

# How Anchored are Inflation Expectations within EMU countries?\*

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This version: May 2009

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## Abstract

Well anchored inflation expectations are helpful for monetary policy making. Our results indicate that monetary policy in the Euro Area has been effective in breaking the link between expected and actual Euro Area inflation. However, this does not imply that central bankers can lean back. It is important to look at expectations of national inflation too. These expectations might behave differently than expectations of Euro Area inflation. First, agents in different countries may have different inflation targets in mind and these targets may deviate from the European Central Bank's target (which refers to the Euro Area average inflation rate). Second, the extent to which they have anchored their inflation expectations to these anchors may differ too. Our findings suggest that country-specific inflation experiences still affect national inflation expectations. The EMU has not made this link disappear.

*Keywords:* Inflation expectations, monetary policy, EMU.

*J.E.L codes:* E52, E58.

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\*Views expressed are our own and do not necessarily reflect those of the institutions with which we are affiliated. We would like to thank Martin Admiraal for the data collection. Any remaining errors are our own.

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# 1 Introduction

European Monetary Union and the advent of the Euro have led to a significant convergence in prices and inflation across all member states. Faber and Stokman (2009) have argued that price convergence has occurred for the past 50 years in the Euro Area and it is therefore not uniquely the result of monetary union (also Rogers, 2007). However, even if price convergence is not exclusively the result of monetary union, there is evidence that the latter has contributed to this process, either through active policy in the EMU area (Allington et al, 2005 and Beck et al, 2006), or through the achievement of greater homogenization in the underlying structures (for example Faber and Stokman, 2009, argue the increase in openness). Beyond the attained convergence in inflation rates between the different countries, we also observe that Euro Area inflation itself has been both low as well as relatively stable. At the same time Euro Area inflation expectations beyond the policy horizon, have been anchored at a level just below the 2 percent upper bound and have not followed the circular movements in inflation. This has implied a good anchoring of expectations at the euro level and by implication a monetary policy that is perceived to be credible by the public (Demertzis et al, 2009).

The question that we pose in this paper is to what extent we can say the same thing about national inflation in the member countries. Are expectations also anchored, in the sense of being stable, at a constant level at the country level? And are they formed independently of the underlying inflation process to characterize national monetary policies as independent as well?

Our results based on EMU period data suggest that national inflation expectations behave differently than Euro Area inflation expectations. Expectations of national inflation seem to be less well anchored than expectations of Euro Area average inflation. Our findings indicate that there is no disconnect between national inflation expectations and country-level actual inflation and that the EMU has not made the relevance of national characteristics for national inflation expectations disappear.

Our paper is organized as follows. First we take a look at the data in Section 2. We examine both actual and expected inflation within the Euro Area, in particular we discuss France, Germany, Italy, the Netherlands and Spain. In Section 3 we first explain the method we use to measure the anchoring of inflation expectations. Our results are presented in Section 4. We end our paper with a conclusion in Section 5.

## 2 Stylized facts

We start with a discussion of the data that we use in our analyses. First, we analyze inflation differentials and trends within the Euro Area in Section 2.1. In Section 2.2 we take a closer look at five important EMU countries: Germany, France, Spain, Italy and the Netherlands. For these countries we have long-term inflation expectations data, which we relate to actual inflation figures.

## 2.1 Inflation in EMU

Within the Euro Area inflation differs from country to country. Figure 1 presents the level of inflation in the EU-12 countries in the past twenty years. Although inflation levels have converged in the last two decades, inflation differentials between countries do remain.

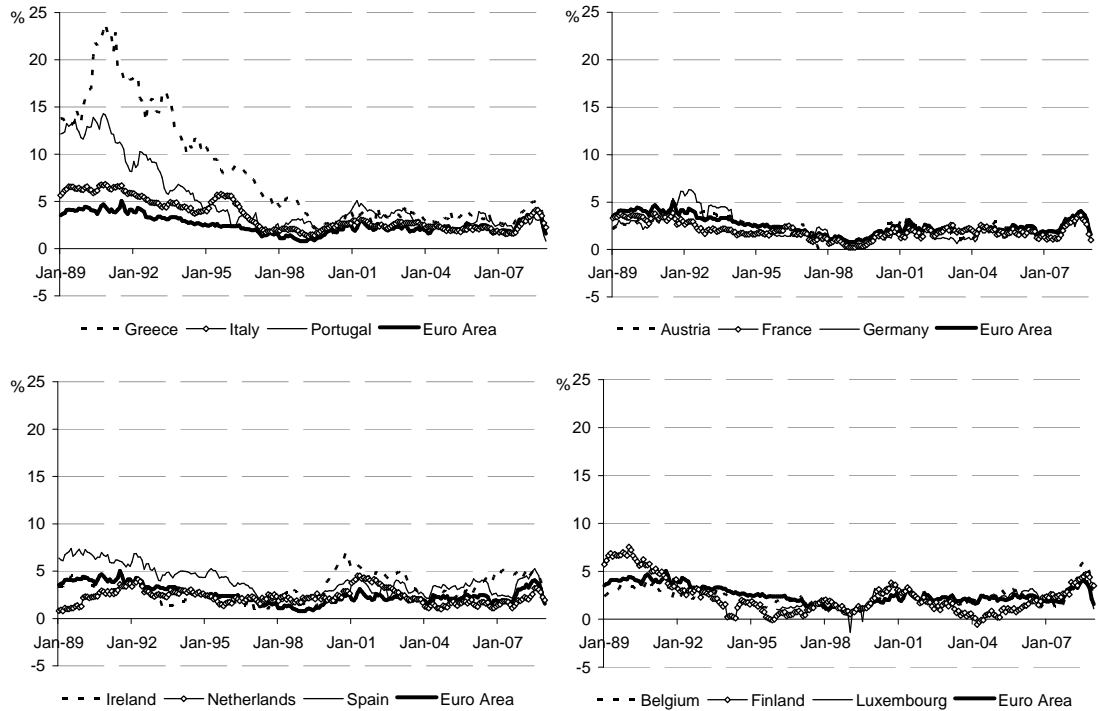


Figure 1: Inflation in the EU-12 countries

Note: monthly data of the year on year % change of the Consumer Price Index (CPI).

Table 1 summarizes inflation pre-EMU and during EMU. Both the level and the standard deviation of inflation declined in the Euro Area. This decrease began already before the start of the EMU in 1999. In the beginning of the nineties inflation was particularly high in Greece and Portugal. But prices have increased at a lower pace since then in these and other Euro Area countries. According to the ECB's target inflation should be close to but below two percent. In the last decade average inflation in most Euro Area countries exceeded this target. For example, Ireland had to contend with an inflation rate of on average almost 4%. Greece and Spain also struggled with inflation rates that on average were more than 3%. The presence of above target inflation in some countries need not shut the door for the ECB to reach its target. However, in the past it

did because below average inflation in a only a few countries (Finland, France and Germany) was not enough to compensate the high inflation in other EMU countries. Average inflation in the Euro Area was slightly above target (2.2%) in the first decade of the existence of the EMU. However, it is commonly perceived that the Euro Area has been characterized by stable prices in the whole period since its inception.

