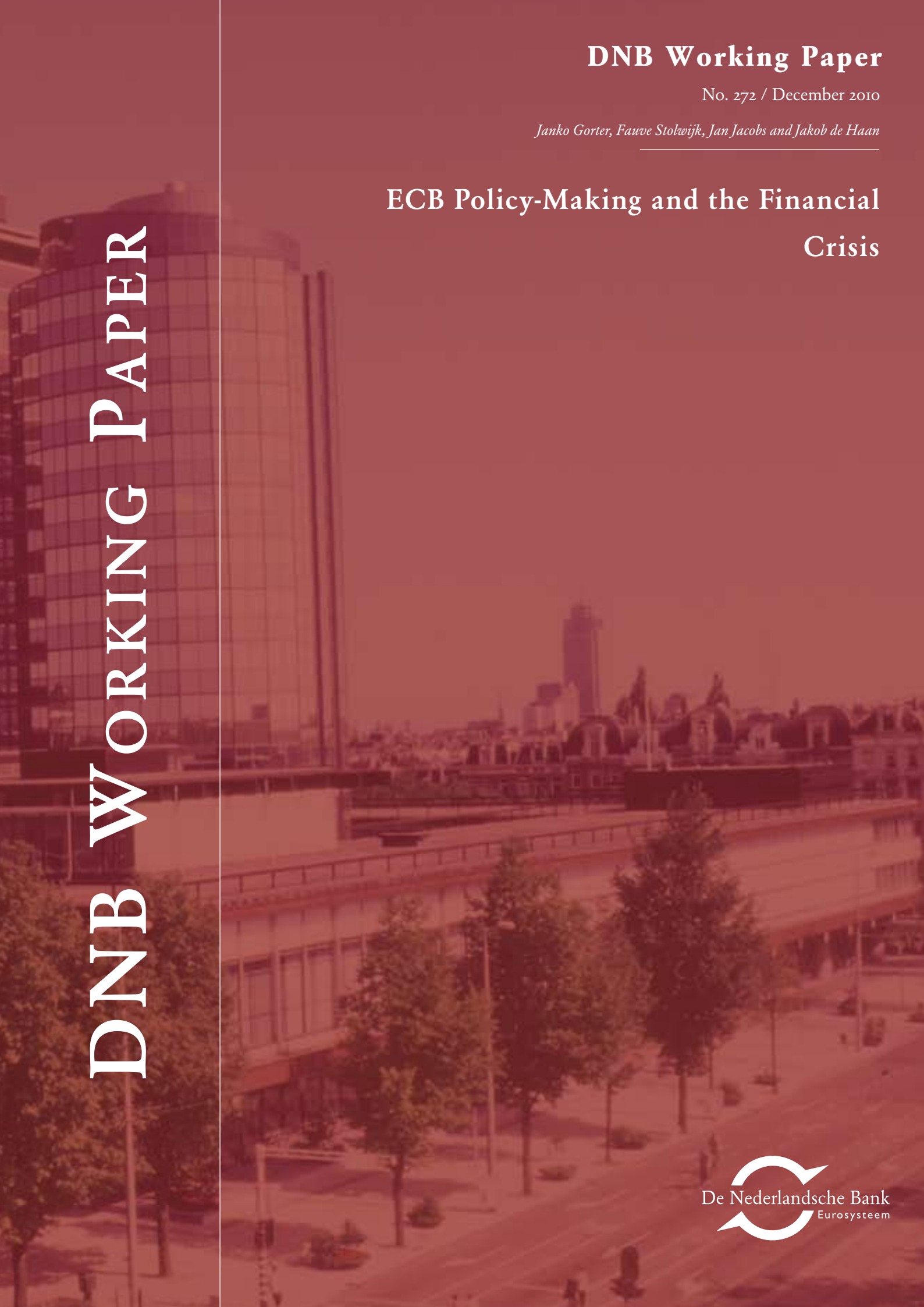

DNB WORKING PAPER

DNB Working Paper

No. 272 / December 2010

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De Nederlandsche Bank
Eurosysteem

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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

Working Paper No. 272

December 2010

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ECB Policy-Making and the Financial Crisis

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Version 13 December 2010

Abstract

We estimate Taylor rule models for the euro area using Consensus Economics forecasts of inflation and output growth for the period 1998.6-2010.8. We first examine whether the recent financial crisis has affected ECB policies. Our results indicate that the ECB puts stronger emphasis on maintaining price stability than earlier point estimates suggested. Next, we analyse whether economic developments in individual euro area countries affect ECB decisions. Despite the diverging economic developments in the countries in the euro area, notably during the recent financial crisis, we do not find support for the view that policy decisions have been influenced by regional developments.

