

THE IMPORTANCE OF BEING VIGILANT: HAS ECB COMMUNICATION INFLUENCED EURO AREA INFLATION EXPECTATIONS?

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Abstract

Using daily data on inflation-indexed bonds, we find evidence of a negative relationship between ECB communication regarding risks to price stability - measured on the basis of the frequency and strength of the keyword 'vigilance' - and changes in euro area break-even inflation. However, this result is only found for the second half of 2005. At that time, the start of a tightening of ECB monetary policy was increasingly likely. This suggests that communication should be closely in line with policy actions before it can be effective. Still, we also find that the economic significance of this type of communication has been small.

JEL Code: E52, E58.

Keywords: central bank communication, ECB, inflation expectations.

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‘Importantly, signalling vigilance proved instrumental in reaching a common understanding with the markets: the ECB, though observationally inactive, was at any time ready to start action’

Jean-Claude Trichet (2006), p. 9.

1 Introduction

Expectations are key for macroeconomic developments. The importance of this insight is widely recognized by central banks. For example, the European Central Bank (ECB) recently wrote: ‘Stabilising the private sector’s inflation expectations is a prerequisite for monetary policy to be able efficiently to achieve the objective of price stability.’ ECB (2006) (p.59). The determinants of expectations are less well understood. This paper investigates whether it is possible for central banks to influence private sector expectations through communication.

There is, by now, compelling evidence that central bank communication affects developments in financial markets. Ehrmann and Fratzscher (2007), for instance, find that communications by the Federal Reserve, the ECB, and the Bank of England have been an important driver of financial markets. This suggests that communication affects, in some way, the expectations of private agents. However, there is still little *direct* on the effects of communication on expectations. Therefore, this paper uses the concept of break-even inflation to measure the impact of central bank communication on private sector expectations.

In particular, we study the relationship between euro area inflation expectations and ECB communications regarding risks to price stability in recent years. This sample period is particularly interesting as it contains two distinct episodes. Between June 2003 and December 2005, the ECB maintained its main refinancing rate at a level of 2%. However, during this period inflation worries frequently arose. For example, inflation expectations as derived from inflation-indexed bonds showed sharp increases at times. This has led the ECB to voice its concerns by signalling that it was ‘vigilant’ regarding upward risks to price

stability. As ‘vigilance’ is a clear keyword to communicate concerns to financial markets, we use its occurrence to identify the effects of communication on inflation expectations.¹ From Autumn-2005 onwards, markets observers regarded a change in the ECB’s policy stance increasingly likely given the incoming macro-economic data.² As it thus became more likely that words would be followed by deed, the effects of the ECB’s communications may have been different than earlier during this period. Finally, from December 2005 onwards, the ECB has raised the main refinancing rate a number of times. Interestingly, the keyword ‘vigilance’ continued to be used in ECB communication. It was, however, used less frequently. Also, its interpretation has changed. It can still be seen as an indication of the ECB’s unease regarding risks to price stability, but it is also strongly perceived by market participants as an indicator of upcoming policy changes.³ This raises the question of whether this type of ECB communication has had similar effects on inflation expectations in this period as in the period 2003 - 2005.

Our key finding is that the relationship between the ECB’s signalling of inflation risks (through the use of ‘vigilance’) and euro area break-even inflation has been varying over time. We only find evidence for a significant relationship between communication and changes in break-even inflation during October and November 2005. This suggests that communication should be closely in line with policy actions before it can be effective. Still, we also find that the economic significance of this type of communication has been small.

The remainder of this paper is structured as follows. Section 2 discusses the relationship between central bank communication and inflation expectations.

¹ECB president Trichet (2005) has noted: ‘Our concern was signalled to the market from autumn 2003 in the press conference. Over time, our communication became increasingly ‘alert’, signalling our vigilance to the upside risks to inflation which grew at the time.’

²For instance, the Consensus survey on 14 November indicated that almost 40% of the respondents expected a rate increase within 30 days.

³According to Bloomberg, ‘ECB President Jean-Claude Trichet has used the word “vigilant” to flag each of the six rate increases since late 2005’ (Bloomberg News, 15 February 2007). Likewise, according to UBS: ‘Trichet has made a practice of effectively pre-announcing hikes at the prior meeting with the use of the key “vigilant” phrase’ (UBS FX Trade and Research, 9 January 2007).

Section 3 outlines how we obtained data on communication and inflation expectations, while section 4 shortly describes this data. Section 5 presents our empirical model, while section 6 shows the estimation results. Section 7 considers the robustness of our findings. Finally, section 8 offers our conclusions.

