, Member States threw more rocks by making irresponsible statements and lacking clarity as to whether they would stick to their commitments and provide the necessary liquidity. This behaviour has become a threat to the independence of the ECB.

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[21] See FN. 18

Part of the problem is a power struggle over who should be responsible for the lender of last resort function. In the UK of the 19th century, the banking community quickly had the Bank of England assume this function, although Parliament and the government monitored the process. In France, Prussia or the early United States, governments took over and used tax revenue for bank bailouts. In a way, it did not matter who acted as the lender of last resort as long as central banks were considered to be part of the government. Their operating losses are always a reduction in public revenue. However, in the euro area, the credibility of the ECB stands and falls with its independence. The resistance by Member States to act swiftly and collectively as a lender of last resort has undermined the ECB's material independence. Technically, the ECB is best suited to provide liquidity by buying up government bonds, although, as Bagehot has taught, the collateral must be sound. The problem with the European debt crisis is that the wavering political commitment to go through the full process of the liquidity bailout until the crisis is over, leads to panic sales which undermine the quality of the collateral and the assets purchased by the European Central Bank.

In fact, the ECB has been trapped by EU-Member States. As Table 3 shows, non-standard liquidity measures under the Covert Bond Purchase Programme (CBPP), which was primarily aimed to banks, reflects approximately a quarter of the ECB's own funds, but the value of assets held under the Securities Market Programme (SMP), which covers sovereign bond purchases in the crisis countries, amounts to about one third of the bank's net worth. Both are less than the value of traditional assets for Main Refinancing Operations (MRO) and Long Term Refinancing Operations (LTRO). With 1.5% of GDP these non-standard interventions are small amounts compared to the United States, where they amount to over 15%. Nevertheless, in terms of exposure towards the ECB's own funds, the risk is not negligible. Some commentators have called for partial debt forgiveness on Hellenic debt, but it is clear from Table 3 that this could entail substantial losses for the ECB. The European Council on 21 July 2011 did not go as far as that, but it has forced the private banking sector to "participate voluntarily" in Greek debt restructuring and this had consequences for private banks' balance sheets. The European Council has, therefore, put the ECB into an uncomfortable position. It may turn out that this will become the most problematic inheritance that Jean-Claude Trichet will leave for his successor Mario Draghi.

Table 3. Securities in the ECB Balance sheet

	Jun 07	Feb 10	Jun 11	Jun 11	Jun 11
	bn euro	bn euro	bn euro	percent of NW	percent of GDP
CBPP	0.0	43.9	94.9	24.5	0.7
SMP	0.0	0.0	119.7	30.9	0.8
MROs	311.2	80.9	174.4	45.0	1.2
LTROs	148.9	643.3	505.8	130.6	3.5
other securitites	129.9	337.7	593.6	153.2	4.1
Net foreign assets	314.6	427.3	829.6	214.1	5.7
Sum	**904.6**	**1533.1**	**2317.9**	**598.3**	**15.9**
revaluation accounts	125.5	220.2	305.9		
Capital and reserves	68.3	74.5	81.5		
Net Worth (NW)	**193.8**	**294.7**	**387.4**		

Source: ECB

The dogmatic and one-sided approach for dealing with the debt crisis, whereby everything is framed in terms of moral hazard and fiscal discipline and no consideration is given to collective action problems and liquidity issues in the market, has become a threat to the

survival of the euro. It poses the problem of the political governance of the euro area with new acuteness and this issue is far bigger than anything the ECB could do. Maybe de Grauwe (2011) is right when he says: "the EFSF and the future ESM have a governance structure that makes them ill-suited for crisis management. Each country maintains a veto power. As a result, the decisions of the EFSF and the future ESM will continuously be called into question by local political concerns ("true Finns" in Finland, Geert Wilders in the Netherlands, and so on)." It is therefore entirely coherent, when Jean-Claude Trichet, "on a personal basis, as a European citizen", has called for a European Treasury: "In this Union of tomorrow, or of the day after tomorrow, would it be too bold, in the economic field, with a single market, a single currency and a single central bank, to envisage a ministry of finance of the Union? Not necessarily a ministry of finance that administers a large federal budget. But a ministry of finance that would exert direct responsibilities in at least three domains: first, the surveillance of both fiscal policies and competitiveness policies, as well as the direct responsibilities mentioned earlier as regards countries in a "second stage" inside the euro area; second, all the typical responsibilities of the executive branches as regards the union's integrated financial sector, so as to accompany the full integration of financial services; and third, the representation of the union confederation in international financial institutions."[22] To push forward in this direction will be one of the tasks of his successors, first of all for Mario Draghi.