**Table 1. Inflation in EMU countries**

	(1) Pre-EMU		(2) EMU	
	Mean	St.Dev.	Mean	St.Dev.
Austria	2.6	1.0	2.0	0.8
Belgium	2.3	0.9	2.2	1.0
Finland	2.7	2.2	1.9	1.2
France	2.2	0.9	1.8	0.7
Germany	2.8	1.5	1.6	0.7
Greece	12.2	5.4	3.3	0.6
Ireland	2.6	0.9	3.8	1.4
Italy	4.6	1.6	2.4	0.5
Luxembourg	1.2	0.3	2.4	0.8
Netherlands	2.3	0.7	2.3	0.9
Portugal	7.0	4.0	2.9	0.8
Spain	4.7	1.7	3.2	0.8
Euro Area	2.9	1.1	2.2	0.6

Note: Monthly year-on-year CPI inflation data. The pre-EMU period ranges from 1989:1-1998:12 (except for Luxembourg: 1996:1-1998:12) and the EMU period ranges from 1999:1-2008:12.

If the ECB is perceived as a credible institute, long-term Euro Area inflation expectations should be anchored strongly around the ECB's inflation target. However, national inflation expectations need not be anchored around this target because the inflation target of the ECB refers to the Euro Area average. National features are likely to affect the formation process of country-specific inflation expectations. As a result inflation expectations need not be formed uniformly across countries. First, the particular inflation target that agents in different countries have in mind may differ. Second, the extent to which they have anchored their inflation expectations to this anchor may differ too.

## 2.2 A closer look

We can test whether country-specific inflation expectations behave differently from each other and from Euro area inflation expectations by taking a closer look at the formation of inflation expectations, as well as inflation, in each member state. We have Consensus Economics inflation expectations data of five main Euro Area countries: France, Germany, Italy, Spain and the Netherlands. Together these countries cover about 85% of EU-12 GDP (*source*: Eurostat). Inflation expectations ( $\pi_t^e$ ) are measured for various time horizons  $t$ . A possible

disconnect between inflation and inflation expectations should be most easily retrieved from the longest run inflation expectations available. For this reason we use inflation expectations at a 6-10 year horizon ( $\pi_{6-10}^e$ ) in our analyses.<sup>1</sup> These inflation expectations are measured twice a year, in April and October, and run from April 1990 till the end of 2008. In line with this we use semi-annual data for inflation, namely the year-on-year percentage change of the Consumer Price Index (CPI) in April and October.<sup>2</sup> Figure 2 gives a visual summary of our data, while Table 2 summarizes it numerically. There are two main observations. First, the level of inflation has declined. Second, inflation has become more stable.

**Table 2. Actual inflation and long run inflation expectations**

	EA		FR		DE		IT		NL		ES	
	$\pi$	$\pi^{\wedge}$	$\pi$	$\pi^e$	$\pi$	$\pi^e$	$\pi$	$\pi^e$	$\pi$	$\pi^e$	$\pi$	$\pi^e$
Mean	2.52	1.89	1.94	2.15	2.19	2.06	3.41	2.52	2.21	2.10	3.89	2.50
Median	2.39	1.90	1.89	1.90	1.96	1.90	2.66	2.00	2.03	2.05	3.58	2.50
Max	4.68	2.00	3.77	3.30	6.28	2.90	6.71	4.60	4.51	2.70	7.09	3.30
Min	0.88	1.80	0.40	1.50	0.55	1.50	1.48	1.50	1.11	1.70	1.68	1.90
St.Dev.	0.91	0.05	0.80	0.55	1.28	0.45	1.61	0.97	0.85	0.28	1.46	0.25
Persistence	0.82	0.89	0.73	0.90	0.77	0.92	0.87	0.87	0.52	0.76	0.78	0.62
Cor ( $\pi^e, \pi$ )		0.09		0.53*		0.65*		0.90*		0.24		0.65*
Start data		99Q1		90S1		90S1		90S1		95S1		95S1

Note:  $\pi$  = year on year CPI inflation measured in April and October. The inflation data ranges from 1989S2-2008S2.  $\pi^e$  = long term (6-10 years ahead). Consensus Economics inflation expectations measured in April and October.  $\wedge$  = 5 years ahead inflation expectations from ECB Survey of Professional Forecasters. \*indicates significance at the 5% level. EA=Euro area, DE=Germany, FR=France, ES=Spain, IT=Italy, NL=the Netherlands.

On average inflation was the highest in Spain (3.9%), followed on its heels by Italy (3.4%). Inflation in Germany and the Netherlands was lower and closer to the ECB target of close to but below two percent. Only in France, inflation was on average below 2%. Various levels of inflation are observed: from a minimum of 0.6% in Germany till a maximum of 7.1% in Spain. Inflation was relatively stable in the Netherlands and France, and volatile in Spain and Italy. Inflation has been the least persistent in the Netherlands (0.5) and the most persistent in Italy (0.9).<sup>3</sup>

<sup>1</sup>We present a summary of alternative inflation expectations series (with shorter horizons) in Appendix A. These series show a strong and positive correlation.

<sup>2</sup>Note that semi-annual inflation based on the Harmonized Index of Consumer Prices (HICP) shows a similar trend as the semi-annual CPI inflation. Because the data period of the latter is longer, we prefer to use CPI inflation.

<sup>3</sup>Inflation persistence is measured by summing up the coefficients of the lags in a AR(4)-model with inflation at the left-hand side and four lags of inflation at the right-hand side of the equation.