2 Communication and inflation expectations

Why is influencing private sector expectations useful from the perspective of the central bank? It is important to realize that the control of the central bank over its ultimate goals, be it solely price stability or also output stabilization, is very indirect. Most central banks try to influence economic developments by changing borrowing conditions at the short end of the yield curve. Changes in the policy rate then feed through into long-term interest rates, exchange rates, asset prices and credit conditions, thus influencing, in the end, spending and pricing decisions of private agents. However, it is not only the current policy stance, but also the expected path of future interest rates that matters for decisions of private agents. This expected path is crucially dependent on the outlook for price developments and economic growth. Therefore, this opens the possibility for central banks to affect current decisions by steering expectations for these variables through communication.⁴

At the same time, it is possible to argue, from a theoretical perspective, that communication has no value added with respect to expectations. If the central bank has committed to a policy rule, if there are no information asymmetries, and if economic agents have rational expectations, the private sector would be able to infer the systemic part of policy from the central bank's actions, thus rendering communication superfluous (see also Woodford (2006)). From a practical point of view, however, these conditions may be questioned. Interest rate decision-making is often highly discretionary, information asymmetries between

⁴See also Blinder, Goodhart, Hildebrand, Lipton and Wyplosz (2001) or Woodford (2006). Theoretically, Morris and Shin (2002) have argued that more public information is not necessarily welfare-enhancing. Svensson (2006) has argued that this result holds only in very special circumstances, which makes it empirically less relevant.

the central bank and the private sector exist when central banks are less than perfectly transparent, and empirical evidence on inflation expectations has often been in conflict with the rational expectations hypothesis. Moreover, as noted, empirical evidence strongly suggests that central bank communications affect developments in financial markets.⁵

With respect to central bank communication on inflation, a distinction should be made between i) the announcement of a target for inflation and ii) communication on inflationary developments. Nowadays, many central banks have publicly announced a target for inflation. In the case of the ECB, this target is specified as a year-on-year change in euro area HICP inflation below, but close to 2%. In general, if the public perceives the central bank as credible, long-run inflation expectations would be anchored around this target. Transitory shocks may cause inflation to differ from this target, but should not necessarily affect long-run expectations. Gürkaynak, Levin, and Swanson (2006) find, in this context, that a well-known and credible inflation target can help in anchoring private sector views regarding long-run inflation outcomes.⁶

How could the central bank then gain from regularly publishing its views on expected economic developments, notably future inflation? First, clear and consistent communication may contribute to building reputation, in particular if the track-record of the central bank concerned is short. Second, the central bank can use communication in a situation in which inflation expectations deviate from target. Communication explaining the deviation and perhaps suggesting possible policy reactions could guide expectations back to target. If agents perceive the comments as new information, they accordingly adjust their expectations, which would be reflected in market prices. Given the developments over the sample period in this study, the latter mechanism is particularly relevant.

⁵See Eijffinger and Geraats (2006) for recent evidence on central bank transparency. Mankiw, Reis, and Wolfers (2004) and Conlisk (1996) discuss rationality in survey data of inflation expectations.

⁶Eusepi and Preston (2007) argue that announcing the inflation target is not enough for expectations stabilization: the central bank must also announce the associated values for nominal interest rates and the output gap.

3 Measuring communication and inflation expectations

Financial markets are continuously flooded with information. It seems likely that analysts and traders employ filtering mechanisms to process the incoming data.⁷ Central banks may, in turn, revert to a strategy of using keywords and key phrases in their communication. In this paper, we focus on the use of ‘vigilance’, ‘vigilant’ or variations thereof as an indicator of the ECB’s perception of risks to price stability.⁸

The ECB uses four main communication instruments. Firstly, there are the press conferences given by the ECB president and vice-president after meetings of the ECB’s Governing Council. A second instrument is the publication of the Monthly Bulletin of which in particular the editorial is scrutinised by analysts. A third instrument are the testimonial hearings by the ECB president (or vice-president) at the European Parliament. Finally, Governing Council members often present their views in speeches and interviews. To search for the occurrence of ‘vigilance’ in communication, we use two main data sources: Bloomberg and the ECB web-site. For the period between 2 June 2003 and 30 November 2005, we searched the archive of Bloomberg News for ECB communications, yielding a comprehensive data-set of over 2,000 news reports. For the period starting in December 2005 we used the ECB web-site. In this latter case, we include i). the ECB press conference, ii). the editorial of the ECB Monthly Bulletin, iii). speeches by Trichet and Papademos.

Table 1 reports the list of people and keywords that were included in the Bloomberg search. We included news reports if i). the comment referred to

⁷Mervyn King (2005), for instance, suggests how the public could use rules-of-thumb: ‘we do not know whether - and, if so, to what extent - people use heuristics to make real economic decisions. But a central bank should be alert to the possibility of their doing so.’ (p. 12).

⁸There may be an issue of reverse causality, as the ECB’s communications may be a reaction to developments in (expected) inflation. However, our identification strategy is based on daily data. Although the ECB may very well use ‘vigilance’ in reaction to a series of upward changes in (expected) inflation, it is less likely that each and every positive change in break-even inflation will entice the ECB to mention ‘vigilance’.