Key words: Taylor rule, ECB, regional influence, real time data

JEL classification: C22, E52

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* The views expressed in the paper do not necessarily reflect the views of De Nederlandsche Bank. We like to thank Friedrich Heinemann and Felix Huefner for their comments on a previous version of the paper.

1. Introduction

This paper re-examines policy-making by the European Central Bank (ECB) addressing two questions: (1) Has the recent financial crisis affected the relative importance of inflation and real developments in determining policy rates?, and (2) Do economic developments in individual countries in the euro area affect ECB policy-making?

In addressing these issues we update estimates of a Taylor rule model as reported in Gorter *et al*. (2008). The Taylor rule seems a reasonable description of central bank behaviour. However, as Svensson (2003) has shown, even if the ultimate objective of monetary policy is to stabilize inflation and output, a simple Taylor rule will not be optimal in a reasonable macroeconomic model. Interest rate changes affect inflation and output with a sizable lag. Therefore, monetary policy has to be forward-looking, i.e., it should be based on *expected* inflation and output. To capture this, we employ forecasts of inflation and output from Consensus Economics for estimating our Taylor rule model for the ECB. The Consensus data are unique, not revised and, consequently, not subject to the critique of Orphanides (2001).[1] We employ the model specification of English *et al.* (2003) that combines the partial adjustment Taylor rule model (Clarida *et al*., 1998) and the Taylor rule model with serial correlation (Rudebusch, 2002) to obtain a nested model.

As to the first research question: the recent financial crisis has been the most severe crisis in industrial countries since the Great Depression. Central banks reduced policy rates to historically low levels and even had to take recourse to unconventional measures in order to get their economies back on track. It seemed that inflation was no longer the main driver of monetary policy-making. Although less aggressive perhaps than the Federal Reserve, the ECB reduced policy rates too and introduced quantitative easing. By updating the Taylor rule study of Gorter *et al*. (2008), we analyze the stability of the coefficients of expected inflation and expected output growth, thereby addressing the question of whether the ECB has really changed its policies due to the recent crisis. Our results indicate that the ECB - in line with its mandate - puts a much stronger emphasis on maintaining price stability than earlier point estimates suggested.

Even though the recent crisis hit all countries in the euro area, they were not all equally affected. Some countries fared much better than others. This brings us to the second issue that we address, namely whether these regional differences have had any impact on ECB policies. The decision-making structure of the ECB is less centralized than that of

[1] Orphanides (2001) has shown that the use of real-time instead of ex post data leads to very different estimated coefficients in Taylor rule models for the Federal Reserve.

comparable central banks, like the Federal Reserve. The national central banks have a very important say in European monetary policy-making. Although the primary objective of the ECB is price stability in the euro area, economic differences across countries in the euro area (the 'regions') may affect the behaviour of national central bank governors within the ECB. Even within more centralized central banks, like the Fed and the Bundesbank, regional economic developments have been found to affect the voting behaviour of central bankers.[2] Unfortunately, voting behaviour within the ECB's Governing Council cannot be analyzed because the ECB does not publish minutes of the Council's meetings. Therefore, Heinemann and Huefner (2004) examined the influence of regional economic conditions on the policies of the ECB by estimating Taylor rule models for the ECB, coming up with evidence in support of regional divergence in ECB decision-making. They argue that "conventional Taylor rules that rely solely on eurozone variables might be biased – in particular with regard to the inflation coefficient." (p. 556). We re-examine this issue. As Heinemann and Huefner (2004) acknowledge their analysis "suffers from some limitations: the most important one results from the short time span of data for the era of ECB responsibility." (p. 556). We estimate Taylor rule models for the period 1998.6-2010.8 and find that ECB policy decisions have not been affected by regional developments in the euro area.

