Measuring consumer inflation expectations in Europe and examining their forward-lookingness

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1. Survey data and quantification methods applied

A straightforward method of measuring the inflation expectations of consumers is to ask them to present quantitative estimates. However, the uncertainty concerning such numerical estimates is considerably higher than in the case of indicating the direction of price changes (Jonung (1986)) and the empirical evidence on the benefits of using quantitative questions is ambiguous. Therefore, most surveys are designed in a qualitative way, even if their results have to be later quantified. The question on inflation expectations included in the European Commission Consumer Survey carried out every month in EU economies takes the following form: "Given what is currently happening, do you believe that over the next 12 months prices will: (1) rise faster than at present; (2) rise at the same rate; (3) rise more slowly; (4) stay at their present level; (5) go down; (6) difficult to say." There is an additional question concerning the perception of current price movements, which can be useful in quantifying the expected rate of inflation: "In your opinion, is the price level now compared to that 12 months ago: (1) much higher; (2) moderately higher; (3) a little higher; (4) about the same; (5) lower; (6) difficult to say."

The empirical part of this paper uses two kinds of measures of inflation perception and expectations based on survey data, ie the measures of expected inflation quantified with different methods and the balance statistics.

As far as the quantified measures of expected inflation are concerned, three kinds of quantification methods are applied to derive them, namely, the probability method, the regression method and the logistic (and linear) function method.

When quantifying the probability measures of inflation expectations, we refer to the canonical Carlson and Parkin (1975) approach, which we have modified in order to use all the information embodied in the survey data. However, different assumptions concerning the density function of the expected rate of inflation and a measure of perceived inflation are made. The probability measure *INFE_1* is calculated under the assumption that the expected inflation is normally distributed and that consumers' perception of price changes currently observed corresponds to the most recent CPI inflation figure (see Batchelor and Orr (1988), Berk (1999), Forsells and Kenny (2004)).[2] The probability measure *INFE_2* uses the same proxy for the perceived inflation, but the density function of the expected inflation is triangular. Due to the novelty of this approach, its detailed description is presented in the next section. In order to derive the probability measure *INFE_3*, the normal distribution is applied, but the CPI measure of current inflation is replaced with a subjective indicator

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[2] The method applied is described in detail in Łyziak (2005).

quantified on the basis of additional survey questions (see Batchelor and Orr (1988), Dias et al (2007)).

The logistic (and linear) function method developed by Papadia and Basano (1981) is used to derive the fourth measure of consumer inflation expectations (*INFE_4*). The final measure of inflation expectations (*INFE_5*) is based on the regression method. Five models were estimated, namely, a model based on the balance statistic (weighting fractions of respondents to the survey question on inflation perception with weights: 3, 2, 1, 0, –1) as well as the models proposed by Anderson (1952), Pesaran (1984, 1987), Smith and McAleer (1995) and Cunningham (1997). The choice of the final specification, presented in Annex A, reflects both the statistical properties of the estimated regressions as well as their economic interpretation (eg correct signs of the estimated coefficients).

The balance statistics are defined as the differences between the (weighted or unweighted) proportions of respondents. They do not measure perceived or expected inflation directly (eg Dias et al (2007)), but at the same time they are not influenced by the assumptions imposed in quantification algorithms. Four different balance statistics are used. The first two are unweighted statistics: BS_1^e (BS_1^p) is the difference between the proportions of respondents expecting (noticing) an increase in prices and their decrease, while BS_2^e (BS_2^p) is the difference between the proportions of respondents expecting (noticing) an increase in prices and their stabilisation or decrease. The third balance statistic, BS_3^e (BS_3^p), is a weighted one, frequently used in the literature (eg Del Giovane and Sabbatini (2004, 2005), ECB (2002, 2003, 2005, 2007)), attaching weight 1 to the proportion of respondents expecting that prices will rise faster than at present (perceiving that current prices are much higher than 12 months ago), ½ to those claiming that prices will rise at the same rate (are moderately higher), 0 to those declaring that prices will rise at slower rate (are a little higher), –½ to the fraction of respondents predicting (noticing) the stabilisation of prices and –1 to those declaring that prices are likely to fall (noticing their fall). In another weighted balance statistic used in this study, BS_4^e (BS_4^p), the respective weights are: 3, 2, 0, 1 and –1.

2. Probability method based on triangular distribution

The assumption of expected inflation being normally distributed is questioned in some studies (eg Carlson (1975), Batchelor and Orr (1988)). Therefore, one of the probability measures of inflation expectations used in this study (*INFE_2*) is based on triangular distribution. When denoting its lower and upper limits by V_t and W_t, respectively, the height (h_t) may be defined in the following way:

$$h_t = \frac{2}{W_t - V_t} \tag{1}$$

In line with suggestions by Berk (1999), the distribution of expected inflation is assumed to become asymmetric when a gap between current inflation (π_t^0) and its (12-month) moving average ($\overline{\pi_t}$) occurs, ie the mode (d_t) equals:

$$d_t = \gamma_t \cdot V_t + \left(1 - \gamma_t\right) \cdot W_t \tag{2}$$

where:

$$\gamma_t = \frac{\pi_{0t}}{\pi_{0t} + \overline{\pi_t}} \tag{3}$$

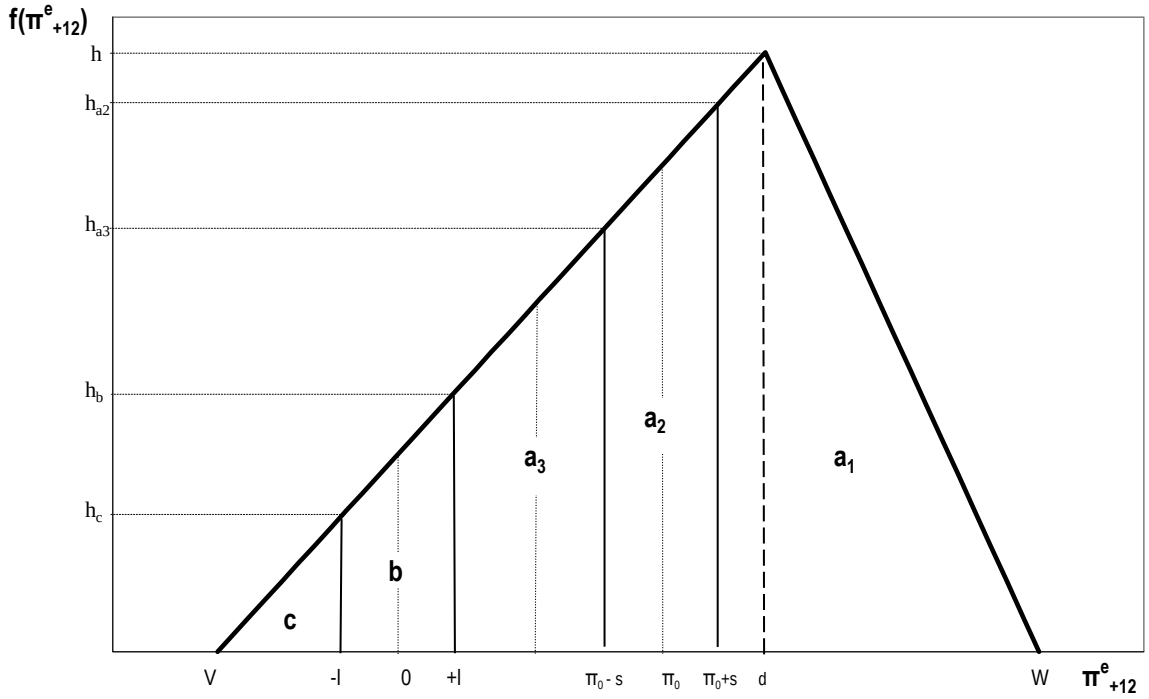
In the probability method, each fraction of respondents is expressed in terms of the respective areas below the density function. For example, the percentage of respondents

declaring that prices will increase at the same rate is equal to the probability that the expected inflation is between π_0-s_t and π_0+s_t, where s_t denotes the time-varying sensitivity interval surrounding the current inflation rate, while the fraction of individuals claiming that prices will be the same corresponds to the probability of inflation being between $-l_t$ and l_t, where l_t is the time-varying sensitivity interval surrounding zero. Other fractions of respondents are expressed in a similar way.