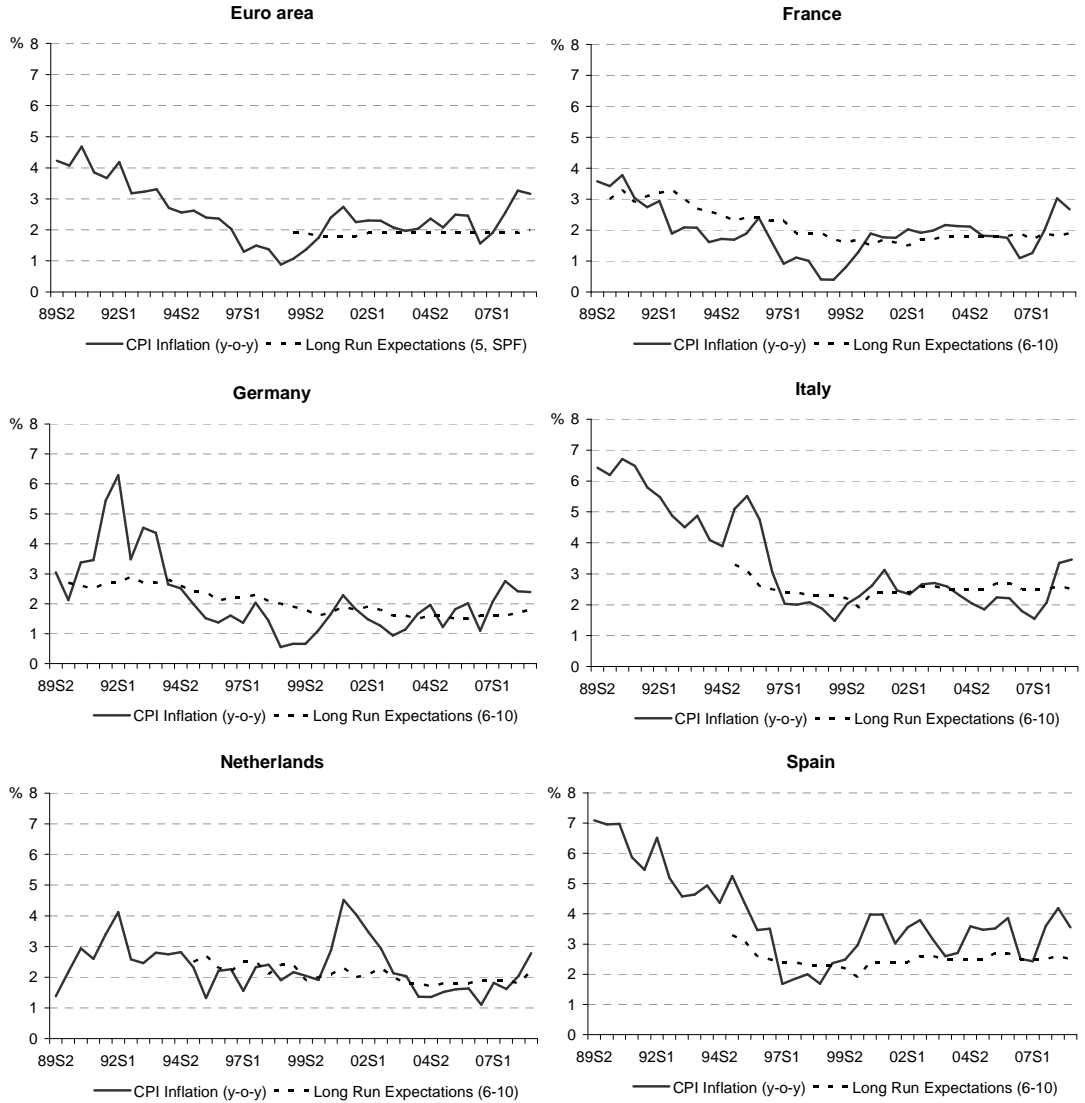


Figure 2: Long-term inflation expectations compared to actual inflation

Source: ECB Survey of Professional Forecasters (Euro Area,  $\pi_5^e$ ) and Consensus Economics (EMU-countries,  $\pi_{6-10}^e$ ).

Figure 2 displays expectations of inflation in the long run (6-10 years) for France, Germany, Italy, the Netherlands and Spain, as well as for the Euro Area as a whole. In almost all countries in our sample, inflation expectations have come closer to the ECB's target. In line with inflation, long-term inflation

expectations in Germany, France and the Netherlands are also close to, although above, two percent. The decline of inflation expectations was the strongest in Italy. Italian inflation expectations have remained close to the target, although recently actual inflation went up. In Spain long-term inflation expectations declined, but they seem to be anchored around a constant that is about 0.5 percentage point higher than the target of the ECB. Inflation expectations are the least persistent in Spain (0.6) and the most persistent in Germany, France and Italy (0.9).

The correlation between inflation and inflation expectations is positive in all countries and significant in four countries. The correlation is the highest in Italy (0.9), and the lowest - and insignificant - in the Netherlands (0.24). This finding is a first signal that inflation expectations might be anchored differently across countries. Furthermore, the correlation between national inflation expectations and national inflation is higher than the correlation between expected Euro Area inflation and actual Euro Area inflation. This is a first signal that expectations of country inflation might behave differently from expectations of Euro Area inflation and that there may be a closer relationship between national inflation expectations and national inflation than between Euro Area inflation expectations and Euro Area inflation.

### 3 Our set-up

In this section we describe the method that characterizes whether or not there is a close relationship between inflation and inflation expectations, as well as measures the degree of the anchoring effect and the anchor itself. We borrow this from Demertzis et al (2008).

#### 3.1 The anchoring effect

We consider first a reduced form model for inflation and inflation expectations and describe how the anchoring effect manifests itself. We show first how inflation is affected by the level of expectations. The central bank has a standard loss function in which it chooses the rate of inflation  $\pi$  to minimize the distance from the inflation objective set,  $\pi^T$ , and close the output gap  $y$ , i.e.,

$$L_{CB}|\xi = \frac{1}{2}\mathbb{E}\left[(\pi_t - \pi^T)^2 + y_t^2\right], \quad (1)$$

subject to a standard Lucas supply function,  $y_t = \pi_t - \pi_t^e + \xi_t$ , where  $\pi_t^e$  represents inflation expectations and  $\xi$  is a supply shock with zero mean and constant variance,  $\sigma_\xi^2$ . Optimization of (1) implies that,

$$\pi_t|\xi = \frac{\pi^T}{2} + \frac{\pi_t^e}{2} - \frac{\xi_t}{2}, \quad (2)$$

where  $\pi_t$  is now the *ex post* inflation outcome conditional on the shock  $\xi_t$ , before solving for private sector expectations,  $\pi_t^e$ . In a typical commitment set-up, where the central bank commits to the target  $\pi^T$ , expectations formed are equal to the central bank's objectives,  $\pi_t^e = \pi^T$ , and the ex post outcome is:

$$\pi_t|\xi = \pi^T - \frac{\xi_t}{2} \quad (3)$$

$$\mathbb{E}(\pi) = \pi^T. \quad (4)$$

However, it is questionable whether empirically it is justified to reduce (2) into (4). Rather than impose an anchor for expectations, we would like to explore how inflation expectations actually evolve. There are a number of ways recent contributions in the literature depart from the full information set-up. A heuristic expectations formation (Brazier et al, 2008), or monetary policy as an information game (Demertzis and Viegi, 2007, 2008), or expectations learning (e.g. Orphanides and Williams, 2005), all constitute such examples. In their simplest form however, these approaches imply that when looking at expectations across time, they would be partly time dependent and partly time invariant. We identify the extent to which expectations are time invariant with the anchoring effect. We model this feature based on Bomfin and Rudebusch (2000), who have assumed that long-run inflation expectations at time  $t$  are a weighted average of a constant  $\pi^*$  (which in their case is the current target) and last period's inflation rate<sup>4</sup>:

$$\pi_t^e = \lambda_t \pi^* + (1 - \lambda_t) \pi_{t-1}. \quad (5)$$

Parameter  $\lambda_t (\in [0, 1])$  then measures the degree to which expectations are anchored. If  $\lambda_t = 1$ , inflation expectations are perfectly anchored to the constant  $\pi^*$ , which for inflation targeting regimes can be cross-checked against the inflation objective  $\pi^T$  communicated. It follows that if  $\lambda_t = 0$  expectations simply follow past inflation.