The remainder of this paper is structured as follows. The next section outlines our model. Section 3 examines the stability of the parameter estimates over time and Section 4 analyzes regional influences on ECB policy-making. Finally, Section 5 offers some concluding comments.

2. Model and data

Taylor (1993) proposed the following rule to describe monetary policy in the U.S.:

$$\hat{i}_t = r^* + \pi^* + k_\pi(\pi_t - \pi^*) + k_x x_t, \qquad (1)$$

[2] For instance, Meade and Sheets (2002) argue that voting in the Federal Open Market Committee (FOMC) of the US Federal Reserve has been influenced by the economic situation in the various Federal Reserve Districts. Likewise, Berger and De Haan (2002) analyze data on individual voting behaviour in the decision-making body of the Bundesbank on discount rate changes in the period 1948 to 1961 and find that the probability of a representative not to vote "yes" on a policy change is significantly larger, the larger is the difference between the regional and national inflation rate.

where $\hat{i}_t$ is referred to as the Taylor-rule rate in period t, r^* is the equilibrium real interest rate, $\pi_t - \pi^*$ is the deviation of inflation in period from the inflation target π^* and x_t is the output gap in period t. Various Taylor rule studies include the lagged interest rate as explanatory variable in the model assuming that central banks dislike jumps in the short-term interest rate and prefer interest-rate smoothing. To account for monetary policy inertia, a smoothing parameter can be added to the Taylor rule model (see, for instance, Clarida *et al*., 1998). Rudebusch (2002) criticizes the partial adjustment Taylor rule as the significance of the lagged interest rate may be caused by omitted shocks in the estimated policy rule, like financial crises, that will give rise to serially correlated errors. He proposes an alternative equation, which includes a first-order serially correlated error instead of a partial adjustment parameter. English *et al*. (2003) combine the partial adjustment model and the serial correlation model to obtain a nested model

$$\hat{i}_t = r^* + \pi^* + k_\pi(\pi_t - \pi^*) + k_x x_t \tag{2a}$$

$$i_t = (1-\lambda)(\hat{i}_t) + \lambda i_{t-1} + \upsilon_t \tag{2b}$$

$$\upsilon_t = \rho\upsilon_{t-1} + u_t, \tag{2c}$$

where i_t is the nominal interest rate, λ is a smoothing parameter, υ is a serially correlated error term, ρ is the serial correlation parameter and u_t is an iid error term. When Equations (2a), (2b), and (2c) are combined and written in first differences, we obtain:

$$\Delta i_t = (1-\lambda)\Delta\hat{i}_t + (1-\lambda)(1-\rho)(\hat{i}_{t-1} - i_{t-1}) + \lambda\rho\,\Delta i_{t-1} + u_t. \tag{3}$$

Equation (3) shows that the change in the nominal short-term interest rate is captured by the most recent change in the Taylor-rule rate, $\Delta\hat{i}_t$, the existing gap between the Taylor-rule interest rate and the actual interest rate in the previous period, $\hat{i}_{t-1} - i_{t-1}$, and the change in the nominal interest rate one period earlier, Δi_{t-1}.

We update estimates reported in Gorter *et al.* (2008) using monthly data series for the period 1998.6-2010.8. Even though the common monetary policy only started in 1999, we also include observations for 1998 as in the run-up to the currency union interest rates were clearly co-ordinated. As in our previous work, we use the three-month EURIBOR as dependent variable. Real-time expected inflation and output growth time series have been constructed from Consensus Economics forecasts. Figures 1 and 2 show the underlying data for inflation and real growth, respectively. Euro area expected inflation and growth series are constructed from these forecasts for all euro area countries except Luxembourg. For month *m* of a given year t, the expectation of inflation or output growth is defined as (13-*m*)/12 times the forecast for year t plus (*m*-1)/12 times the forecast for year $t+1$. All national series are then aggregated with annually updated real GDP weights. As Consensus Economics does not publish forecasts of the output gap, we construct forecasts of the *change* of the output gap.[3] For this we use the ECB's estimate of the annual potential growth rate in combination with the Consensus forecasts of GDP growth rates. We set the potential growth of output to 2.25%, the midpoint of the interval given by the ECB. Similarly, using the ECB definition of stability, i.e., HICP inflation below but close to 2% over the medium-long term, we subtract 2% from the inflation expectations to obtain the expected inflation gap (see Gorter *et al*., 2008 for further details).