Table 1: Key topics used in searching Bloomberg News

People		Topics
<i>Executive Board</i>	<i>Tenure</i>	<i>Decisions</i>
Duisenberg (p)	t 31/10/03	interest rates
Trichet (p)	f 01/11/03	
Papademos (vp)		<i>Economic analysis</i>
Issing		inflation
Tumpel-Gugerell		prices
Domingo Solans	t 31/05/04	GDP
González-Páramo	f 01/06/04	economic growth
Padoa Schioppa	t 31/05/05	unemployment
Bini Smaghi	f 01/06/05	confidence indicators
		consumer spending
		investment
		trade
<i>NCB presidents</i>	<i>Country</i>	<i>Monetary analysis</i>
Liebscher	Austria	
Quaden	Belgium	
Vanhala	Finland	t 01/04/04
Louekoski		f 01/04 t 12/07/04
Liikanen		f 12/07/04
Trichet	France	t 31/10/03
Noyer		f 01/11/03
Welteke	Germany	t 27/04/04
Weber		f 30/04/04
Garganas	Greece	euro
Hurley	Ireland	euro-dollar
Fazio	Italy	fx intervention
Mersch	Luxembourg	
Wellink	Netherlands	
Constâncio	Portugal	
Caruana	Spain	

Notes: p = president/ vp= vice-president/ f = start date of tenure/ t = end date of tenure.

euro area (as opposed to national) economic conditions, ii). concerned economic issues as specified in the second column of table 1, and iii). contained new information. This latter point implies that updates of news reports are only included as far as they contain more detailed comments or comments on new issues. To analyse this data, we performed *keyword in context* (KWIC) searches for occurrences of the words ‘vigilance’ and ‘vigilant’.⁹ These KWIC searches generated several useful pieces of information. Apart from knowing who made the comments, and when, we also recorded how the term ‘vigilance’ was used. For example, some comments used ‘vigilance’, while others used the terms ‘strong vigilance’ or ‘very strong vigilance’. We will further investigate the effects of these different formulations in section 5. The KWIC searches also reported the topics to which ‘vigilance’ referred. We will return to this information as part of our robustness checks in section 7.

Research on inflation expectations has so far mainly relied on survey data. For our purposes, inflation-indexed bonds are more suited as data is available on a daily basis.¹⁰ This is useful in estimating the high-frequency impact of communication. At the moment, few countries have issued bonds linked to euro area inflation which, as a consequence, somewhat limits us in our analysis. This paper uses data on the OATei instrument: a French inflation-indexed bond, first issued by the Agency France Trésor (AFT) in November 2001. The OATei instrument is linked to the euro area HICP index (exclusive of tobacco prices) and is best suited for our purposes as it is the longest time-series available. We downloaded yields for the OATei 2012 series and the regular OAT 2012 from the AFT web-site (www.aft.gouv.fr). The difference in the yield of the OAT and OATei, the so-called break-even inflation, is often used as a proxy for medium-term inflation expectations.

However, some caution is needed in using break-even inflation. The main

⁹We have used the computer program WordStat Version 5.0. This program has been developed by Provalis Research as an add-on feature of the statistical program SimStat. For more information, see www.provalisresearch.com.

¹⁰The key characteristic of inflation-indexed bond is that, over time, the principal value and the coupon payments are adjusted on the basis of a measure of inflation. Cukierman (1977) is one of the earliest contributions using inflation-indexed bonds.

reason is that break-even inflation may also pick up other factors than expected inflation, in particular a liquidity and an inflation risk premium. This is illustrated by the following two equations:

$$i_t = r_t + \pi_t^e + \rho_t \quad (1)$$

$$i_t^{ind} = r_t + \lambda_t \quad (2)$$

where i denotes the yield on a conventional bond, i^{ind} denotes the yield on an indexed bond, r denotes the real interest rate, π^e denotes expected inflation, ρ denotes an inflation risk premium and λ denotes a liquidity premium. As noted, inflation-indexed bonds were only recently introduced in the euro area. Investors may have demanded a liquidity premium for holding these bonds, to compensate for their relative illiquidity. Secondly, investors may require a risk compensation for holding conventional bonds as actual inflation may differ from expected inflation.¹¹ Subtracting (2) from (1) shows that break-even inflation in this case equals:

$$BEI = \pi_t^e + \rho_t - \lambda_t \quad (3)$$

Initially, a liquidity premium may well have been an important component in break-even inflation. However, turnover in the markets for the OATei 2012 security has strongly increased since 2001. The instrument has by now established itself and the AFT has since then successfully introduced other issues of the OATei instrument. For the US, Sack (2000) finds that most of the bias in break-even inflation can be attributed to the liquidity premium. He also reports that changes in break-even inflation and ‘corrected’ measures of break-even inflation are highly correlated.