Figure 1 presents the case in which the mode exceeds π_0+s_t. As far as survey responses are concerned, the following symbols are used: a_{1t} is the percentage of respondents expecting prices to rise faster; a_{2t} is the percentage of respondents expecting prices to rise at the same rate; a_{3t} is the percentage of respondents expecting prices to rise more slowly; b_t is the percentage of respondents expecting prices to stay at their present level; and c_t is the percentage of respondents expecting prices to go down.

Figure 1

Triangular distribution probability quantification method



The quantification method presented in Figure 1 uses the following set of equations:

$$h_{ct} = f\left(-l_t\right) = \frac{2c_t}{-l_t - V_t} \tag{4}$$

$$h_{bt} = f\left(l_t\right) = \frac{2 \cdot \left(b_t + c_t\right)}{l_t - V_t} \tag{5}$$

$$h_{a3t} = f\left(\pi_{0t} - s_t\right) = \frac{2 \cdot \left(a_{3t} + b_t + c_t\right)}{\pi_{0t} - s_t - V_t} \tag{6}$$

$$h_{a2t} = f\left(\pi_{0t} + s_t\right) = \frac{2 \cdot \left(a_{2t} + a_{3t} + b_t + c_t\right)}{\pi_{0t} + s_t - V_t} \tag{7}$$

The following conditions hold:

$$\frac{h_t}{h_{ct}} = \frac{d_t - V_t}{-l_t - V_t} \tag{8}$$

$$\frac{h_t}{h_{bt}} = \frac{d_t - V_t}{l_t - V_t} \tag{9}$$

$$\frac{h_t}{h_{a3t}} = \frac{d_t - V_t}{\pi_{0t} - s_t - V_t} \tag{10}$$

$$\frac{h_t}{h_{a2t}} = \frac{d_t - V_t}{\pi_{0t} + s_t - V_t} \tag{11}$$

where d_t is given by equations (2)–(3).

The solution takes the following form:

$$V_t = \pi_{0t} \cdot \frac{\alpha_{1t}}{\alpha_{1t} - \alpha_{2t}} \tag{12}$$

$$W_t = \pi_{0t} \cdot \frac{\alpha_{1t}}{\alpha_{1t} - \alpha_{2t}} \cdot \left[1 + \frac{1}{\left(\pi_{0t} \cdot \frac{\alpha_{1t}}{\alpha_{1t} - \alpha_{2t}} + \sqrt{(1-\gamma) \cdot c} \right) \cdot \beta_{1t}} \right] \tag{13}$$

$$l_t = \pi_{0t} \cdot \frac{-\alpha_{1t}}{\beta_{1t} \cdot (\alpha_{1t} - \alpha_{2t})} \tag{14}$$

$$s_t = \pi_{0t} \cdot \frac{-\alpha_{2t}\alpha_{3t}}{(\alpha_{1t} - \alpha_{2t}) \cdot \alpha_{1t}} \tag{15}$$

where:

$$\alpha_{1t} = \frac{1}{\sqrt{1 - a_{1t}} + \sqrt{1 - a_{1t} - a_{2t}}} \tag{16}$$

$$\alpha_{2t} = \frac{1}{\sqrt{c_t} + \sqrt{b_t + c_t}} \tag{17}$$

$$\alpha_{3t} = \sqrt{1 - a_{1t}} - \sqrt{1 - a_{1t} - a_{2t}} \tag{18}$$

$$\beta_{1t} = -\frac{\sqrt{c_t} + \sqrt{b_t + c_t}}{\sqrt{c_t} - \sqrt{b_t + c_t}} \tag{19}$$

A similar procedure is developed for the mode located in other parts of the probability distribution. Table 1 presents the results.

Table 1

Quantification results for the mode located in other parts of the distribution

d_t	Equation	Results for a given location of d_t
π_{0t}-$s_t \le d_t < \pi_{0t}$+s_t	(12)	$V_t = 2\pi_{0t} \dfrac{\mu_t}{\mu_t \cdot (\lambda_t + 1) - \dfrac{1}{\beta_{1t}} - 1}$
	(13)	$W_t = 2\pi_{0t} \dfrac{\mu_t}{\mu_t \cdot (\lambda_t + 1) - \dfrac{1}{\beta_{1t}} - 1} \cdot \dfrac{\beta_{1t} + \beta_{2t} - 1}{\beta_{2t}}$
	(14)	$l_t = 2\mu_t \pi_{0t} \cdot \left[1 - \dfrac{\mu_t \cdot (\lambda_t + 1) - 1}{\mu_t \cdot (\lambda_t + 1) - \dfrac{1}{\beta_{1t}} - 1} \right]$
	(15)	$s_t = \pi_{0t} \cdot \left[\dfrac{2\lambda_{1t}\mu_t}{\mu_t \cdot (\lambda_t + 1) - \dfrac{1}{\beta_{1t}} - 1} - 1 \right]$
	Additional symbols	$\beta_{2t} = \dfrac{\sqrt{(1-\gamma_t)c_t} \cdot \left(\sqrt{c_t} + \sqrt{b_t + c_t} \right)}{\sqrt{c_t} - \sqrt{b_t + c_t}}$, $\lambda_{1t} = \dfrac{\beta_{1t} + \beta_{2t} - 1 - (\beta_{1t} - 1) \cdot \sqrt{\gamma_t a_{1t}}}{\beta_{2t}}$, $\mu_t = \dfrac{\sqrt{b_t + c_t}}{\sqrt{1 - a_{1t} - a_{2t}}}$
$l_t \le d_t < \pi_{0t}$-s_t	(12)	$V_t = \dfrac{2\pi_{0t}}{\lambda_{2t}}$
	(13)	$W_t = \dfrac{2\pi_{0t}}{\lambda_{2t}} \cdot \dfrac{\beta_{1t} + \beta_{2t} - 1}{\beta_{2t}}$
	(14)	$l_t = \dfrac{2\pi_{0t}}{\lambda_{2t}} \cdot \left[\sqrt{(1-\gamma_t)c_t} \cdot \left(1 - \dfrac{\beta_{1t} + \beta_{2t} - 1}{\beta_{2t}} \right) - 1 \right]$
	(15)	$s_t = \pi_{0t} \cdot \left[\dfrac{2 \cdot (\beta_{1t} + \beta_{2t} - 1)}{\beta_{2t}\lambda_{2t}} - 2\sqrt{\gamma_t a_{1t}} \cdot \dfrac{\beta_{1t} - 1}{\beta_{2t}\lambda_{2t}} - 1 \right]$
	Additional symbols	$\lambda_{2t} = \dfrac{2 \cdot (\beta_{1t} + \beta_{2t} - 1)}{\beta_{2t}} - \dfrac{\beta_{1t} - 1}{\beta_{2t}} \cdot \left[\sqrt{\gamma_t a_{1t}} + \sqrt{\gamma_t (a_{1t} + a_{2t})} \right]$
-$l_t \le d_t < l_t$	(12)	$V_t = \dfrac{2\pi_{0t}}{\lambda_{3t}}$
	(13)	$W_t = \dfrac{2\pi_{0t}}{\lambda_{3t}} \cdot \dfrac{\beta_{1t} + 1}{\beta_{1t} \cdot (\rho_{1t} - 1)}$
	(14)	$l_t = -\dfrac{2\pi_{0t}}{\lambda_{3t}\beta_{1t}}$
	(15)	$s_t = \pi_{0t} \cdot \left[\dfrac{2}{\lambda_{3t}} \cdot \left(\dfrac{\beta_{1t} + 1}{\beta_{1t} \cdot (\rho_{1t} - 1)} \cdot \left(1 - \sqrt{\gamma_t a_{1t}} \right) + \sqrt{\gamma_t a_{1t}} \right) - 1 \right]$
	Additional symbols	$\rho_{1t} = \sqrt{\gamma_t \cdot (a_{1t} + a_{2t} + a_{3t})}$, $\lambda_{3t} = \dfrac{2 \cdot (\beta_{1t}\rho_{1t} + 1)}{\beta_{1t} \cdot (\rho_{1t} - 1)} - \dfrac{\beta_{1t} + 1}{\beta_{1t} \cdot (\rho_{1t} - 1)} \cdot \left[\sqrt{\gamma_t a_{1t}} + \sqrt{\gamma_t (a_{1t} + a_{2t})} \right]$
$d_t < -l_t$	(12)	$V_t = \dfrac{2\pi_{0t}}{\lambda_{4t}}$
	(13)	$W_t = \dfrac{2\pi_{0t}}{\lambda_{4t}} \cdot \dfrac{\rho_{1t} + \rho_{2t}}{\rho_{1t} + \rho_{2t} - 2}$
	(14)	$l_t = \dfrac{2\pi_{0t}}{\lambda_{4t} \cdot (\rho_{1t} + \rho_{2t} - 2)} \cdot \left[2\sqrt{\gamma_t \cdot (1 - c_t)} - (\rho_{1t} + \rho_{2t}) \right]$
	(15)	$s_t = \pi_{0t} \cdot \left[\dfrac{2 \cdot (\rho_{1t} + \rho_{2t})}{\lambda_{4t} \cdot (\rho_{1t} + \rho_{2t} - 2)} \cdot \left(1 - \sqrt{\gamma_t a_{1t}} \right) - 1 \right]$
	Additional symbols	$\rho_{2t} = \sqrt{\gamma_t \cdot (1 - c_t)}$, $\lambda_{4t} = \dfrac{2 \cdot (\rho_{1t} + \rho_{2t})}{\rho_{1t} + \rho_{2t} - 2} - \dfrac{2}{\rho_{1t} + \rho_{2t} - 2} \cdot \left[\sqrt{\gamma_t a_{1t}} + \sqrt{\gamma_t (a_{1t} + a_{2t})} \right]$