[Insert Figures 1, 2 here]

3. Stability over time

The recent crisis provides unique information about the behaviour of monetary policy makers. The first column in Table 1 shows our estimates of equation (3) for two different sample periods: 1998.6-2007.12 and 1998.6-2010.8. The first period is the sample used by Gorter *et al*. (2008), while the second sample runs until 2010.8, thereby taking the reaction of the ECB to the financial crisis into account. Following Heinemann and Huefner (2004), this specification is called 'euro area advocates' as it models "the official view that all members of the Governing Council base their decision solely on GDP weighted eurozone average data." (p. 552).

[3] Walsh (2004) argues that a Taylor rule in which the level of the output gap is replaced by its change performs quite well in the presence of imperfect information about the output gap.

[Insert Table 1 here]

Various conclusions can be drawn from these estimates. First, the ECB follows a stabilizing policy, i.e., a rise in expected inflation causes real interest rates to rise even more. This result is in line with our previous findings. Second, we observe that the ECB not only cares about the expected inflation gap but also considers the output growth gap when taking policy decisions. Third, the coefficient for the expected output growth gap according to the estimates based on more recent data that include the financial crisis is significantly lower compared to that based on estimates using pre-crisis data. In contrast, the coefficient for expected inflation is statistically unchanged, i.e., we cannot reject the null of coefficient stability at conventional confidence levels. Apparently, the ECB gives priority to its primary objective to secure price stability in the euro area even in economic hard times.

To provide more detail about the stability of the parameter estimates, Figure 3 shows the estimated coefficients of expected inflation and expected growth using rolling regressions. We obtain these results by performing the least squares estimation of Equation (3) with a moving window, i.e., we successively add a new month to the sample period and simultaneously remove the oldest one, keeping the sample size constant. Our first estimation period is 1997.3-2006.1; the last one is 2001.10-2010.8. The figure suggests that in the course of 2008 the coefficient of expected inflation increases; after a while it returns to its pre-crisis level. In contract, the coefficient of expected output drops during the crisis and remains at this lower level.

[Insert Figure 3 here]

4. Regional influences

Table 2 compares the ECB's Governing Council (GC) with other major central banks' Monetary Policy Committee (MPC) as of August 2009. Both the GC's size (22) and the proportion of regional 'representatives' (16/22) appear rather large, especially if one keeps in mind that 7 out of the 12 Federal Reserve Presidents do not vote as a result of the rotation system in place at the Federal Open-Market Committee (FOMC).

[Insert Table 2 here]

As Figures 1 and 2 show, expected inflation and growth differ substantially across the countries in the euro area. This implies that the ECB's policies may not be optimal for many countries ('one size does not fit all'). So national central bank governors, who all have one vote in the GC, may have an incentive to take national considerations into account. To examine whether the strong representation of regions has affected the ECB's policies, we follow Heinemann and Huefner (2004) and adjust our Taylor rule model. The main idea is to test whether ECB reaction functions that make use of the distance between median inflation/output growth and euro area average inflation/output growth outperform a Taylor rule model based on euro area aggregates.

We estimate two different models. The first specification is based on the assumption that central bank governors only take national data into account in their behaviour ("pure national advocates"). In this specification the explanatory variables are the median of the expected inflation and growth rate in the countries in the euro area. In view of the "one person – one vote" decision rule within the ECB's Governing Council, the median voter determines interest rate decisions. Since it is not possible to identify each Council member's individual preferences, it is also not possible to identify the median voter in the Council. We therefore follow Heinemann and Huefner (2004) and use the median expected inflation rate and output growth. If regional developments play a role, the coefficients of these variables should be significantly positive. The medians have been calculated both for the complete Governing Council (including Executive Board members, cf. Heinemann and Huefner) and for the subset of national central bank governors.[4]

In the second specification the explanatory variables are euro area expected inflation and growth and the difference between the expected euro area inflation (growth) rate and the median expected inflation (growth) rate. This specification is an intermediate case where national considerations are assumed to play a role in addition to euro area wide factors ("intermediate rule").