Greater clarity regarding future monetary policy could reduce the uncertainty regarding future levels of inflation and therefore reduce the inflation risk

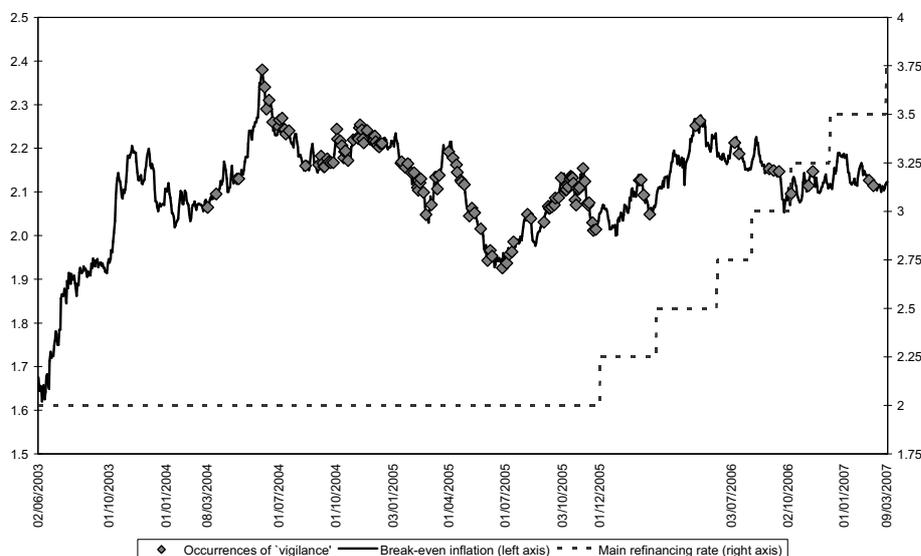
¹¹Two other factors affecting break-even inflation are differences in duration (due to differences in the payment structure) and declining time to maturity. Recently, the ECB (2006) investigated the effects of these issues for French inflation-indexed bonds and concluded that ‘break-even inflation rates .. seem to be rather good approximations of the preferable zero-coupon constant maturity measures and are little biased by potential distortions due to duration mismatching (p. 31).’ See also Sack (2000) or Kwan (2005) for a discussion of these issues.

premium. This would be reflected in a lower level of break-even inflation. However, Hördahl and Tristani (2007) find that, on average, the inflation risk premium calculated using OATei data has not differed significantly from zero over the EMU sample.

4 Data description

Figure 1 shows ten-year euro area break-even inflation (solid line) and the occurrence of vigilance (the grey diamonds) between June 2003 and March 2007. The dotted line denotes the ECB's main refinancing rate. There are step upward movements in expected inflation in late 2003 and early 2004. Starting in March 2004, the term 'vigilance' is used extensively in communication. After December 2005, the term is used less often. To be precise, it occurs only sixteen times in communication. This decline would be in line with the different interpretation of this keyword after 2005.

Figure 1: 'Vigilance' in ECB communication (2003 - 2007)



This figure shows euro area break-even inflation (solid line) and the use of 'vigilance' in ECB communications (the grey diamonds) between June 2003 and March 2007. The dotted line denotes the ECB policy rate. Dates are denoted in DD/MM/YYYY.

In comparison, table 2 shows that between March 2004 and November 2005 vigilance was used some 200 times. The second column shows that in 58 cases, ‘vigilance’ was mentioned without any further qualification. In about a quarter of the cases, the term ‘strong vigilance’ was used. Qualifications with probable high impact, such as ‘very strong vigilance’ or ‘extremely vigilant’ are seldom used. We will examine the effects of these differences in qualifications in the remainder of this paper. To this end, the third and fourth column of table 2 show two classifications of ‘vigilance’. Column 3 outlines an *a priori* classification of our reading of ECB code words. The scale is between 1 and 4, where the scale is increasing in the intensity of the terminology. The scale ranges from the occurrences of ‘vigilance’ (value 1) through to the transition to ‘more vigilance’ (value 2) to phases with ‘high’ (value 3) or ‘very high vigilance’ (value 4) or equivalents of these four cases. The last column presents a scale that *ex post* aims to capture the news component in ECB communication by measuring observations according to the inverse of their relative occurrence. If a particular term is often used in communication, its occurrence may not be considered as news anymore. In contrast, if a term is used that has never been used before, markets will probably react strongly to its occurrence.

5 Empirical model

In the spirit of the ‘news approach’, we model daily changes in break-even inflation as a linear function of lagged dependents, a dummy variable that measures the occurrence of ‘vigilance’ and a set of control variables.¹² As we find evidence of clustered volatility we use a GARCH model. We estimate this model using a normal distribution or, alternatively, a t-distribution in cases where the Jarque-Bera statistic rejected normality in the residuals. Our baseline regression model

¹²Another motivation for looking at changes rather than levels is that unit root tests could not conclusively dismiss the hypothesis that break-even inflation is an I(1) series.

Table 2: ‘Vigilance’: occurrences and two classifications (2003-2005)

	No. of occurrences <i>n</i>	Scale 1: Keywords (Scale 1 to 4)	Scale 2: News value (200/ <i>n</i>)
Vigilance	58	1	3.4
<i>Qualifications:</i>			
Strong	46	3	4.3
Continued	28	1	7.1
Remain	19	1	10.5
Particularly	12	3	16.7
Ongoing	9	1	22.2
Very	7	3	28.6
Especially	3	3	66.7
Increased	3	2	66.7
Extremely	2	4	100
Very strong	2	4	100
Warrants	2	1	100
Emphasizes	1	3	200
Enhanced	1	2	200
Heightened	1	2	200
More	1	2	200
Particularly strong	1	4	200
Reinforcing	1	2	200
Special	1	3	200
Stepping up	1	2	200
Still	1	1	200
TOTAL	200		

Note: This table describes the qualifications used by the ECB when stating the words ‘vigilance’ and ‘vigilance’. The last two columns outline two classifications of vigilance which are used in the regression analysis. This table is for the period between 2 June 2003 and 30 November 2005.