### 3.2 Inflation and inflation expectations disconnect

The main observation of the previous analysis is that well anchored inflation expectations will be characterized by a disconnect between inflation and inflation expectations dynamics. In what follows, we identify how this disconnect would manifest itself in the data and then how inflation expectations are anchored once they are disconnected from the historical inflation experience.

Following (2) and (5) and allowing for the presence of dynamics, we model

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<sup>4</sup>If expectations are formed according to an information game, then (5) is a very good proxy for the way they are generated across time and therefore, consistent with optimizing agents.

inflation,  $\pi_t$ , and inflation expectations,  $\pi_t^e$ , in the following VAR specification:

$$\begin{pmatrix} \pi_t \\ \pi_t^e \end{pmatrix} = \begin{pmatrix} c_1 \\ c_2 \end{pmatrix} + \begin{pmatrix} a(L) & b(L) \\ c(L) & d(L) \end{pmatrix} \begin{pmatrix} \pi_{t-1} \\ \pi_{t-1}^e \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix}, \quad (6)$$

$$\begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix} \sim i.i.d. \left( \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{12} & \sigma_{22} \end{pmatrix} \right).$$

Demertzis et al (2008) argue that a credible disconnect between the two variables will be captured by the following five hypotheses.

**Conjecture 1** *A credible inflation expectations disconnect would imply that the following hypotheses are satisfied:*

- H1: *Expected inflation is not affected by lagged actual inflation, i.e.,  $c(L) = 0$ .*
- H2: *Expected inflation is anchored to a constant on average, i.e.,  $c(L) = 0$  and  $d(L) = 0$ .*
- H3: *Actual inflation is not affected by expected inflation, i.e.,  $b(L) = 0$ .*
- H4: *The persistence of actual inflation, the sum of the coefficients of  $a(L)$ , decreases with credibility.*
- H5: *There is no contemporaneous transmission of shocks from actual to expected inflation and vice versa, i.e.,  $\sigma_{12} = 0$ .*

Following this methodology we also use standard Wald tests to test the first three hypotheses. For hypotheses 1 and 3 we use Granger non-causality tests. We examine H2 by looking at the restrictions and the estimated inflation expectations persistence. It is difficult to verify the fourth hypothesis, because we need to be able to compare estimated inflation persistence in different credibility periods. Demertzis et al (2008) had a long data set of the US at their disposal and were able to do so. In contrast, we have only a short data set for the Euro Area. Despite this, we investigate differences between the period before and after the start of the EMU. The last hypothesis is satisfied when the VAR errors are uncorrelated ( $corr(e_{1t}, e_{2t}) = 0$ ). These correlations are based on heteroskedasticity consistent versions of the VARs. Similar to Demertzis et al (2008) we look at impulse response functions (IRFs) of actual inflation to a shock in inflation expectations and vice versa. H1, H3 and H5 imply that all elements in these IRFs are zero.

Note that to the extent that all five hypotheses are validated then there is a stable relationship between inflation and inflation expectations and then one can estimate an average  $\lambda_t$  and  $\pi^*$ . We can re-write (5) as follows:

$$\pi_t^e = \lambda \pi^* + (1 - \lambda) \pi_{t-1}. \quad (7)$$

where  $\lambda$  then serves a proxy for the average extent to which inflation is anchored to a constant  $\pi^*$ . For a generalized VAR length, VAR(p) then these two parameters are calculated as follows:

$$\pi_t^e = c_0 + c_1\pi_{t-1} + \dots + c_p\pi_{t-p} + d_1\pi_{t-1}^e + \dots + d_p\pi_{t-p}^e + e_{pt}, \quad (8)$$

and

$$\lambda = 1 - \frac{\sum_{n=1}^{n=p} c_n}{1 - \sum_{n=1}^{n=p} d_n} \quad (9)$$

$$\pi^* = \frac{c_0}{(1 - \sum_{n=1}^{n=p} d_n) \lambda}. \quad (10)$$

Because  $\lambda$  is not constrained to fall within the  $[0,1]$  interval we can re-write (9) as follows:

$$c_1 = (1 - \lambda) * (1 - \sum_{n=1}^{n=p} d_n) - \sum_{n=2}^{n=p} c_n \quad (11)$$

which yields

$$\begin{aligned} \pi_t^e = & c_0 + [(1 - \lambda) * (1 - \sum_{n=1}^{n=p} d_n) - \sum_{n=2}^{n=p} c_n] \pi_{t-1} \\ & + \dots + c_p \pi_{t-p} + d_1 \pi_{t-1}^e + \dots + d_p \pi_{t-p}^e + e_{pt}. \end{aligned} \quad (12)$$

## 4 Results

### 4.1 Anchoring of Euro Area inflation expectations

First, we present the results for the Euro Area aggregate inflation expectations. We utilize quarterly ECB Survey of Professional Forecasters data. The results are in Table 3.<sup>5</sup> These findings support the idea that Euro Area inflation expectations are well anchored. There are no significant effects of actual inflation on expectations of Euro Area inflation, and vice versa. Furthermore the correlation of the VAR errors is small.

**Table 3. Granger Causality (H1, H3, H5) (1999q2-2008q4)**

	<i>Dependent</i>	<i>Excluded</i>	df	$\chi^2$	(Pr)	$\text{cor}_{e_1, e_2}$
Euro-Area	$\pi$	$\pi^e$	2	1.82	0.40	<b>0.18</b>
	$\pi^e$	$\pi$	2	3.50	0.17	

Notes: Inflation expectations 5 years ahead from ECB Survey of Professional Forecasters. Bold indicates significance at a 5% level.

<sup>5</sup>We do not use Consensus inflation expectations data because Consensus data only starts measuring long-term expectations from 2003 onwards which does not provide much of information.