Columns (2) and (3) in Table 1 show our results. We find that the regional factors have coefficients that are implausible (i.e., negative) or insignificant, or both. The only exception is the coefficient of expected output growth in the 'pure national advocates' specification (column 3). However, the "pure national advocates" results imply that higher expected inflation does not significantly increase the probability of a monetary tightening,

[4] Although Executive Board members are perhaps more likely to focus on the euro area as a whole, Meade and Sheets (2005) find for the case of the U.S. that especially Federal Reserve board members seem to be influenced by regional developments.

which is implausible. We therefore conclude that there is no convincing evidence for a regional bias in ECB decision-making.

We have examined what causes the differences between our findings and those of Heinemann and Huefner (2004) by re-estimating the models shown in Table 2 for their sample period. As Table 3 shows, the results for this short sample period provide some support for regional influences in ECB policy-making, suggesting that the difference in sample periods plays a role in explaining the diverging outcomes of both studies. Perhaps socialization of its members can explain that over time national considerations became less important in the ECB's Governing Council decisions. Socialization processes take time. Some political science studies on national versus European views in the European Parliament suggest that the individual length of parliamentary membership has an impact on individual policy preferences (cf. Franklin and Scarrow, 1999 and Scully and Farrell, 2003).

[Insert Table 3 here]

Finally, we also examine whether inflation dispersion in the euro area has affected ECB policies. Although the inflation objective of "close to 2 per cent" seems high enough to forego deflation in the euro area as a whole, it is possible that deflation occurs in an individual country, depending on how large inflation differentials are in the monetary union. In case of significant inflation differentials within the euro area it is possible for some countries to experience deflation, even if the euro area as a whole does not. Some authors have argued that the ECB may therefore be inclined to take inflation differentials in the euro area into account. For instance, Fendel and Frenkel (2009) hypothesize that the ECB may have been less restrictive than euro area wide developments would dictate thereby preventing deflation in the low inflation countries. Their Taylor rule model outcomes suggest an influence of inflation differentials on monetary policy in the euro area. With higher inflation divergence, the ECB was more reluctant to fight an overall inflation gap. However, when we add the standard deviation of national *expected* inflation rates to the model shown in column (1) of Table 2, the coefficient turns out negative but insignificant (see Table 4).

[Insert Table 4 here]

5. Concluding comments

By updating the Taylor rule study of Gorter et al. (2008), we analyze the stability of the coefficients of expected inflation and expected output growth, thereby addressing the question whether the ECB has changed its policies due to the recent crisis. Our results suggest that the ECB - in line with its mandate - puts a stronger emphasis on maintaining price stability than earlier point estimates of Taylor rule models indicated. In addition we address whether regional developments have affected ECB policies. Some critics of the governance structure of the ECB "think the institution and the process will be unavoidably politicised - member countries facing asymmetric shocks will want the ECB to follow different policies, the country governments will be able to influence their representatives on the ECB to fight for the national interest, and exert pressure through other channels of operation of the European Union, and at least sometimes succeed in bending the ECB's policies." (Dixit, 2000, p. 759). Despite the diverging economic developments in the countries in the euro area, notably during the recent financial crisis, we do not find support for the view that policy decisions have been influenced by regional developments.

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Figure 1. Expected inflation according to Consensus Economics for all euro area countries (except Luxembourg), 1997-2010