Table 3: Overview of control variables

<u>Macroeconomic releases</u>	(surprise component of:)
<i>Euro area</i>	
HICP	y-o-y growth
Gross domestic product	q-o-q growth
Industrial production	m-o-m growth
Producer prices index	y-o-y growth
<i>Germany</i>	
HICP	y-o-y growth
Gross domestic product	q-o-q growth
IFO indicator	level
Industrial production	m-o-m growth
Producer price inflation	y-o-y growth
<i>France</i>	
HICP	y-o-y growth
Gross domestic product	q-o-q growth
Industrial production	m-o-m growth
Producer price inflation	y-o-y growth
<u>Financial variables</u>	
Oil futures	Brent crude, log difference
Dollar/euro exchange rate	log difference
FTSE100	log difference
Dow Jones Industrial Avg	log difference
Eurostoxx50	log difference
US T-bill	3 months, first difference
US Treasury note	7years, first difference

is as follows:

$$\Delta\pi_t^e = \beta_0 + \beta_v V_t + \sum_{i=1}^n \beta_i \Delta\pi_{t-i}^e + \sum_{m=1}^k \beta_m z_t^m + \beta_t t + \epsilon_t, \quad \epsilon_t | \Psi_t \sim (0, \sigma_t^2) \quad (4)$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^p \delta_i \epsilon_{t-i}^2 + \sum_{i=1}^q \alpha_i \sigma_{t-i}^2 \quad (5)$$

where π_t^e denotes the break-even inflation rate, V_t is a dummy variable measuring the use of ‘vigilance’, and the z_t denotes control variables. Our main interest is in β_v as it captures the relationship between ECB communications and changes in inflation expectations. We test whether β_v is significantly different from zero.

Table 3 describes the control variables. Firstly, we include the surprise component for releases of various macroeconomic series. These are taken from Bloomberg surveys. We include variables for the euro area, France and Germany. Secondly, we take up daily returns on a number of financial variables, such as oil futures, stock market indices, the dollar/euro exchange rate and US T-bills and T-bonds. We use lagged values to circumvent endogeneity problems. These series are taken from Datastream.¹³

6 Results

Table 4 shows estimation results for a number of specifications. Column 1 shows a baseline estimation for the period 2 June 2003 to 9 March 2007. On the basis of the Akaike information criterion, the model is specified as an AR(1)-GARCH(1,1) without a constant and trend term. Inflation expectations react to news on prices and the IFO indicator, and oil futures. Next, we focus on the period between 2003 and 2005 when ‘vigilance’ was most actively used. Columns 2 to 4 show three estimation results which include measures of ‘vigilance’. In all three cases, the coefficient related to vigilance is negative. Column 2 shows

¹³We also ran regressions with controls for weekdays, the timing of ECB Governing Council meetings and FOMC meetings and decisions. This did not lead to any qualitative changes in our conclusions.

the results if we use a dummy variable which has the value 1 when ‘vigilance’ is used in communication, and the value 0 otherwise. The conditional effect of using ‘vigilance’ is a decline of inflation expectations by a fifth of a basis point (0.0021). The coefficient is, however, only significant at the 10% level ($p = 0.08$). The results for the two alternative classifications are presented in columns 3 and 4. Using the classification based on our keyword scale, we find a coefficient for the effect of ‘vigilance’ equal to -0.001%. This coefficient is also significantly different from zero at the 10% level ($p=0.07$). For the model using the second classification, based on the news value of a statement, we find that the coefficient for the ‘vigilance’ variable is strongly significant ($p=0.01$).

However, as discussed in section 1, the period between June 2003 and November 2005 was not a homogenous period. From Autumn-2005 onwards, it was increasingly considered likely that the ECB would start to tighten monetary policy. Incoming macroeconomic data suggested and ECB communication signalled a change in the policy stance.¹⁴ We therefore investigate whether the effects of communication were different in this period by estimating rolling-window regressions for the model in (4) and (5) using the (0,1) ‘vigilance’ dummy. Each window includes 180 days. We start on 1 March 2004, so that the end-point of the first sample is 5 November 2004. The last estimation sample ends at 30 November 2005. The estimated coefficient β_v in each of these regressions is shown in figure 2. Diamonds are used to denote that the coefficient is significantly different from zero at the 5% level. Figure 2 clearly shows that timing is important for the results. Initially, the estimated β_v is not significantly different from zero. Once the estimation window includes the months of October and November 2005 the coefficient is significant. The estimated effects of vigilance range roughly between 0.0035% and 0.0045%. We conclude that

¹⁴For example, during the press conference on 1 September 2005, the wording was changed from ‘ongoing vigilance’ to ‘particular vigilance’, followed by ‘strong vigilance’ at the October and November press conferences. According to Consensus Forecast, in September only 4.9% of the respondents expected a rate increase in the next 30 days. In October, this figure was up to 11.3% and in November it was up to 37.4%, the highest number in 2.5 years.