The mean of the expected inflation ($\overline{\pi_t^e}$) is derived in the following way:

$$\overline{\pi_t^e} = \frac{1}{3} \cdot \left[\left(1 + \gamma_t\right) \cdot V_t - \left(2 - \gamma_t\right) \cdot W_t \right] \tag{20}$$

3. Balance statistics and quantification results

The balance statistics and quantified measures of inflation expectations described above were calculated for all EU economies and for the EMU as a whole. Table 2 and Table 3 present the averages of the balance statistics of inflation perception and expectations for the common sample period – starting in November 2002 – and for full individual samples (see Annex A for the graphs of the balance statistics).

Table 2

Balance statistics of inflation perception (period averages)

	Start of the sample	Common sample (Nov 2002–May 2007)				Full individual sample			
		BS_1^P	BS_2^P	BS_3^P	BS_4^P	BS_1^P	BS_2^P	BS_3^P	BS_4^P
Austria	01.1985	0.90	0.82	0.37	1.73	0.65	0.42	0.10	1.19
Belgium	01.1985	0.89	0.80	0.51	1.99	0.83	0.71	0.37	1.73
Bulgaria	05.2001	0.87	0.80	0.46	1.86	0.85	0.77	0.39	1.74
Cyprus	05.2001	0.82	0.75	0.43	1.78	0.82	0.73	0.40	1.73
Czech Republic	01.2001	0.42	0.08	–0.16	0.63	0.52	0.23	–0.07	0.82
Denmark	01.1985	0.34	–0.19	–0.25	0.48	0.43	–0.02	–0.18	0.63
EMU	01.1985	0.86	0.74	0.42	1.83	0.79	0.62	0.26	1.50
Estonia	04.2001	0.91	0.84	0.38	1.73	0.91	0.84	0.32	1.62
Finland	11.1995	0.71	0.47	–0.06	0.88	0.55	0.22	–0.13	0.72
France	01.1985	0.89	0.80	0.46	1.92	0.68	0.40	0.17	1.32
Germany	01.1985	0.82	0.67	0.34	1.66	0.82	0.68	0.24	1.46
Greece	01.1985	0.93	0.87	0.66	2.32	0.86	0.75	0.40	1.80
Hungary	02.1993	0.79	0.68	0.24	1.47	0.82	0.74	0.38	1.74
Ireland	01.1985	0.91	0.84	0.45	1.90	0.83	0.68	0.32	1.64
Italy	01.1985	0.86	0.73	0.46	1.91	0.85	0.73	0.36	1.72
Latvia	05.2001	0.93	0.89	0.45	1.88	0.90	0.84	0.37	1.71
Lithuania	05.2001	0.81	0.69	0.19	1.36	0.80	0.67	0.17	1.33
Luxembourg	01.2002	0.89	0.81	0.40	1.78	0.89	0.82	0.39	1.76
Malta	11.2002	0.79	0.65	0.41	1.79	0.79	0.65	0.41	1.79
Netherlands	01.1985	0.71	0.48	0.39	1.77	0.64	0.36	0.20	1.37
Poland	05.2001	0.78	0.61	0.19	1.34	0.78	0.61	0.18	1.34
Portugal	06.1986	0.90	0.84	0.44	1.85	0.89	0.80	0.38	1.74
Romania	05.2001	0.92	0.86	0.54	2.08	0.92	0.87	0.57	2.12
Slovakia	04.2000	0.86	0.76	0.27	1.51	0.89	0.81	0.33	1.64
Slovenia	03.1996	0.79	0.64	0.30	1.58	0.77	0.68	0.38	1.65
Spain	06.1986	0.96	0.94	0.54	2.07	0.88	0.80	0.33	1.64
Sweden	10.1995	0.37	–0.15	–0.27	0.45	0.35	–0.16	–0.26	0.45
United Kingdom	01.1985	0.57	0.32	0.03	1.03	0.72	0.52	0.12	1.23
Minimum		*0.34*	*–0.19*	*–0.27*	*0.45*	*0.35*	*–0.16*	*–0.26*	*0.45*
Maximum		*0.96*	*0.94*	*0.66*	*2.32*	*0.92*	*0.87*	*0.57*	*2.12*
Mean		***0.79***	***0.64***	***0.31***	***1.59***	***0.77***	***0.60***	***0.25***	***1.47***

Source: Author's calculations based on EC data.

Table 3

Balance statistics of inflation expectations (period averages)

	Start of the sample	Common sample (Nov 2002–May 2007)				Full individual sample			
		BS_1^e	BS_2^e	BS_3^e	BS_4^e	BS_1^e	BS_2^e	BS_3^e	BS_4^e
Austria	01.1985	0.72	0.48	0.24	1.46	0.61	0.32	0.16	1.30
Belgium	01.1985	0.63	0.35	0.14	1.20	0.69	0.48	0.21	1.34
Bulgaria	05.2001	0.76	0.68	0.36	1.56	0.75	0.67	0.33	1.50
Cyprus	05.2001	0.70	0.61	0.36	1.52	0.74	0.66	0.40	1.65
Czech Republic	01.2001	0.67	0.50	0.31	1.52	0.70	0.56	0.34	1.58
Denmark	01.1985	0.46	0.08	0.00	0.96	0.56	0.24	–0.06	0.84
EMU	01.1985	0.63	0.34	0.13	1.19	0.69	0.47	0.22	1.39
Estonia	04.2001	0.85	0.79	0.50	1.93	0.86	0.80	0.50	1.92
Finland	11.1995	0.68	0.43	0.18	1.34	0.60	0.30	0.13	1.24
France	01.1985	0.66	0.39	0.14	1.23	0.59	0.27	0.12	1.18
Germany	01.1985	0.68	0.45	0.19	1.32	0.77	0.60	0.29	1.53
Greece	01.1985	0.68	0.49	0.25	1.39	0.80	0.69	0.38	1.70
Hungary	02.1993	0.93	0.92	0.56	2.06	0.92	0.91	0.51	1.97
Ireland	01.1985	0.73	0.59	0.22	1.34	0.77	0.62	0.23	1.41
Italy	01.1985	0.41	–0.06	–0.11	0.72	0.66	0.42	0.24	1.42
Latvia	05.2001	0.89	0.85	0.49	1.92	0.86	0.80	0.43	1.80
Lithuania	05.2001	0.85	0.77	0.51	1.98	0.85	0.76	0.48	1.92
Luxembourg	01.2002	0.70	0.47	0.17	1.31	0.69	0.46	0.17	1.29
Malta	11.2002	0.55	0.29	0.24	1.34	0.55	0.29	0.24	1.34
Netherlands	01.1985	0.49	0.10	0.07	1.10	0.60	0.31	0.21	1.35
Poland	05.2001	0.74	0.58	0.28	1.47	0.76	0.61	0.30	1.51
Portugal	06.1986	0.84	0.74	0.39	1.72	0.80	0.70	0.31	1.54
Romania	05.2001	0.88	0.84	0.48	1.91	0.89	0.85	0.50	1.95
Slovakia	04.2000	0.84	0.74	0.42	1.80	0.86	0.78	0.44	1.84
Slovenia	03.1996	0.71	0.55	0.33	1.61	0.79	0.67	0.41	1.78
Spain	06.1986	0.70	0.54	0.20	1.27	0.71	0.58	0.15	1.18
Sweden	10.1995	0.53	0.20	0.19	1.38	0.49	0.12	0.14	1.23
United Kingdom	01.1985	0.63	0.38	0.14	1.25	0.75	0.59	0.29	1.53
Minimum		*0.41*	*–0.06*	*–0.11*	*0.72*	*0.49*	*0.12*	*–0.06*	*0.84*
Maximum		*0.93*	*0.92*	*0.56*	*2.06*	*0.92*	*0.91*	*0.51*	*1.97*
Mean		***0.70***	***0.50***	***0.26***	***1.46***	***0.73***	***0.55***	***0.29***	***1.51***

Source: Author's calculations based on EC data.