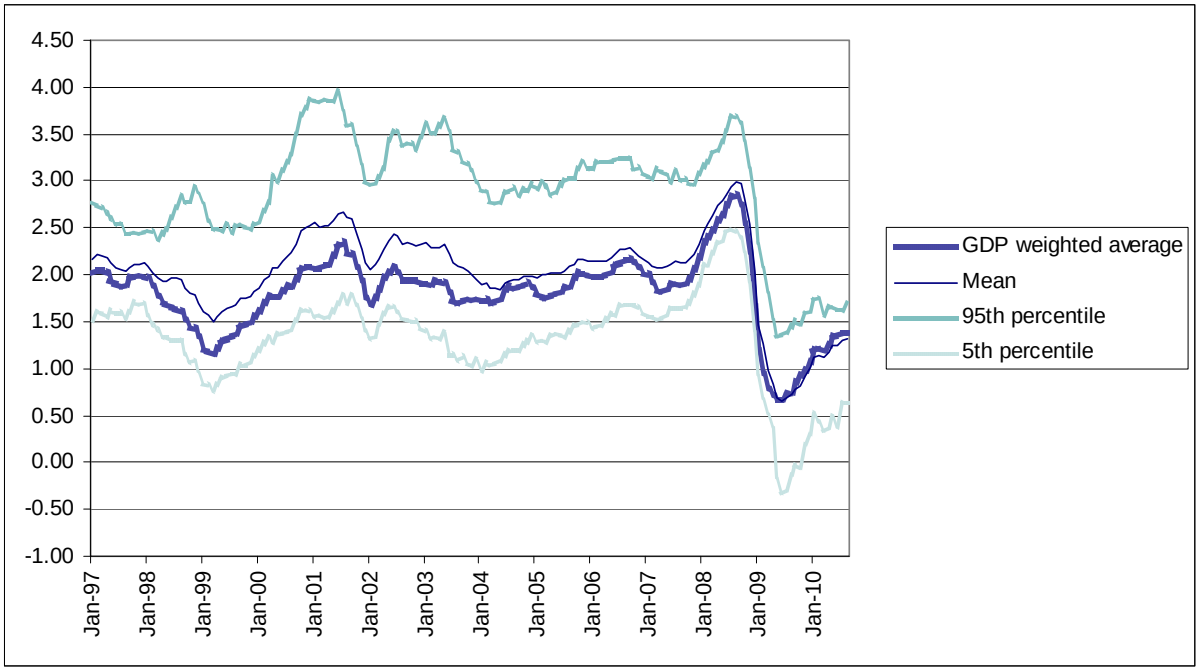


Figure 2. Expected real GDP growth according to Consensus Economics for all euro area countries (except Luxembourg), 1997-2010

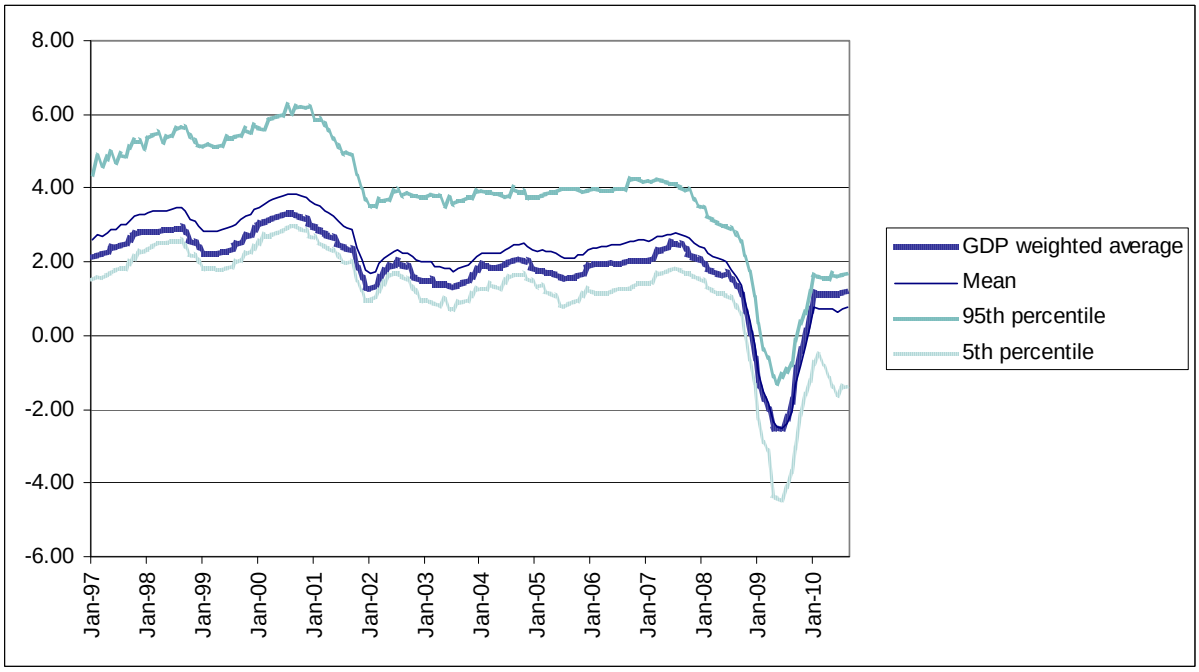
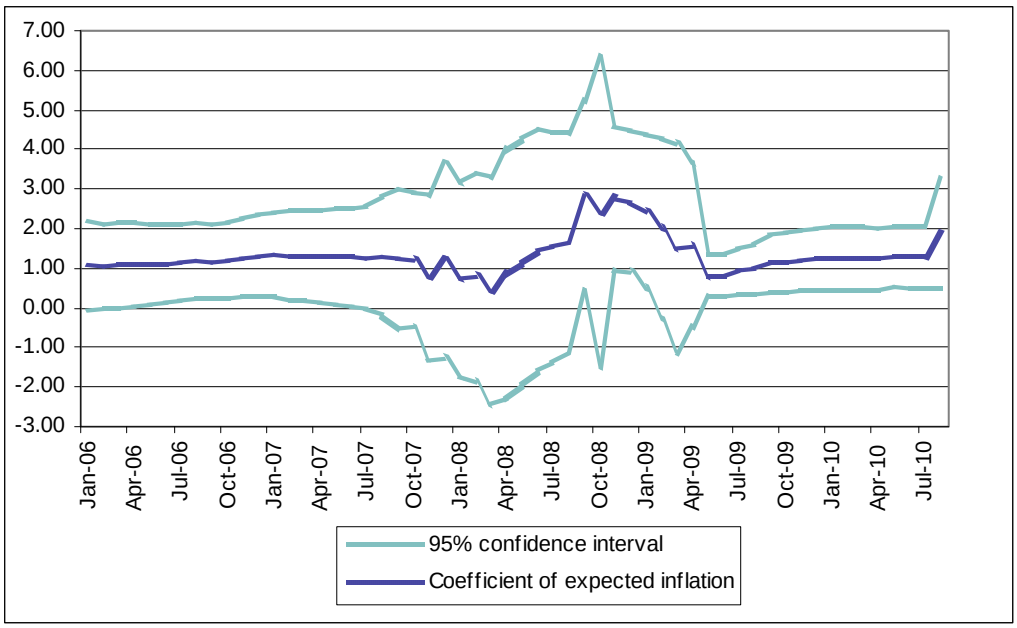