Figure 3 reports the estimated impulse responses and their 95% confidence intervals. The IRFs support a disconnect between inflation and inflation expectations.

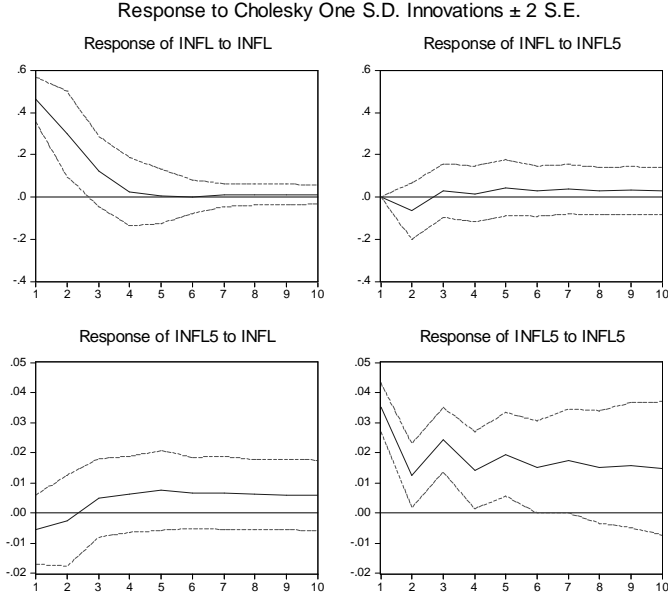


Figure 3: Impulse response functions for Euro Area (EMU-period)

Our results show that there is neither contemporaneous nor dynamic statistically significant correlation between actual values and long-term inflation expectations. This is line with the perceived notion that monetary policy in the Euro Area has been effective in breaking the link between inflation and inflation expectations.

Given this finding we can then also calculate the extent to which expectation are anchored, as well as the anchor itself. Table 4 shows the results for different inflation expectations horizons and number of lags. We find that  $\lambda$  is close to 1 and the implicit inflation target ( $\pi^*$ ) is in line with the ECB's inflation target (of below but close to 2%).

**Table 4. The degree of credibility based on expected EMU inflation**

$\pi^e$	$df$	$\lambda$	$\pi^*$	<i>period</i>
Euro Area (SPF, t=2)	1	0.92	1.83%	99Q2-08Q4
Euro Area (SPF, t=5)	1	0.92	1.83%	99Q2-08Q4
Euro Area (SPF, t=2)	2	0.91	1.83%	99Q3-08Q4
Euro Area (SPF, t=5)	2	0.76	1.86%	99Q3-08Q4

Source: SPF = ECB Survey of Professional Forecasters.

The question that we address next, is whether we can draw similar conclusions for individual Euro Area countries as well.

## 4.2 Anchoring of national inflation expectations: EMU period

Again, our analysis covers the EMU-period (1999-2008). In contrast to before we use expectations of national inflation and relate these to national inflation rates. We analyze the outcomes of the VAR model and test hypotheses 1-5.<sup>6</sup> The lag length selection is based on the Schwarz information criterion (including 4 lags). This results in 1 lag for Germany, the Netherlands and Spain and 3 lags for France and Italy. The outcomes are presented in Table 5.

**Table 5. Granger Causality (H1, H3 and H5): EMU period**

		<i>Dependent</i>	<i>Excluded</i>	<i>df</i>	$\chi^2$	(Pr)	$\text{cor}_{e_1, e_2}$
France	99S1-08S2	$\pi$	$\pi_{6-10}^e$	3	<b>11.69</b>	(0.01)	0.00
		$\pi_{6-10}^e$	$\pi$	3	<b>14.73</b>	(0.00)	
Germany	99S1-08S2	$\pi$	$\pi_{6-10}^e$	1	3.02	(0.08)	-0.01
		$\pi_{6-10}^e$	$\pi$	1	<b>4.05</b>	(0.04)	
Italy	99S1-08S2	$\pi$	$\pi_{6-10}^e$	3	7.02	(0.07)	0.00
		$\pi_{6-10}^e$	$\pi$	3	<b>11.50</b>	(0.01)	
Netherlands	99S1-08S2	$\pi$	$\pi_{6-10}^e$	1	0.15	(0.70)	<b>-0.03</b>
		$\pi_{6-10}^e$	$\pi$	1	1.21	(0.27)	
Spain	99S1-08S2	$\pi$	$\pi_{6-10}^e$	1	2.60	(0.11)	-0.01
		$\pi_{6-10}^e$	$\pi$	1	1.82	(0.18)	

Notes: Bold indicates significance at 5% level. Lag length selection is based on Schwarz information criterion (including 4 lags).

The anchoring effect differs between countries. The results indicate that in the Netherlands and Spain there is indeed an credible inflation expectations disconnect. There are no significant effects of actual inflation on long-term inflation expectations, and vice versa, and there is no evidence of contemporaneous shock transmission (the significant correlation of the VAR errors in case of the Netherlands is about zero). In contrast, in Germany, France and Italy inflation expectations are not well anchored. Inflation expectations in these countries are affected by lagged actual inflation (H1 is rejected). In France inflation is also affected by lagged inflation expectations (H3 is rejected). The VAR errors are uncorrelated in France, Germany, Italy and Spain (H5 is not rejected).

Next, we take a look at the impulse response functions (Figures 4-8). For all countries in the sample it holds that shocks hitting inflation expectations are smaller than shocks hitting inflation, sometimes even much smaller. As

<sup>6</sup>As Demertzis et al. (2008) note it would be better to use a single equation approach instead of a VAR framework if there is perfect collinearity between inflation and inflation expectations. In practice, however, correlations are at most 0.90 (see Table 2).

mentioned before, H1, H3 and H5 imply that all elements in the IRFs are zero. This is not the case for all countries in the sample. Based on the IRFs H2 is rejected for France (Figure 4), Germany (Figure 5), Italy (Figure 6), the Netherlands (Figure 7) and Spain (Figure 8). In all countries both inflation and inflation expectations show some persistence. In addition, according to the IRFs there is a significant link between inflation and inflation expectations in several countries.