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[22] http://www.ecb.int/press/key/date/2011/html/sp110602.en.html

5. THE TASKS AHEAD FOR MARIO DRAGHI

Forecasting what Mario Draghi will or should do over the next eight years is of course impossible. If the ECB loses its power struggle with Member State governments over the provision of liquidity to distressed debtors, it is possible that the euro will not survive and Mario Draghi would simply be the last administrator of a failed enterprise. However, we must assume that common sense will prevail. We can then see the major challenges for ECB President Draghi.

The first is solving the debt crisis. This is without any doubt the most delicate task. The ECB must continue to steer a path between austerity policies that kill growth and debt bailouts that invite moral hazard. This is essentially a political task to which Mario Draghi with his personal background of experiences in the private sector, the Italian Treasury, central banking and international Institutions, including as Chairman of the Financial Stability Board is uniquely well qualified.

The second is terminating non-standard monetary policy operations as the situation in European financial markets normalizes. An important distinction may have to be made between the liquidity situation in money market and in bond markets, which will remain distorted by sovereign debt for a considerable period of time.

The third is the speed of raising interest rates back to levels above 2%, i.e. to levels where expected interest rates are positive in real terms. The present level of 1.5 percent is not sustainable over the medium run and probably not even compatible with the present level of core inflation. If one can learn one thing from the Greenspan experience in the mid 2000s, it is that negative real policy rates fuel financial bubbles. It is, however, possible to combine rising interest rates with non-standard monetary policy operations at least for some time.

The fourth challenge is the evolution of the global economy. The risks of a global recession are increasing, as the United States struggles with a fractioned political system and structural weaknesses. Japan still has to overcome the Tsunami shock. China is emerging as the new global economic player, but it is handicapped by rising domestic inflation which bears serious risks for political stability at home.[23]

Finally, the global economy will profoundly change over the next eight years. Aging populations will require new social and fiscal policies. The growth centres in the world will shift to Asia and later to Africa. During its first decade, European Monetary Union has benefitted from the Great Moderation, which made achieving the ECB's primary objective relatively easy. The integration of China into the global economy added a quarter of the world's labour force and therefore kept a lid on wage pressures worldwide. However, there are signs that China's unlimited supply of labour is coming to an end. This will transform the conditions for maintaining price stability and conducting monetary policy over the next decade.[24]

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[23] The political and social unrest in 1989, which culminated in the famous Tiananmen incidence were to a large degree caused by inflation and sinking purchasing power.

[24] In a recent statement (Monthly Bulletin 7/2011: 12-14) the ECB argues that "China is expected to remain a low-cost country for a prolonged period". However, I have argued in a previous briefing paper for the European Parliament that it is not entirely clear that China is a low-cost country when unit labour costs are compared with the Euro Area. See:
http://www.stefancollignon.de/PDF/How%20to%20avoid%20currency%20war_Nov10%20%283%29.pdf

6. CONCLUSION

President Jean-Claude Trichet has steered the European Central Bank through a difficult period. He has consolidated the achievements by Wim Duisenberg in setting up the new institution, and he was able to build on the improved reputation when the Global Financial Crisis posed a major threat to the world economy and to the European Union. Let us conclude by saying:

Bravo et merci, Monsieur Trichet!
and
Buona fortuna, Presidente Draghi!

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ANNEX: ESTIMATING THE ECB´S POLICY REACTION FUNCTION

THEORETICAL MODEL AND EMPIRICAL SPECIFICATION

The starting point is the standard specification of the Taylor rule:

$$r_t = r* + k(\pi_t - \pi*) + \beta x_t + \varepsilon_t \quad (1)$$

Where r* and �п* are the equilibriums values for the nominal interest rate and the inflation rate; *k* is the reaction of the interest rate to inflation changes and x is a measure for the output gap. k>1 indicates stabilizing monetary policy as the increase in the nominal interest rate is higher than that of inflation, resulting in a positive reaction of the real interest rate. On the contrary, k<1 means that the central bank is accommodating inflation movements. A partial adjustment mechanism can be introduced as it follows:

$$r_t = \rho r_{t-1} + (1-\rho)(r* + k(\pi_t - \pi*) + \beta x_t) + \varepsilon_t \quad (2)$$

this specification implies that the interest rate adjusts to its past value and to the inflation and output variables by weighting the two components with a parameter ρ.