Figure 3. Least squares estimated coefficients of expected inflation and expected growth, rolling regressions



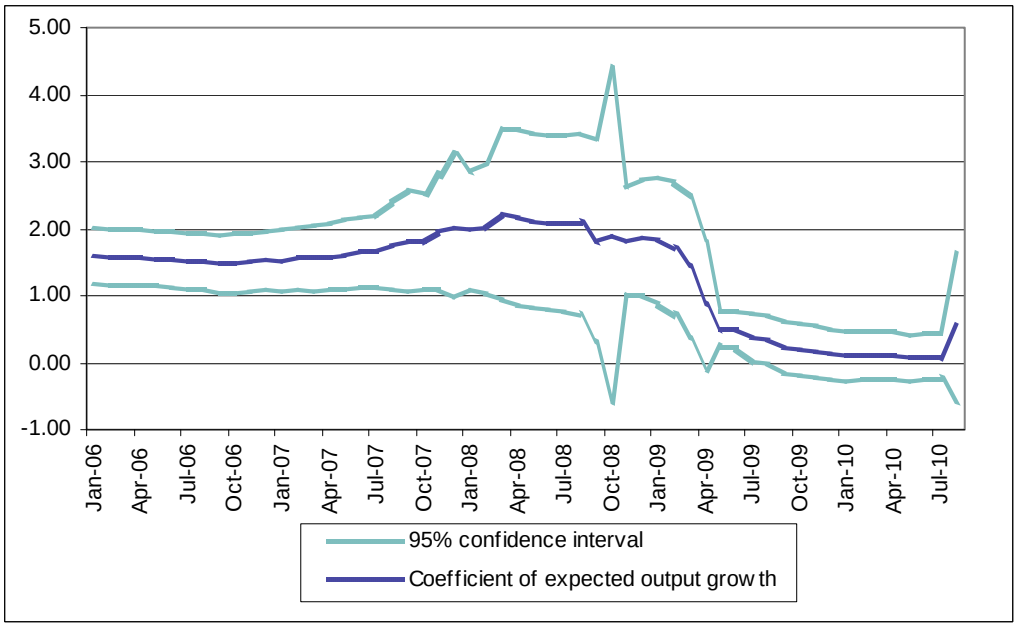


Table 1. Least squares estimations results of equation (3)