Our results support the idea that expectations of country inflation can behave differently than expectations of Euro Area inflation. We do not find support that monetary policy in the Euro Area has been successful in weakening the link between national actual and expected inflation.<sup>7</sup>

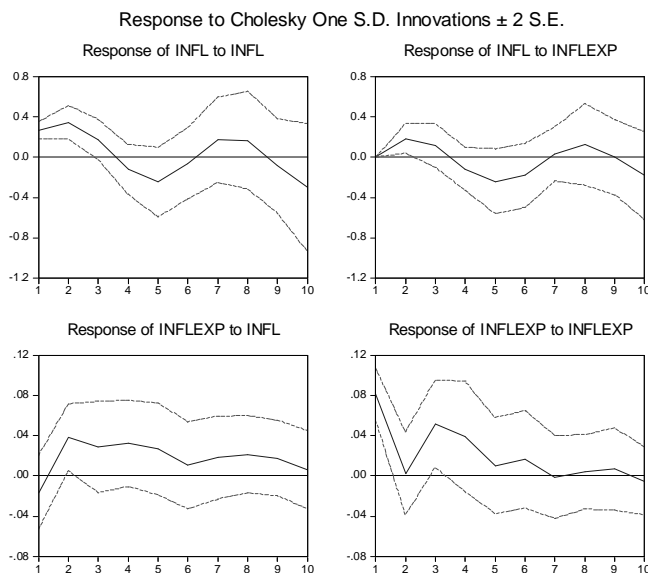


Figure 4: Impulse response functions for France (EMU-period)

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<sup>7</sup>Note that because not all five hypotheses are validated there is no stable relationship between inflation and inflation expectations and one cannot estimate an average  $\lambda_t$  and  $\pi^*$ .

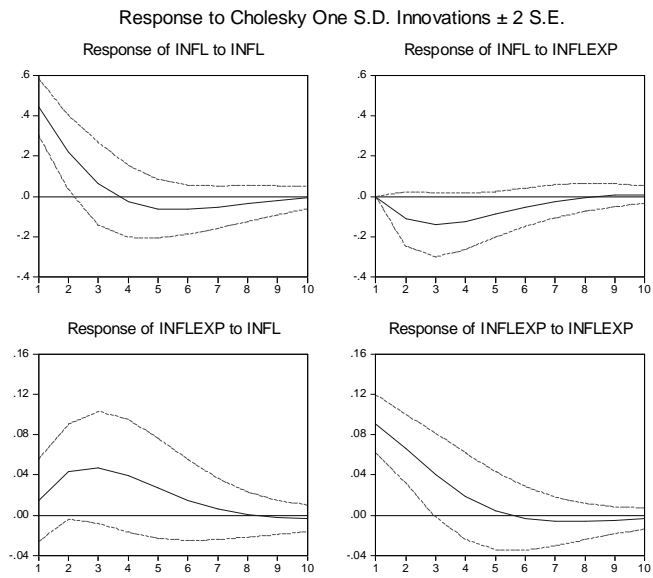


Figure 5: Impulse response functions for Germany (EMU-period)

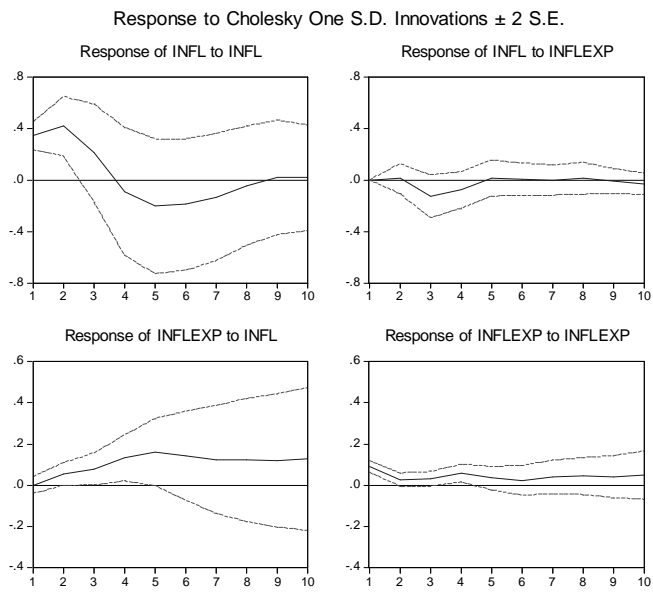


Figure 6: Impulse response functions for Italy (EMU-period)

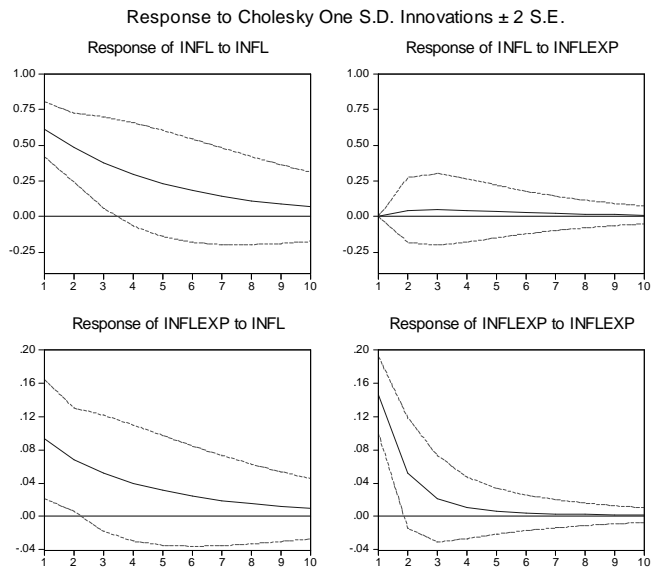


Figure 7: Impulse response functions for Netherlands (EMU-period)

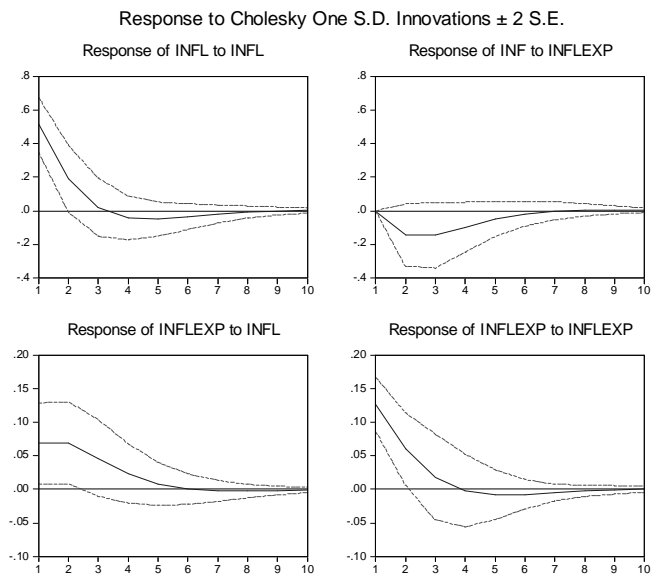


Figure 8: Impulse response functions for Spain (EMU-period)

### 4.3 Anchoring of national inflation expectations: whole period

Last, we analyze whether the start of the EMU has affected the inflation expectations formation process within Europe. We check whether the anchoring effect has changed over time. We do this by analyzing whether analyses based on the whole sample period yield different results than our baseline regressions which are based on the EMU period only.<sup>8</sup> Table 6 presents the outcomes based on the whole period. The IRFs are in Figures 9-13.