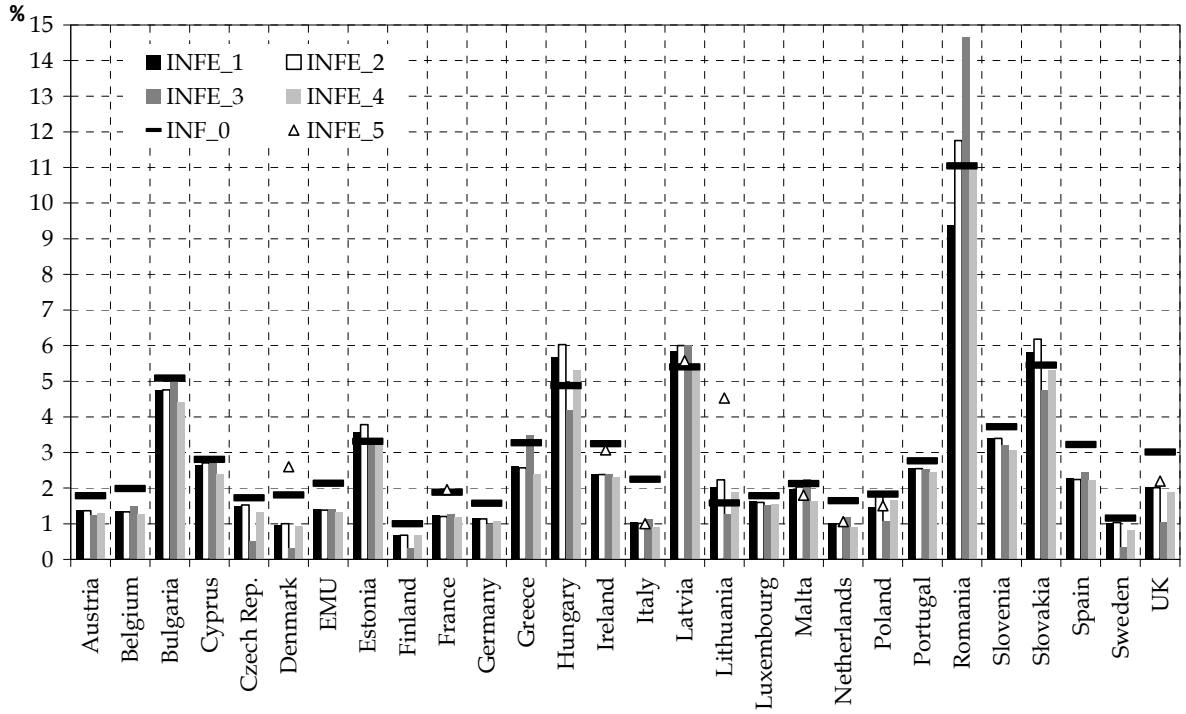
Taking into consideration the common sample period, it may be observed that a vast majority of consumers in European economies declare that prices are higher than 12 months before; the balance statistic BS_1^p equals approximately 79 percentage points, while BS_2^p equals 64 percentage points. Both reach their maximum values in Spain (96 and 94 percentage points, respectively) and minimum values in Denmark (34 and –19 percentage points, respectively). The balance statistics capturing different degrees of price increase noticed by respondents, ie BS_3^p and BS_4^p, indicate that consumers in Sweden are the most optimistic in terms of perceived changes in the price level, while Greeks seem to be the most pessimistic.

Opinions about future changes in the price level are generally better than survey responses to the question on perceived price changes: the difference between the fraction of respondents expecting a price increase and decrease, ie balance statistic BS_1^e, amounts to 70 percentage points on average, while the difference between the fraction of respondents declaring expectations of a price increase on the one hand, and their stabilisation or decrease on the other, ie balance statistic BS_2^e, equals approximately 51 percentage points. The weighted balance statistics of inflation expectations BS_3^e and BS_4^e, which equal 0.27 and 1.47, respectively, are also lower than their counterparts measuring opinions on perceived price changes (BS_3^p equals 0.31; BS_3^p equals 1.59). All the balance statistics show that Italian consumers reveal the highest degree of optimism when assessing future price changes, while Hungarian consumers are the most pessimistic.

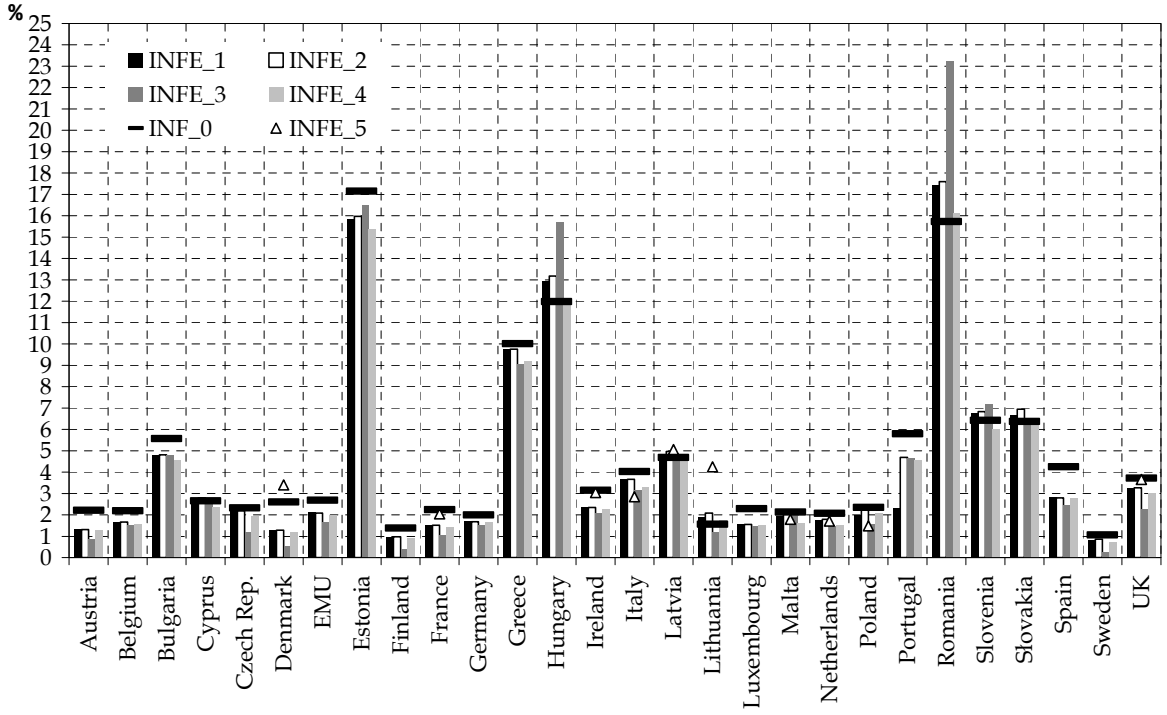
Figure 2

Averages of current inflation (*INF_0*) and different measures of inflation expectations[1]

2.A Common sample (Nov 2002–May 2007)



2.B Full individual sample[2]



Notes: [1] *INFE_1*: objectified probability measure assuming normal distribution of expected inflation; *INFE_2*: objectified probability measure assuming triangular distribution of expected inflation; *INFE_3*: subjectified probability measure assuming normal distribution of expected inflation; *INFE_4*: objectified logistic function measure; *INFE_5*: regression measure. [2] Start of the sample period: see Table 2 or Table 3.