	(1)		(2)		(3)	
	Euro area advocates		**Intermediate rule**		**Pure national advocates**	
Sample range	1998.6-2007.12	1998.6-2010.8	1998.6-2007.12	1998.6-2010.8	1998.6-2007.12	1998.6-2010.8
i_{t-1}	0.89***	0.89***	0.92***	0.92***	0.95***	0.92***
s.e	0.04	0.04	0,03	0.03	0.03	0.04
u_{t-1}	0.49***	0.56***	0.40***	0.51***	0.50***	0.55***
s.e.	0.11	0.08	0.09	0.09	0.13	0.09
π^{E}_{t+12}	1.83**	1.35**	1.19	0.66		
s.e.	0.93	0.61	0.95	0.88		
x^{E}_{t+12}	1.74***	0.92***	2.37***	1.53***		
s.e.	0.36	0.27	0.68	0.53		
π^{median}_{t+12}					-1.17	0.10
s.e.					2.17	1.00
x^{median}_{t+12}					2.13**	1.36***
s.e.					1.06	0.52
$\pi^{median}_{t+12} - \pi^{E}_{t+12}$			-2.75	-3.44*		
s.e.			1.81	1.53		
$x^{median}_{t+12} - x^{E}_{t+12}$			0.42	-0.65		
s.e.			1.25	1.37		
Adj R^2	0.99	0.99	0.99	0.99	0.99	0.99
Durbin's h	0.27	0.58	0.81	0.85	0.28	0.60

Notes: ***/**/* significant at 1%/5%/10% level, respectively.
Reported standard errors (s.e.) are Newey-West adjusted

Table 2. Main characteristics of selected Monetary Policy Committees

Country	MPC size	Number of regional 'representatives'	De jure decision rule	Non-voting MPC members
Euro area	22	16	Simple majority	0
United States	19	12	Simple majority	7
Japan	9	6	Simple majority	0
United Kingdom	9	4	Simple majority	0

Note: Data as of August 2009.

Source: Stella and Vandenbussche (2010)

Table 3. Least squares estimations results of Equation (3) for Heinemann-Huefner sample

	Euro area advocates	**Intermediate rule**	**Pure national advocates**
i_{t-1}	0.73***	0.66***	0.74***
s.e	0.07	0.10	0.06
v_{t-1}	0.38***	0.40***	0.30*
s.e.	0.13	0.13	0.15
π^{E}_{t+12}	1.24***	1.33***	
s.e.	0.41	0.34	
x^{E}_{t+12}	0.94***	0.75***	
s.e.	0.28	0.26	
π^{median}_{t+12}			1.37***
s.e.			0.38
x^{median}_{t+12}			0.69**
s.e.			0.27
$\pi^{median}_{t+12} - \pi^{E}_{t+12}$		1.14	
s.e.		1.03	
$x^{median}_{t+12} - x^{E}_{t+12}$		-0.74	
s.e.		0.76	
Adj R^2	0.96	0.96	0.96
Durbin's h	0.48	0.91	0.26

Notes: ***/**/* significant at 1%/5%/10% level, respectively.

Sample range is 1999.1-2002.4

Reported standard errors (s.e.) are Newey-West adjusted

Table 4. Model with inflation dispersion

Sample range	1998.6-2010.8
i_{t-1}	0.90***
s.e	0.04
v_{t-1}	0.53***
s.e.	0.09
π^{E}_{t+12}	1.29**
s.e.	0.59
x^{E}_{t+12}	1.06***
s.e.	0.36
$\sigma(\pi^{N}_{t+12})$	-2.56
s.e.	2.14
Adj R^2	0.99
Durbin's h	0.77

Notes: ***/**/* significant at 1%/5%/10% level, respectively.
Reported standard errors (s.e.) are Newey-West adjusted

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