**Table 6. Granger Causality (H1, H3 and H5): Whole sample period**

	<i>Dependent</i>	<i>Excluded</i>	<i>df</i>	$\chi^2$	(Pr)	$\text{cor}_{e_1, e_2}$
France	$\pi$	$\pi_{6-10}^e$	2	1.09	(0.58)	0.00
	$\pi_{6-10}^e$	$\pi$	2	<b>10.90</b>	(0.00)	
Germany	$\pi$	$\pi_{6-10}^e$	1	0.70	(0.40)	-0.01
	$\pi_{6-10}^e$	$\pi$	1	<b>16.92</b>	(0.00)	
Italy	$\pi$	$\pi_{6-10}^e$	2	<b>21.13</b>	(0.00)	0.01
	$\pi_{6-10}^e$	$\pi$	2	1.87	(0.39)	
Netherlands	$\pi$	$\pi_{6-10}^e$	1	0.28	(0.60)	-0.01
	$\pi_{6-10}^e$	$\pi$	1	0.32	(0.57)	
Spain	$\pi$	$\pi_{6-10}^e$	1	1.56	(0.21)	-0.02
	$\pi_{6-10}^e$	$\pi$	1	3.07	(0.08)	

Notes: Bold indicates significance at the 5% level. Lag length selection is based on Schwarz information criterion (including 6 lags).

The lag length selection is based on the Schwarz information criterion (including 6 lags). Specifications with either one or two lags are preferred. The findings indicate that in France, Germany and Italy the link between inflation and inflation expectations existed during the whole period. In addition, the outcomes of this analysis suggest that a significant link between inflation and inflation expectations in the Netherlands and Spain was absent during the whole period. There are no significant effects of actual inflation on long-term inflation expectations, and vice versa, and there is no evidence of contemporaneous shock transmission in these countries. Results based on the whole sample period do not differ much from findings based on the EMU-period only. Therefore, we find no support for a beneficial EMU-effect. The EMU did not make the link between inflation and inflation expectations disappear in Germany, Italy and France. Country differences remained after the start of the EMU.

<sup>8</sup>Note that the data period before EMU is too short to perform reliable analyses with.

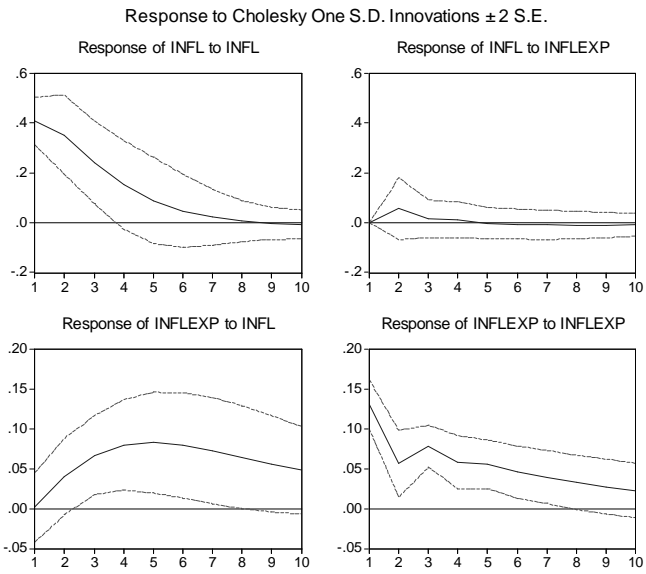


Figure 9: Impulse response functions for France (whole period)

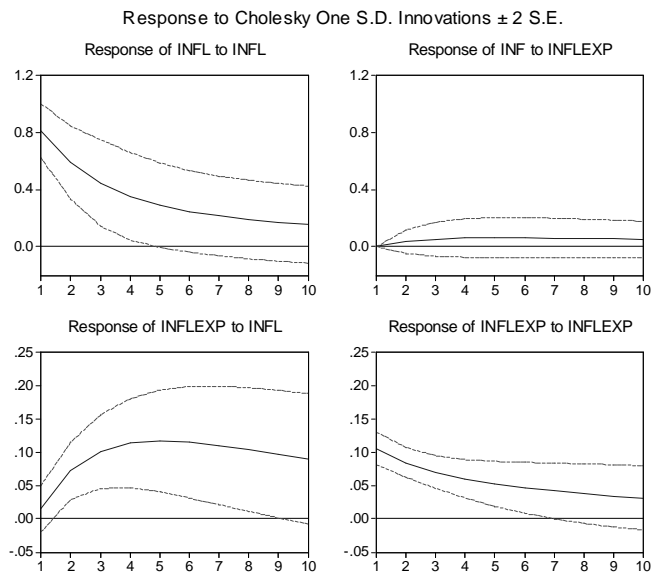


Figure 10: Impulse response functions for Germany (whole period)

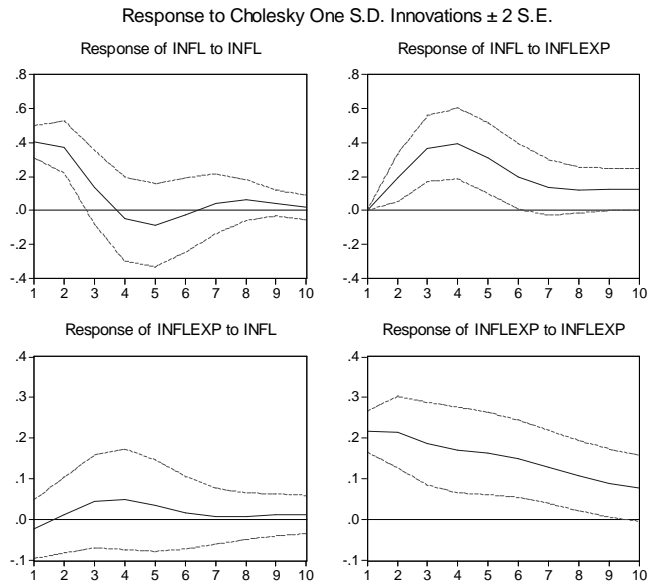


Figure 11: Impulse response functions for Italy (whole period)