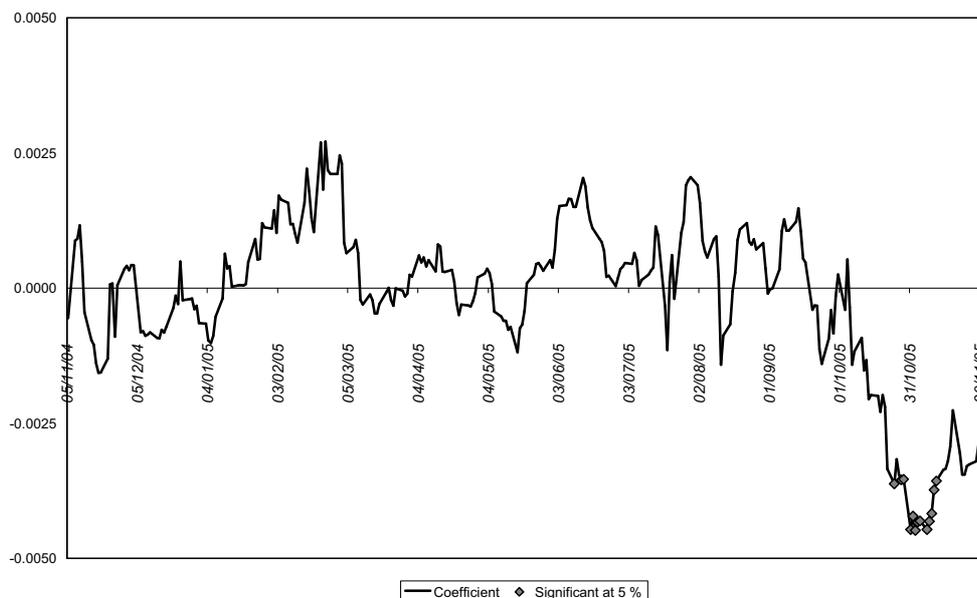
Table 4: The importance of being vigilant: regression results

	2003 - 2007	2003 - 2005			2006 - 2007
	(1)	(2)	(3)	(4)	(5)
	<i>Baseline</i>	<i>(0,1)</i> <i>dummy</i>	<i>Keyword</i> <i>scale</i>	<i>News</i> <i>scale</i>	<i>(0,1)</i> <i>dummy</i>
Mean equation					
Vigilance		-0.0021*	-0.001*	-0.00004**	-0.0010
		(0.00)	(0.00)	(0.00)	(0.00)
$\Delta\pi_{t-1}^e$	0.12***	0.19***	0.19***	0.19***	-0.03
	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)
$\Delta\pi_{t-2}^e$		-0.06	-0.06	-0.06	-0.03
		(0.04)	(0.04)	(0.05)	(0.05)
Consumer prices (G)	0.03***				0.06***
	(0.01)				(0.02)
Ifo indicator (G)	0.004***	0.005**	0.005**	0.005**	0.005***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Consumer prices (F)	0.01***	0.06***	0.06***	0.05***	
	(0.00)	(0.02)	(0.02)	(0.02)	
GDP (F)		0.05***	0.04***	0.04**	
		(0.01)	(0.01)	(0.02)	
Producer prices (F)		0.04***	0.04***	0.04***	
		(0.01)	(0.01)	(0.01)	
Brent futures	0.12***	0.08***	0.08***	0.08***	0.24***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)
US T bond	0.03***	0.03***	0.03***	0.03***	
	(0.01)	(0.00)	(0.01)	(0.01)	
Variance equation					
α_0	0.00**	0.00*	0.00*	0.00*	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
δ_1	0.08***	0.07**	0.07**	0.07**	0.05
	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
α_1	0.87***	0.88***	0.88***	0.88***	0.84***
	(0.04)	(0.05)	(0.05)	(0.05)	(0.12)
Adjusted R^2	6.8%	5.7%	5.7%	5.7%	14.8%
Log likelihood	2897.07	1897.82	1897.86	1898.28	1030.45
Akaike IC	-5.85	-5.76	-5.76	-5.76	-6.04
ARCH(2)	0.52	0.00	0.00	0.04	0.94
	(0.59)	(0.99)	(0.99)	(0.96)	(0.39)

Notes: This table presents the results for the regression in equations (1) and (2) in the main text. (E) denotes euro area, (G) denotes Germany and (F) denotes France. For control variables, we only report coefficients significant at the 5% level. */**/** denotes significance at the 10/5/1 % level. Standard errors are in parentheses. ARCH (2) denotes the F-statistic for the ARCH LM test with the p-values shown in parentheses.

the effectiveness of communication with respect to influencing expectations is strongly related to the perception of upcoming changes in the monetary policy stance.