Source: Author's calculations based on EC and IFS data.

As far as quantified indicators of expected inflation are concerned, probability and logistic function measures are available for all the economies under consideration, while the regression measure is available only for some of them (see Annex B for the estimation results of the regression models applied). Figure 1 presents the averages of available measures of inflation expectations and current inflation for the common sample period and full individual samples (Annex C presents the graphs with detailed quantification results).

To assess the uncertainty in measuring inflation expectations, the differences between the maximum and minimum estimates were calculated. Table 4 shows the results for the common sample, while Table 5 presents the results for all observations available for each economy.

Table 4

Differences between inflation expectation measures, common sample

	Data availability		Wedge (in pp), *INFE_i*, *i*=1, 2, 3, 4				Average correlation: *INFE_i*, 1<*i*<5 with *INFE_1*	Wedge (in pp), *INFE_i*, *i*=1, 2, 3, 4, 5				Average correlation: *INFE_i*, 1<*i*<5 with *INFE_1*
	INFE_1 – INFE_4	*INFE_5*	Mean	Minimum	Maximum	Relative to mean		Mean	Minimum	Maximum	Relative to mean	
Austria	x		0.25	0.06	0.61	18.7%	0.95	0.25	0.06	0.61	18.7%	0.95
Belgium	x		0.30	0.06	0.81	23.5%	0.96	0.30	0.06	0.81	23.5%	0.96
Bulgaria	x		1.19	0.08	3.78	23.6%	0.97	1.19	0.08	3.78	23.6%	0.97
Cyprus	x		0.86	0.02	2.86	45.4%	0.91	0.86	0.02	2.86	45.4%	0.91
Czech Republic	x		1.06	0.00	2.96	68.2%	0.94	1.06	0.00	2.96	68.2%	0.94
Denmark	x	x	0.70	0.19	2.18	74.9%	0.95	1.60	1.19	2.18	193.6%	0.90
EMU	x		0.19	0.06	0.47	14.3%	0.91	0.19	0.06	0.47	14.3%	0.91
Estonia	x		1.00	0.24	2.87	40.8%	0.95	1.00	0.24	2.87	40.8%	0.95
Finland	x		0.42	0.00	1.15	36.5%	0.96	0.42	0.00	1.15	36.5%	0.96
France	x	x	0.17	0.02	0.47	14.8%	0.90	0.81	0.35	1.14	71.5%	0.75
Germany	x		0.25	0.05	0.73	22.3%	0.95	0.25	0.05	0.73	22.3%	0.95
Greece	x		1.09	0.20	1.98	43.8%	0.94	1.09	0.20	1.98	43.8%	0.94
Hungary	x		1.88	0.10	6.29	33.2%	0.97	1.88	0.10	6.29	33.2%	0.97
Ireland	x	x	0.54	0.05	1.43	23.8%	0.93	0.99	0.16	1.80	45.0%	0.92
Italy	x	x	0.28	0.10	0.65	27.4%	0.94	0.33	0.11	0.71	32.1%	0.90
Latvia	x	x	1.55	0.09	3.31	30.9%	0.97	2.78	1.24	3.90	74.2%	0.90
Lithuania	x	x	1.29	0.45	3.46	47.4%	0.97	3.43	0.81	9.16	92.6%	0.91
Luxembourg	x		0.21	0.06	0.73	13.8%	0.95	0.21	0.06	0.73	13.8%	0.95
Malta	x	x	1.00	0.09	2.49	54.9%	0.94	1.41	0.09	3.61	70.8%	0.78
Netherlands	x	x	0.46	0.09	1.78	45.5%	0.80	1.00	0.10	3.25	107.9%	0.71
Poland	x	x	0.84	0.03	2.86	48.0%	0.97	0.97	0.26	2.86	51.1%	0.95
Portugal	x		0.37	0.06	0.86	15.1%	0.96	0.37	0.06	0.86	15.1%	0.96
Romania	x		3.73	0.25	9.08	29.3%	1.00	3.73	0.25	9.08	29.3%	1.00
Slovakia	x		1.61	0.11	4.68	30.8%	0.98	1.61	0.11	4.68	30.8%	0.98
Slovenia	x		0.77	0.15	1.93	24.1%	0.98	0.77	0.15	1.93	24.1%	0.98
Spain	x		0.30	0.03	0.83	15.0%	0.96	0.30	0.03	0.83	15.0%	0.96
Sweden	x		0.74	0.02	2.38	51.3%	0.96	0.74	0.02	2.38	51.3%	0.96
United Kingdom	x	x	0.98	0.56	1.83	50.4%	0.94	1.27	0.90	2.19	66.9%	0.81
Minimum			*0.17*	*0.00*	*0.47*	*13.8%*	*0.80*	*0.19*	*0.00*	*0.47*	*13.8%*	*0.71*
Maximum			*3.73*	*0.56*	*9.08*	*74.9%*	*1.00*	*3.73*	*1.24*	*9.16*	*193.6%*	*1.00*
Mean			***0.86***	***0.11***	***2.34***	***34.6%***	***0.95***	***1.10***	***0.24***	***2.71***	***48.4%***	***0.92***

Source: Author's calculations based on EC and IFS data.

When summarising the 2002–2007 results, the following points should be made. First, regression measures seem quite different from the other measures. The difference between the extreme estimates of inflation expectations equals 1.1 percentage points on average for all the measures and 0.9 percentage points for the probability and logistic function measures, which corresponds to 48.4% and 34.6% of their average, respectively. Second, taking into consideration the relative wedge between the probability and logistic function measures, it

appears that the uncertainty in measuring consumer expectations is relatively low in the EMU as a whole and its member economies (Austria, France, Germany, Luxembourg, Portugal and Spain), whereas it is relatively high in the Czech Republic, Denmark, Lithuania, Malta, Poland, Sweden and the United Kingdom. The relative wedge between the analysed measures of inflation expectations is positively correlated with the relative gap between the perceived current inflation quantified on the basis of survey data and its statistical measure and with the volatility of the parameter γ, ie the difference between current inflation and its 12-month moving average (Figure 3). Third, all the measures of consumer inflation expectations are highly correlated, which suggests that, even in economies where measurement uncertainty is elevated, all the proxies follow similar tendencies.

Table 5

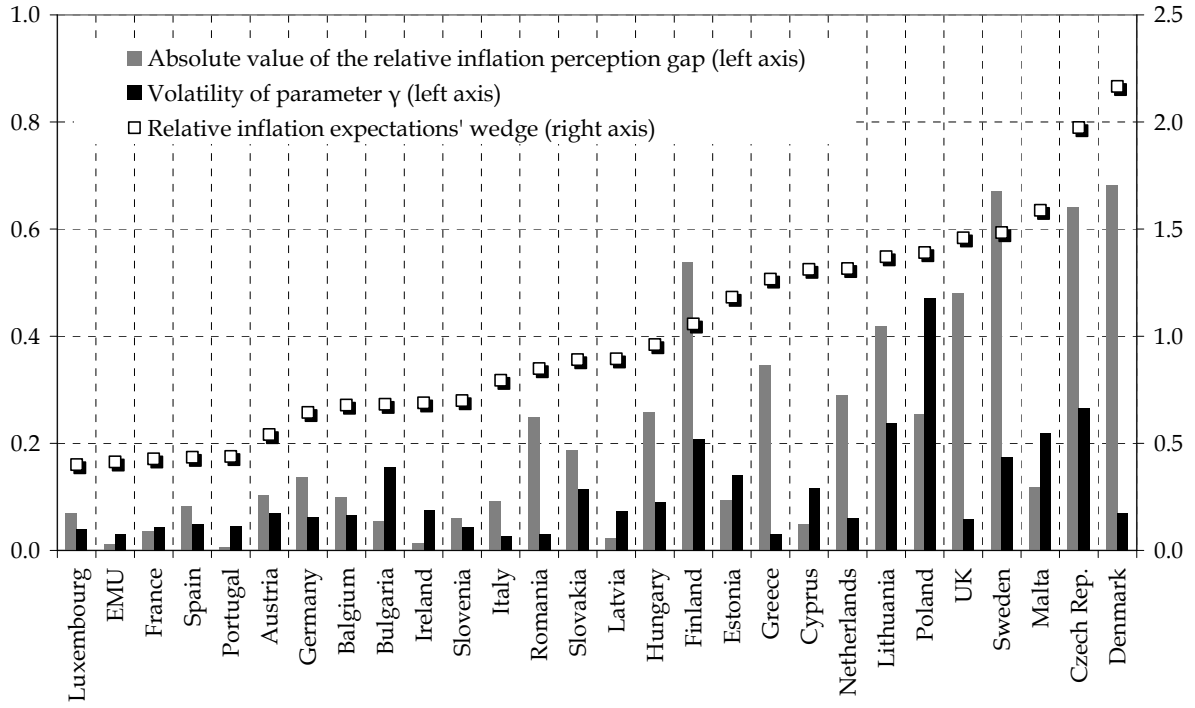
Differences between inflation expectation measures, full individual sample