Rearranging equation (2) we obtain:

$$r_t = (1-\rho)\alpha + \rho r_{t-1} + (1-\rho)k\pi_t + (1-\rho)\beta x_t + \varepsilon_t \quad (3)$$

where *a=r*-kп**. The final equation is then:

$$r_t = a + \rho r_{t-1} + b\pi_t + cx_t + \varepsilon_t \quad (4)$$

Where *a=(1-ρ)a; b=(1-ρ)k; c=(1-ρ)β*. This specification assumes all variables are contemporaneous. Sauer and Sturm (2007) found that for the ECB a forward looking specification fits better the data. In order to transform equation (4) into a forward looking specification there are a number of alternatives. First, leads of historical or real time data can be introduced, as in Clarida et. Al. (1998), and the equation is estimated via GMM:

$$r_t = a + \rho r_{t-1} + bE[\pi_{t+n}|\Omega_t] + cE[x_t|\Omega_t] + \varepsilon_t \quad (5)$$

With Ω_t being the information set available to the central bank. This is equivalent to assuming rational expectations, as the orthogonality condition imposed by the GMM procedure assures asymptotically correct standard errors. The alternative is to use expectation data and run a standard OLS regression. Our choice is to use a combination of the two models. We use expectation data for the output gap variable while for inflation we alternatively try historical contemporaneous data, as in equation (4), and inflation in t+3 as in equation (5). In the latter case we estimate the model with GMM. The structural break is modelled as a regime shift for the constant term *a* and for the slope parameter of inflation *k*. The final mixed and forward looking specifications are the following:

$$r_t = a_1 + TR + \rho r_{t-1} + b_1\pi_t + b_2 TR(\pi_t) + cx_t + \varepsilon_t \quad (6a)$$

$$r_t = a_1 + TR + \rho r_{t-1} + b_1 E[\pi_{t+n}|\Omega_t] + b_2 TR(E[\pi_{t+n}|\Omega_t]) + cx_t + \varepsilon_t \quad (6b)$$

where TR is a dummy variable which takes the value 1 from November 2003 onward.

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DATA AND RESULTS

For the nominal short term interest rate we use the Euro Overnight Index Average (EONIA), calculated as monthly average of daily data. As measure of inflation we use the year on year difference of the monthly Harmonised Index of Consumer Prices (HICP) calculated by Eurostat. Turning to the output gap measure, we do not use the classical contemporaneous variable calculated applying the Hodrik Prescott filter to the monthly industrial production data. This is because this variable is not stationary, so that applying the filter would potentially result in the creation of artificial cycles. We use instead three measures of expectations on the evolution of the economy provided by the European Commission. The first measure is the EMU Economic Sentiments indicator (EUESEMU), the second is the EMU Business Climate Indicator (EUBCI) and the third is the EMU Manufacturing Confidence Indicator (EUICEMU).

Most of the empirical works on the Taylor rule do not take into account the potential non stationarity of the series. In particular, while the interest rate and the output gap are typically stationary, inflation can be approximated by an integrated process if mean shifts are not explicitly taken into account (Russell, 2011). This means that once the mean shift is considered, the t statistics of the supposed I(1) regressor will not be oversized due to spurious regression (Stewart, 2010).

Table A1 Unit root tests

	EONIA	INFLATION	EUESEMU	EUBCI	EUICEMU	IPI
ADF	-2.63*	-0.17	-2.01	-3.1**	-2.65*	-0.40
ERS DFGLS	-2.14**	0.47	-1.83*	-2.47**	-2.33**	1.28
Phillips Perron	-1.66	-0.09	-1.75	-2.32	-2.20	-0.35
KPSS*	0.25	0.89***	0.28	0.22	0.24	1.20**
ERS optimal	1.84***	2.07	4.99	1.81***	2.56**	118.9
Ng Perron	12.49**	22.2	-6.27*	-14.80***	-10.80**	1.38
Zivot Andrews		-2.77 (2003m4)				

Source: own calculations
* the null hypothesis is that series are stationary. ADF=augmented Dickey Fuller; ERS DFGSP=Elliot, Rotemberg and Stock Dickey-Fuller-GLS; KPSS=Kwiatkowski, Phillips, Schmidt, Shin; ERS optimal=Elliot, Rotemberg and Stock optimal test.

In Table A1 we report the results of the unit root tests. The interest rate is stationary in five out of six cases, while inflation has a unit in all cases. As to the performance indicators, the Industrial Production Index is non stationary as anticipated, implying that its use after applying the HP filter may lead to meaningless results. Among the expectation indicators, EUBCI and EUICEMU are stationary in four cases out of five while EUESEMU has a unit root in three cases, is stationary in one case, while in the remaining two cases it is stationary at 10%. This means that this variable can be unit root or near unit root, causing problems in the estimates. Accordingly, we consider the results with EUBCI and EUICEMU more reliable. In order to check whether a structural break took place when Trichet became president, we test for unit root with a single endogenous break point by using the Zivot and Andrews test (last row of Table A1). The result is in line with our expectations, the series is found to be stationary once the break is accounted and the break date is April 2003, half a year before Trichet came in charge. In any case, it must be noted that the Zivot and Andrews test has been often criticised for anticipating the break date. This means that the real break date can be very close or coincident with change of presidency, giving first evidence in favour of a change of monetary policy when Trichet took office.