Figure 2: The coefficient for ‘vigilance’ in rolling window regressions



This figure shows the estimated β_v using 180 days moving windows. The dates are denoted in DD/MM/YYYY and represent the endpoint of the sample. The estimations start at 1 March 2004, so that the first endpoint is 5 November 2004. The last endpoint is 30 November 2005. Diamonds denote that the coefficient is significantly different from zero at the 5% level.

This raises an interesting issue: did this type of ECB communication continue to have these effects on expectations during the period when the ECB continued to tighten monetary policy in 2006 and 2007? The answer is ‘no’, as can be seen in the last column of table 4. The coefficient β_v is negative, but not significantly different from zero ($p=0.71$).¹⁵ One reason for this result has already suggested itself: ‘vigilance’ was used less frequently, making it harder

¹⁵For this analysis, we have also performed rolling-window regressions. The coefficient for

to pick up any effect in the estimation. But, the absence of reactions in expectations also suggests that communication may be most effective in shaping expectations at the turning-points in monetary policy, in this case, the start of tightening after a prolonged period of constant policy rates.

7 Robustness

We have argued that occurrences of ‘vigilance’ are an adequate representation of the ECB’s assessment of risks to price stability. By focusing on this single concept, we may be missing important elements of ECB communication. Perhaps ECB communication has contained other signals that markets have reacted to. These signals would not be incorporated in our ‘vigilance’ measure which could lead to biased estimates. To study this, we first assess whether the use of ‘vigilance’ in ECB communications was related to inflationary developments. Between June 2003 and November 2005, when ‘vigilance’ most often occurred, it was used in connection with 21 different topics. On 46 occasions, ‘vigilance’ did not explicitly refer to a certain topic. Out of 197 occurrences of the topics, ‘vigilance’ referred to ‘risks to price stability’ 48 times. Other topics that were often mentioned were ‘inflation expectations’ (24 times), ‘2nd round effects’ (23 times), ‘oil prices’ (22 times), ‘inflation’ (21 times), ‘M3’ (17 times) and ‘inflation risks’ (8 times). In all, this analysis supports our use of ‘vigilance’ as a signal of risks to price stability.

We also tested for the effects of ECB communications when ‘vigilance’ is not used. To this end, we include in our baseline regression a variable that is equal to one if the ECB communicated on a particular day *without* using ‘vigilance’ and equal to zero otherwise. The result for the 2003 - 2005 sample is shown in column 1 of table 5. We find that the absence of ‘vigilance’ in ECB communication actually coincided with higher levels of break-even inflation. Further evidence is provided in figure 3.

When incorporating the second half of 2005 in the ‘vigilance’ variable was in no case significant. Results available upon request from the corresponding author.

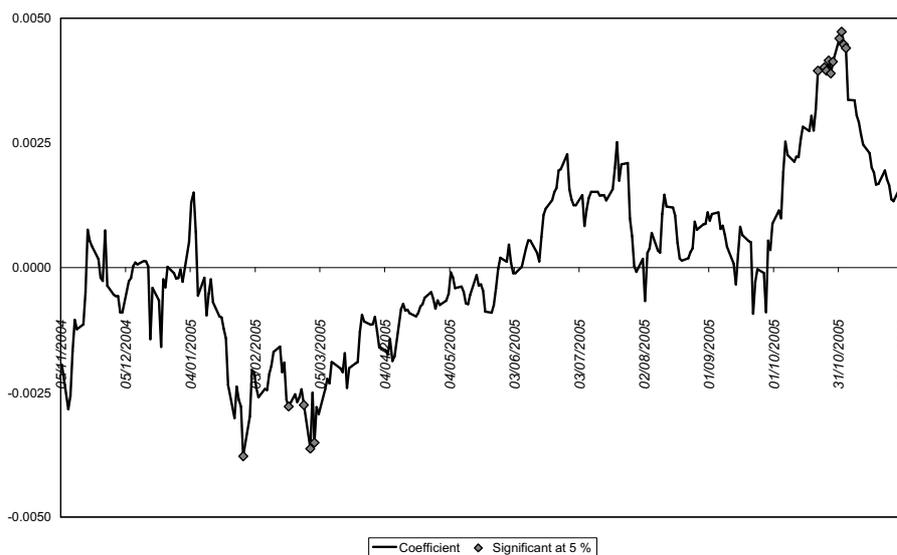
Table 5: Robustness

	(1)	(2)
	<i>Communication, no vigilance (2003-2005)</i>	<i>No ECB communication (2003-2005)</i>
Mean equation		
No vigilance	0.0002 (0.00)	
No communication		0.0006 (0.00)
$\Delta\pi_{t-1}^e$	0.19*** (0.04)	0.19*** (0.04)
$\Delta\pi_{t-2}^e$	-0.06 (0.04)	-0.06 (0.04)
IFO indicator (G)	0.004** (0.00)	0.004** (0.00)
Consumer prices (F)	0.05*** (0.01)	0.05*** (0.01)
GDP (F)	0.04*** (0.01)	0.04*** (0.01)
Producer prices (F)	0.04*** (0.01)	0.04*** (0.01)
Brent futures	0.08*** (0.02)	0.08*** (0.03)
US T-bond	0.03*** (0.01)	0.03*** (0.01)
Variance equation		
α_0	0.00* (0.00)	0.00* (0.00)
δ_1	0.07*** (0.03)	0.08*** (0.03)
α_1	0.88*** (0.05)	0.87*** (0.04)
Adjusted R^2	5.4%	5.4%
Log likelihood	1895.65	1895.46
Akaike IC	-5.75	-5.75
ARCH(2)	0.00 (0.99)	0.01 (0.99)