	Start of the sample	Data availability		Wedge (in pp), *INFE_i*, *i*=1, 2, 3, 4				Average correlation: *INFE_i*, 1<*i*<5 with *INFE_1*	Wedge (in pp), *INFE_i*, *i*=1, 2, 3, 4, 5				Average correlation: *INFE_i*, 1<*i*<5 with *INFE_1*
		INFE_1 – INFE_4	*INFE_5*	Mean	Minimum	Maximum	Relative to mean		Mean	Minimum	Maximum	Relative to mean	
Austria	01.1985	x		0.24	0.00	1.36	23.2%	0.95	0.24	0.00	1.36	23.2%	0.95
Belgium	01.1985	x		0.32	0.01	1.94	24.3%	0.96	0.32	0.01	1.94	24.3%	0.96
Bulgaria	05.2001	x		1.26	0.03	3.78	24.3%	0.95	1.26	0.03	3.78	24.3%	0.95
Cyprus	05.2001	x		0.88	0.02	2.86	42.1%	0.90	0.88	0.02	2.86	42.1%	0.90
Czech Republic	01.2001	x		1.09	0.00	2.96	57.4%	0.97	1.09	0.00	2.96	57.4%	0.97
Denmark	01.1985	x	x	0.68	0.10	2.18	65.4%	0.98	1.71	0.10	3.16	200.5%	0.85
EMU	01.1985	x		0.43	0.06	1.39	24.2%	0.98	0.43	0.06	1.39	24.2%	0.98
Estonia	04.2001	x		3.62	0.05	48.77	27.6%	0.99	3.62	0.05	48.77	27.6%	0.99
Finland	11.1995	x		0.59	0.00	1.92	59.1%	0.98	0.59	0.00	1.92	59.1%	0.98
France	01.1985	x	x	0.41	0.02	2.20	32.5%	0.96	1.01	0.03	3.02	100.5%	0.91
Germany	01.1985	x		0.36	0.03	2.05	25.6%	0.99	0.36	0.03	2.05	25.6%	0.99
Greece	01.1985	x		1.51	0.15	6.32	22.8%	0.99	1.51	0.15	6.32	22.8%	0.99
Hungary	02.1993	x		5.08	0.10	36.44	30.5%	0.99	5.08	0.10	36.44	30.5%	0.99
Ireland	01.1985	x	x	0.47	0.03	1.69	22.8%	0.97	1.05	0.13	2.21	55.2%	0.96
Italy	01.1985	x	x	0.60	0.10	3.18	21.4%	0.99	0.92	0.11	4.31	29.6%	0.98
Latvia	05.2001	x	x	1.38	0.03	3.31	34.6%	0.98	2.69	1.24	3.90	98.6%	0.94
Lithuania	05.2001	x	x	1.21	0.12	3.46	50.6%	0.96	3.24	0.81	9.16	121.9%	0.90
Luxembourg	01.2002	x		0.20	0.06	0.73	13.6%	0.95	0.20	0.06	0.73	13.6%	0.95
Malta	11.2002	x	x	1.00	0.09	2.49	54.9%	0.94	1.41	0.09	3.61	70.8%	0.78
Netherlands	01.1985	x	x	0.63	0.01	2.79	35.4%	0.96	1.15	0.09	3.72	71.6%	0.89
Poland	05.2001	x	x	0.80	0.03	2.86	43.7%	0.97	0.91	0.19	2.86	43.7%	0.95
Portugal	06.1986	x		0.75	0.03	3.46	18.2%	0.99	0.75	0.03	3.46	18.2%	0.99
Romania	05.2001	x		7.23	0.25	27.23	34.7%	0.99	7.23	0.25	27.23	34.7%	0.99
Slovakia	04.2000	x		1.65	0.11	6.16	28.2%	0.97	1.65	0.11	6.16	28.2%	0.97
Slovenia	03.1996	x		1.81	0.15	5.38	26.8%	0.98	1.81	0.15	5.38	26.8%	0.98
Spain	06.1986	x		0.49	0.03	1.36	21.4%	0.98	0.49	0.03	1.36	21.4%	0.98
Sweden	10.1995	x		0.69	0.02	2.38	43.4%	0.94	0.69	0.02	2.38	43.4%	0.94
United Kingdom	01.1985	x	x	0.96	0.06	3.03	36.7%	0.99	1.82	0.24	4.99	85.6%	0.96
Minimum				*0.20*	*0.00*	*0.73*	*13.6%*	*0.90*	*0.20*	*0.00*	*0.73*	*13.6%*	*0.78*
Maximum				*7.23*	*0.25*	*48.77*	*65.4%*	*0.99*	*7.23*	*1.24*	*48.77*	*200.5%*	*0.99*
Mean				***1.33***	***0.06***	***6.89***	***33.0%***	***0.97***	***1.58***	***0.15***	***7.05***	***50.9%***	***0.95***

Source: Author's calculations based on EC and IFS data.

Figure 3

Factors affecting relative wedge between probability and logistic function measures of inflation expectations



Source: Author's calculations based on EC and IFS data.

4. Are European consumers forward looking?

Direct measures of inflation expectations are particularly useful in testing various hypotheses concerning the formation of expectations. The empirical part of the present paper is focused on assessing the degree of forward-lookingness of consumer inflation expectations in European economies.

Before presenting the results of the estimations using quantified proxies for consumer expectations, it should be underlined that the assumptions of quantification methods may cause some correlation between the quantified measures of inflation expectations and the current inflation rate, thereby affecting the assessment of the forward-lookingness of expectations. This is due to the fact that the survey question makes the respondents express their foresights in terms of their perception of price changes currently observed. The proxies for the perceived current inflation used in quantification methods are – at least to some extent – related to the official measure of current inflation. To illustrate the reaction of the measures of inflation expectations applied in the present study to changes in the current inflation rate, the following experiment was conducted. It was assumed that the current inflation rate was rising from 2% to 3% with a different distribution of responses to the survey question. The responses of expectation measures *INFE_1*, *INFE_2*, *INFE_3* and *INFE_4* were then checked. The results obtained (Table 6 and Figure 4) show, in general terms, that all the measures change following a change in the current rate of inflation, with the magnitude of the reaction dependent on the survey responses.