Estimate results for equation (6) are reported in Table A2. The first three columns show the results for the basic mixed specification, columns 4-6 report the mixed specification with partial adjustment and columns 7-9 the forward looking specification. The first important

result is that for all the specifications there is a significant level shift, which implies a change in the equilibrium value for inflation. The change in k is not significant in the specification without smoothing parameter while it is strongly significant in the others. Further, in the first specification we find a *k*<1 indicating that monetary policy from 1998 to 2008 was accommodating. This result is not confirmed when a smoothing parameter is introduced. The latter is always extremely significant and with a coefficient above 0.9, indicating that inflation and output gap contribute to the change in EONIA by less than 10%. It means policy responds only slowly. In the mixed specification monetary policy is stabilising during Duisenberg's presidency but becomes accommodating with Trichet. The reaction coefficient *k* ranges from 0.99 to 1.56. Further, the level shift suggests that a break in the equilibrium values for inflation and interest rates took place, with the Trichet dummy always being significant. The results from the forward looking specification are similar, with slightly higher constant terms and slightly lower *k* and the basic conclusion that monetary policy changed from stabilising to accommodating keeps valid. In both cases the higher *k* is estimated when EUESEMU is used, probably due to its (near) unit root process, which makes this result less reliable.

Table A2 Taylor rule estimates

| | Dependent variable: EONIA | | | | | | | | |
| | no smoothing (OLS) | | | with smoothing (OLS) | | | with future inflation (GMM) | | |
	euesemu	eubci	euicemu	euesemu	eubci	euicemu	euesemu	eubci	euicemu
eonia t-1				0.904***	0.922***	0.914***	0.908***	0.914***	0.919***
				[0.014]	[0.019]	[0.020]	[0.021]	[0.023]	[0.018]
output	0.091***	0.815***	0.089***	0.020***	0.174***	0.019***	0.020***	0.175***	0.018***
	[0.018]	[0.165]	[0.018]	[0.002]	[0.020]	[0.002]	[0.002]	[0.026]	[0.002]
inflation	0.886***	0.623**	0.597**	0.151***	0.087***	0.085***			
	[0.177]	[0.247]	[0.280]	[0.029]	[0.026]	[0.021]			
inflation*trichet	-0.068	0.076	0.054	-0.075**	-0.049*	-0.052**			
	[0.251]	[0.307]	[0.326]	[0.034]	[0.026]	[0.019]			
inflation t+3							0.203***	0.102**	0.094**
							[0.038]	[0.035]	[0.034]
inflation t+3*trichet							-0.130***	-0.041	-0.064**
							[0.035]	[0.039]	[0.030]
trichet	-1.171***	-1.417***	-1.394***	-0.091**	-0.126**	-0.130**	-0.123**	-0.149***	-0.132**
	[0.262]	[0.282]	[0.327]	[0.028]	[0.043]	[0.043]	[0.042]	[0.040]	[0.045]
constant	1.996***	2.364***	2.977***	0.055	0.083	0.237***	-0.05	0.087	0.203***
	[0.323]	[0.397]	[0.448]	[0.060]	[0.058]	[0.067]	[0.069]	[0.086]	[0.057]
R²	0.632	0.571	0.597	0.983	0.982	0.983	0.982	0.982	0.983
N	126	126	126	126	126	126	126	126	126
Hansen J							6.779	7.442	8.008
Under. Id.							10.667*	27.798***	9.023*
Weak id.							6.819	11.048	12.216
F endog. regr.							11.3***	2.6***	4.3***
Chi2 endog. regr.							99.9***	22.8***	37.6***
Implied α Duisemberg	2.00	2.36	2.98	0.57	1.07	2.76	-0.54	1.01	2.52
Implied α Trichet	0.82	0.95	1.58	-0.39	-0.55	1.25	-1.88	-0.73	0.88
implied k Duisenberg	0.89	0.62	0.60	1.58	1.12	0.99	2.21	1.19	1.16
implied k Trichet	0.82	0.70	0.64	0.79	0.48	0.38	0.80	0.71	0.37

Source: own calculations

Standard errors in brackets; * significant at 10% level, ** significant at 5**level; *** significant at 1% level. Estimating period January 1998-June 2008