Notes: For the mean equation, we only report coefficients significant at the 5% level. */**/** denotes significance at the 10/5/1 % level. In parentheses, standard errors are reported.

estimation, we find evidence of a conditional impact of close to a half basis point. At the same time, there is evidence of a negative reaction earlier in 2005. It is possible, therefore, that other aspects of communication have been important. Nevertheless, the effects in this case are less marked. On balance, the focus on ‘vigilance’ seems justified. Another robustness test is to see what happens when the ECB does not communicate at all. Perhaps inflation expectations would have decreased regardless of whether communication took place. In that case, we would wrongly attribute the negative change in expectations to central bank communication. However, as column 2 of table 5 shows, this is not the case. Between 2003 and 2005, changes in break-even inflation on days without communication were slightly positive.¹⁶

Figure 3: Robustness: absence of ‘vigilance’ in communication

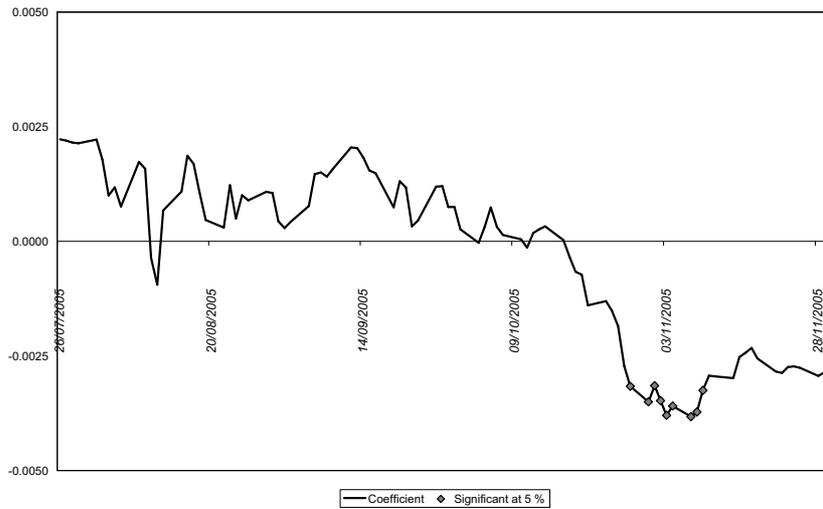


Note: This figure shows the estimated coefficient for the ‘communication, no vigilance’ dummy using 180 days moving windows. The dates are denoted in DD/MM/YYYY and represent the endpoint of the sample. The estimations start at 1 March 2004, so that the first endpoint is 5 November 2004. The last endpoint is 30 November 2005. Diamonds denote that the coefficient is significantly different from zero at the 5% level.

¹⁶Rolling window regressions were also performed in this case without finding significant results. Results available upon request.

Finally, so far we have not addressed the fact that the OATei2012 security has been off-the-run since the OATei2015 series was issued in November 2004. Therefore, we also estimated rolling-window regressions using break-even inflation derived from the OATei2015 and the OAT2014 series. As figure 4 shows, the results are very similar to those for the OATei2012 series.

Figure 4: Robustness: results for OATei2015 series



Note: This figure shows the estimated β_v using 180 days moving windows and OATei2015 series. The dates are denoted in DD/MM/YYYY and represent the endpoint of the sample. The first endpoint is 26 July 2005. The last endpoint is 30 November 2005. Diamonds denote that the coefficient is significantly different from zero at the 5% level.

8 Conclusions

Our key finding is that the ECB's signalling of discomfort with inflationary developments through communication has had a negative relationship with changes in euro area break-even inflation even during a period when the interest rate instrument was not used. However, this type of communication has only led to responses in financial markets when it closely coincided with the perception of upcoming changes in the ECB's monetary policy stance. Even more so, the effects are found at the *start* of a tightening phase, but not during this period. Despite its statistical significance, the economic significance of this type of communication has been small.

There are a number of questions that future research may address. To start with, it may be worthwhile to investigate this issue at lower frequencies. Perhaps a series of comments may have a stronger impact on expectations than isolated statements. It would also be interesting to investigate the high-frequency relationship between communications and inflation expectations for a number of other central banks, such as the Bank of England or the Federal Reserve. Finally, it would be instructive to further explore the possibility of a connection between communication and the different components of break-even inflation.

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