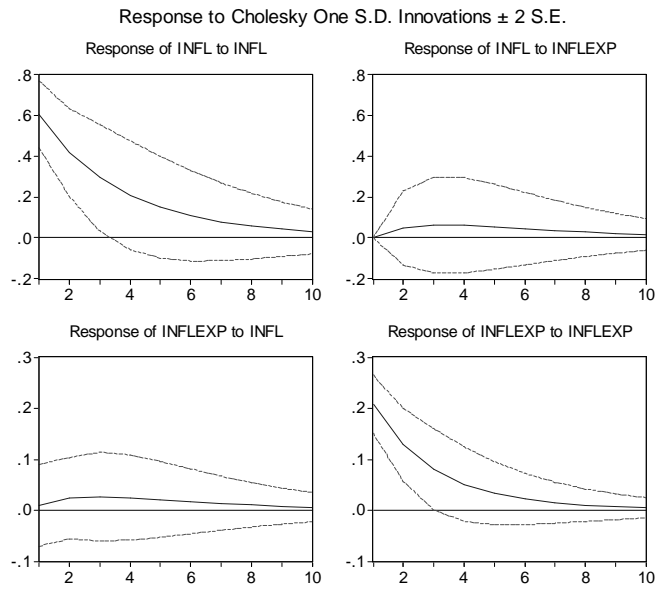


Figure 12: Impulse response functions for the Netherlands (whole period)

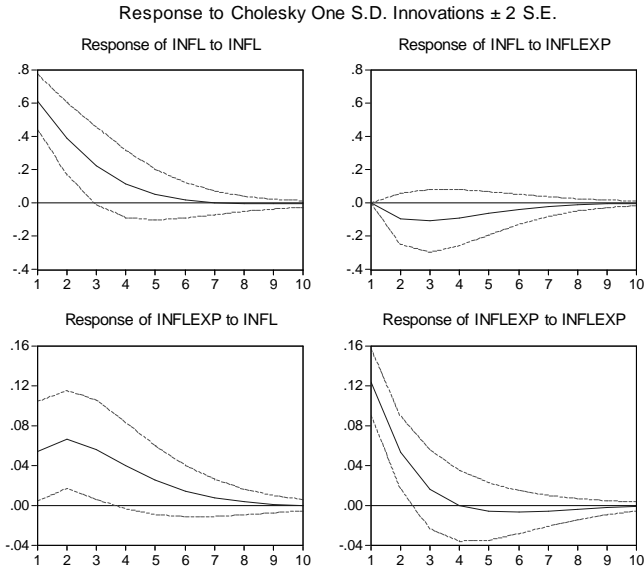


Figure 13: Impulse response functions for Spain (whole period)

## 5 Conclusions

Well-anchored inflation expectations simplify monetary policy making. After a shock to inflation it is easier and less painful for central bankers to bring inflation back to the target. The inflation goal of the ECB is an inflation rate of close to but below two percent. In line with previous research we find that expectations of Euro Area average inflation are well anchored to this inflation target. However, our analyses indicate that this does not imply that central bankers can lean back.

We show that central bankers miss out on important information when they only look at expectations of Euro Area inflation. It is important to, in addition, analyze the formation of expected country-specific inflation. For the economic behavior of EMU citizens these inflation expectations are the most relevant. The manner in which inflation expectations are formed may be different for different EMU countries. First, the implicit inflation target that agents have in mind may be country-specific. Second, the extent to which inflation expectations are anchored to these implicit inflation targets may differ from country to country. Our findings indicate that inflation expectations are not formed similarly across

countries. National characteristics still seem to matter for the formation of national inflation expectations.

For the ECB it is important to realize that national inflation expectations may behave differently from Euro Area inflation expectations. Economic agents know that the ECB only aims at an EMU *average* inflation rate of close to but below two percent. Therefore actual national inflation may still be used as a guideline for future national inflation and the disconnect between inflation expectations and actual inflation may not hold at a national level. This complicates it for the ECB to steer national inflation expectations and thereby to achieve its inflation goal.

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## APPENDIX

### A Inflation expectations: alternative horizons

Alternative inflation expectations series correlate strongly with the inflation expectations that we have used in our baseline analyses. Table A1 gives a summary of these alternative inflation expectations series with shorter horizons.

**Table A1. Alternative long run inflation expectations**

	$\pi_t^e$	Mean	Median	Max	Min	St.Dev.	Cor. ( $\pi_t^e, \pi_b^e$ )	Sample
EA	$\pi_2^e$	1.83	1.80	2.10	1.50	0.11	0.51	99Q1-08Q4
DE	$\pi_2^e$	2.19	1.90	4.00	1.40	0.67	0.92	89S2-08S2
	$\pi_3^e$	2.16	2.00	3.40	1.50	0.57	0.96	89S2-08S2
	$\pi_4^e$	2.12	1.90	3.20	1.60	0.52	0.97	89S2-08S2
	$\pi_5^e$	2.08	1.90	3.00	1.50	0.49	0.98	89S2-08S2
FR	$\pi_2^e$	2.12	1.80	3.40	1.40	0.61	0.96	89S2-08S2
	$\pi_3^e$	2.15	1.90	3.40	1.40	0.59	0.96	89S2-08S2
	$\pi_4^e$	2.16	1.90	3.40	1.60	0.55	0.98	89S2-08S2
	$\pi_5^e$	2.14	1.90	3.30	1.50	0.55	0.99	89S2-08S2
ES	$\pi_2^e$	2.62	2.55	4.10	2.10	0.42	0.90	95S1-08S2
	$\pi_3^e$	2.55	2.50	4.10	2.10	0.39	0.92	95S1-08S2
	$\pi_4^e$	2.51	2.50	3.60	2.10	0.31	0.91	95S1-08S2
	$\pi_5^e$	2.50	2.50	3.40	2.10	0.28	0.91	95S1-08S2
IT	$\pi_2^e$	2.90	2.00	5.70	1.50	1.39	0.97	89S2-08S2
	$\pi_3^e$	2.79	2.00	5.50	1.50	1.25	0.98	89S2-08S2
	$\pi_4^e$	2.70	2.00	5.20	1.50	1.17	0.99	89S2-08S2
	$\pi_5^e$	2.64	2.00	5.10	1.50	1.10	0.99	89S2-08S2
NL	$\pi_2^e$	2.10	2.15	2.60	1.40	0.34	0.68	95S1-08S2
	$\pi_3^e$	2.05	2.05	2.60	1.60	0.30	0.77	95S1-08S2
	$\pi_4^e$	2.08	2.10	2.70	1.60	0.26	0.83	95S1-08S2
	$\pi_5^e$	2.15	2.10	2.70	1.70	0.26	0.87	95S1-08S2

Source: ECB Survey of Professional Forecasters (Euro Area two years ahead) and Consensus Economics (other inflation expectations series).

Note:  $\pi_t^e$  is inflation expected  $t$  years from now.  $\pi_b^e$  are the inflation expectations used in the baseline regressions. EA=Euro area, DE=Germany, FR=France, ES=Spain, IT=Italy, NL=the Netherlands.