Table 6

Response of different measures of inflation expectations (*INFE_1*, *INFE_2*, *INFE_3*, *INFE_4*) to a change in current inflation (*INF_0*)

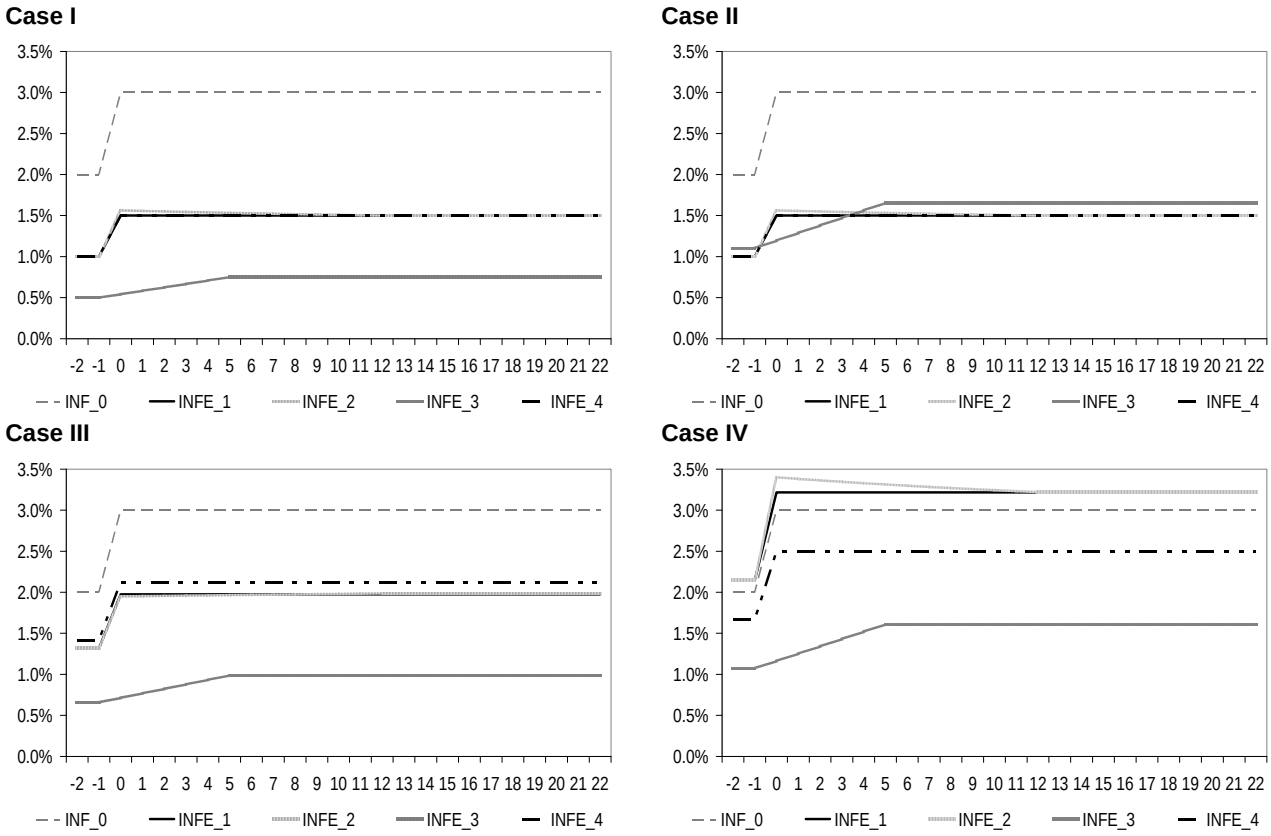
		Change in *INF_0* (in pp)	Response (in pp)			
			INFE_1	*INFE_2*	*INFE_3*	*INFE_4*
Case I	Maximum response [lag]	1 [0]	0.50 [0]	0.56 [0]	0.25 [12]	0.50 [0]
	Response in the long-term	1	0.50	0.50	0.25	0.50
Case II	Maximum response [lag]	1 [0]	0.50 [0]	0.56 [0]	0.55 [12]	0.50 [0]
	Response in the long-term	1	0.50	0.50	0.55	0.50
Case III	Maximum response [lag]	1 [0]	0.66 [0]	0.66 [0]	0.33 [12]	0.71 [0]
	Response in the long-term	1	0.66	0.66	0.33	0.71
Case IV	Maximum response [lag]	1 [0]	1.07 [0]	1.25 [0]	0.54 [12]	0.83 [0]
	Response in the long-term	1	1.07	1.07	0.54	0.83

Case I: A_1^p=20%, A_2^p=20%, A_3^p=20%, B^p=20%, C^p=20%, A_1^e=20%, A_2^e=20%, A_3^e=20%, B^e=20%, C^e=20%;
Case II: A_1^p=40%, A_2^p=30%, A_3^p=20%, B^p=5%, C^p=5%, A_1^e=20%, A_2^e=20%, A_3^e=20%, B^e=20%, C^e=20%;
Case III: A_1^p=20%, A_2^p=20%, A_3^p=20%, B^p=20%, C^p=20%, A_1^e=5%, A_2^e=50%, A_3^e=35%, B^e=5%, C^e=5%;
Case IV: A_1^p=20%, A_2^p=20%, A_3^p=20%, B^p=20%, C^p=20%, A_1^e=40%, A_2^e=25%, A_3^e=10%, B^e=15%, C^e=10%.
In all the cases: D^p=0, D^e=0.

Source: Author's calculations.

Figure 4

Response of different measures of inflation expectations (*INFE_1*, *INFE_2*, *INFE_3*, *INFE_4*) to a change in current inflation (*INF_0*)



Case I: A_1^p=20%, A_2^p=20%, A_3^p=20%, B^p=20%, C^p=20%, A_1^e=20%, A_2^e=20%, A_3^e=20%, B^e=20%, C^e=20%;

Case II: A_1^p=40%, A_2^p=30%, A_3^p=20%, B^p=5%, C^p=5%, A_1^e=20%, A_2^e=20%, A_3^e=20%, B^e=20%, C^e=20%;
Case III: A_1^p=20%, A_2^p=20%, A_3^p=20%, B^p=20%, C^p=20%, A_1^e=5%, A_2^e=50%, A_3^e=35%, B^e=5%, C^e=5%;
Case IV: A_1^p=20%, A_2^p=20%, A_3^p=20%, B^p=20%, C^p=20%, A_1^e=40%, A_2^e=25%, A_3^e=10%, B^e=15%, C^e=10%.
In all the cases: D^p=0, D^e=0.

Source: Author's calculations.

To address the risk that the degree of forward-lookingness estimated on the basis of quantified measures of inflation expectations may be biased downwards, the balance statistics are also used to assess how opinions about past price changes affect price expectations.

4.1 Degree of forward-lookingness assessed with quantified measures of inflation expectations

Empirical studies examining the formation of consumer inflation expectations in European economies indicate that backward-looking mechanisms are relatively more important than forward-looking ones. Gerberding (2001) verifies the model of consumer inflation expectation formation in France, Germany and Italy, showing that expectations are neither purely forward-looking nor purely adaptive, although the relative weight of the adaptive mechanism is, in all cases, greater than one half. Forsells and Kenny (2004) show that consumer inflation expectations in the euro area are characterised by an intermediate degree of rationality, with consumers taking into consideration a wide – but not complete – set of information in forming their expectations. Consumers seem to gradually adjust their expectations in order to eliminate any systematic expectational error, so their expectations approach actual future inflation in the long term. Döpke et al (2006) estimate Carroll's sticky information model of households' inflation expectations in France, Germany, Italy and the United Kingdom. They show that, in the formation of inflation expectations, households mainly use past inflation, although there is also a role for available professional forecasts, which are interpreted as a forward-looking variable. It is found that European households adjust sluggishly to new information, which is similar to the findings of Forsells and Kenny (2004).

In order to assess the formation of European consumers' inflation expectations on the basis of the survey measures described above, two types of equations are estimated in the present paper. The first specification tests rational versus adaptive expectations in line with the approach used by Gerberding (2001), Carlson and Valev (2002) and Heineman and Ullrich (2006). The equation has the following form:

$$\pi^{e}_{t+12|t} = \alpha_1 + \alpha_2 \cdot \pi_{t+12} + \left(1-\alpha_2\right)\cdot\left[\pi^{e}_{t-2|t-14} + \alpha_3 \cdot \left(\pi^{e}_{t-2|t-14} - \pi_{t-2}\right) + \alpha_4 \cdot \left(\pi_{t-2} - \pi_{t-14}\right)\right] + \varepsilon_t \qquad (21)$$

where $\pi^{e}_{t+i|t}$ denotes inflation expectations formed at time t with respect to inflation at time $t+i$, while π_t denotes inflation at time t.

If the hypothesis that the estimated parameter α_2 equals 1 is not rejected, it suggests that inflation expectations meet the unbiasedness requirement of the rational expectations hypothesis.[3] If the estimation results show that α_2 is insignificantly different from zero, inflation expectations are adaptive, ie they depend on their lag adjusted for previous expectations' errors (ie the difference between current inflation[4] and the expectations formed with respect to it a year before). Moreover, the specification takes into account the possible impact of a change in the current inflation on inflation expectations.

An alternative version of the test equation – similarly to equation (21) – has a hybrid nature, capturing both forward- and backward-looking determinants of inflation expectations.

[3] It requires economic agents not to make systematic forecast errors, which implies that their expectations are equal to actual inflation on average and to actual inflation plus a random forecast error period by period.

[4] Surveys are carried out at the beginning of each month; therefore, the year-on-year CPI index lagged two months (due to publication lags) is used as the current inflation (known to the respondents while answering the survey question).

However, the static mechanism is applied in its backward-looking part, in which expectations depend on the currently observed inflation:

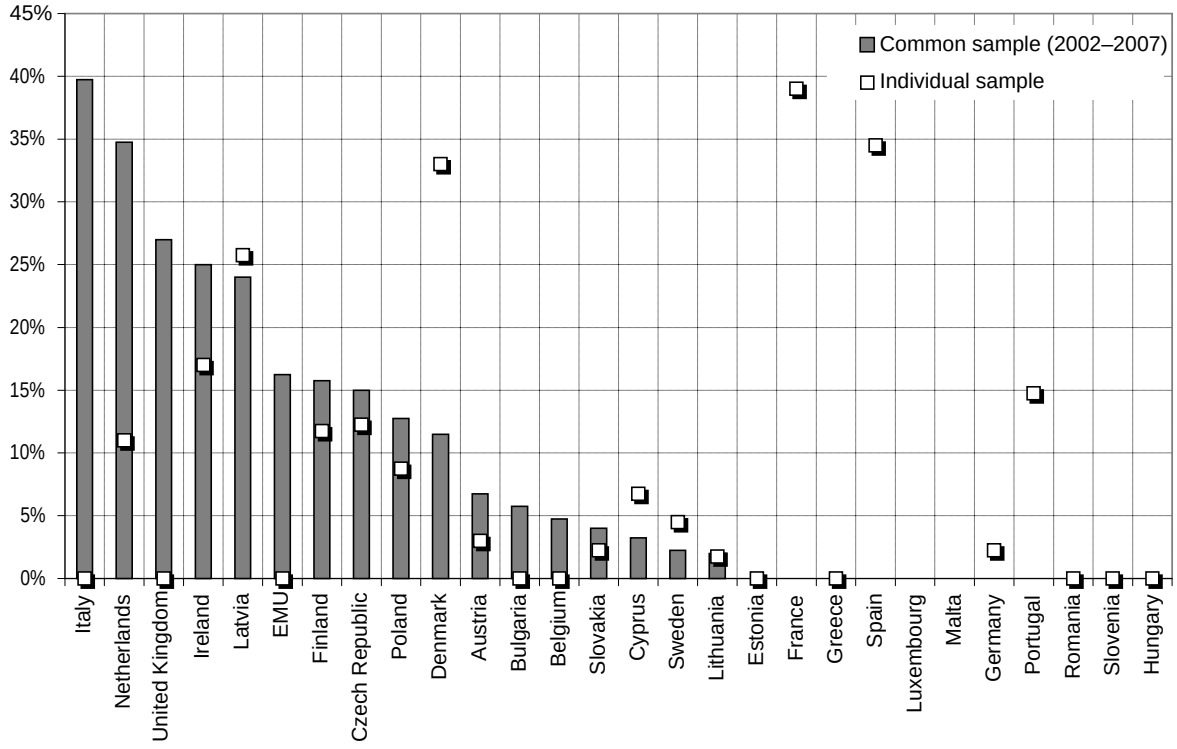
$$\pi^{e}_{t+12|t} = \alpha_1 + \alpha_2 \cdot \pi_{t+12} + (1-\alpha_2) \cdot \pi_{t-2} + v_t \qquad (22)$$

Both test equations were estimated using four quantified measures of inflation expectations available for all economies (*INFE_1*, *INFE_2*, *INFE_3*, *INFE_4*). The final version of the estimated equation for each of the economies was selected on the basis of a comparison of statistical properties. Where both equations were satisfactory in terms of statistical properties, the selection was based on the empirical fit measured with the adjusted R^2 coefficient.

Figure 5 presents the average weight of the forward-looking factor in the formation of consumer inflation expectations in individual economies across all the measures considered. Table 7 provides detailed estimation results for every measure of inflation expectation as well as a description of the estimation technique applied. The results are presented both for the common sample and individual sample periods.

Figure 5

The weight of the forward-looking mechanism in the formation of consumer inflation expectations (average for all measures under consideration)



Source: Author's calculations based on the results presented in Table 7.

Table 7

Formation of inflation expectations – estimation results[1] of equations (21) and (22)

	Start of the individual sample	Common sample (Nov 2002–May 2007)					Individual sample				
		Expectations' measure, equation version[(2)], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness $(1-\alpha_2)$	α_3	α_4	Expectations' measure, equation version[(2)], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness $(1-\alpha_2)$	α_3	α_4
Austria	01.1985	1,A* 0,95	–	1	–1,06 (0,10)	–0,14 (0,07)	1,A 0,60	–	1	–	0,73 (0,07)
		2,S* 0,93	0,08 (0,03)	0,92 (0,03)			2,A 0,61	0,07 (0,04)	0,93 (0,04)	–	0,74 (0,06)
		3,A* 0,86	0,13 (0,08)	0,87 (0,08)	–1,86 (0,32)	–0,88 (0,22)	3,A* 0,78	–	1	–0,70 (0,04)	–
		4,A* 0,97	0,06 (0,04)	0,94 (0,04)	–1,14 (0,12)	–0,20 (0,08)	4,A 0,65	0,05 (0,03)	0,95 (0,03)	–	0,68 (0,05)
Belgium	01.1985	1,A* 0,94	0,05 (0,03)	0,95 (0,03)	–0,88 (0,03)	–	1,A* 0,91	–	1	–0,91 (0,02)	–
		2,A* 0,93	0,06 (0,04)	0,94 (0,04)	-0,87 (0,03)	–	2,A* 0,90	–	1	–0,91 (0,02)	–
		3,A* 0,81	–	1	–0,92 (0,04)	–	3,A* 0,73	–	1	–1,47 (0,19)	–0,66 (0,17)
		4,A* 0,94	0,08 (0,03)	0,92 (0,03)	–0,85 (0,03)	–	4,A* 0,92	–	1	–0,89 (0,02)	–
Bulgaria	05.2001	1,A* 0,95	–	1	–0,94 (0,02)	–	1,A* 0,92	–	1	–0,93 (0,02)	–
		2,S* 0,92	0,07 (0,04)	0,93 (0,04)			2,A* 0,92	–	1	–0,93 (0,02)	–
		3,S* 0,70	0,16 (0,08)	0,84 (0,08)			3,A* 0,68	–	1	–0,85 0,08)	–
		4,A* 0,97	–	1	–0,91 (0,02)	–	4,A* 0,95	–	1	–0,91 (0,02)	–
Cyprus	05.2001	1,A 0,81	–	1	–1,03 (0,05)	–	1,A 0,74	–	1	–1,06 (0,06)	–
		2,A 0,73	–	1	–1,04 (0,05)	–	2,A 0,63	–	1	–1,07 (0,07)	–
		3,– –	–	–	–	–	3,– –	–	–	–	–
		4,S* 0,83	0,13 (0,07)	0,87 (0,07)			4,A 0,75	0,27 (0,11)	0,73 (0,11)	–1,07 (0,09)	–
Czech Republic	01.2001	1,A* 0,90	0,12 (0,06)	0,88 (0,06)	–0,46 (0,23)	0,63 (0,27)	1,A* 0,90	0,13 (0,04)	0,87 (0,04)	–1,02 (0,04)	–
		2,S* 0,85	0,10 (0,05)	0,90 (0,05)			2,S* 0,88	0,10 (0,04)	0,90 (0,04)		
		3,A* 0,64	0,27 (0,05)	0,73 (0,05)	–0,70 (0,03)	–	3,A* 0,78	0,12 (0,03)	0,88 (0,03)	–0,64 (0,03)	–
		4,A* 0,93	0,11 (0,04)	0,89 (0,04)	–0,52 (0,17)	0,48 (0,18)	4,A* 0,93	0,14 (0,03)	0,86 (0,03)	–0,97 (0,03)	–
Denmark	01.1985	1,A* 0,92	0,09 (0,04)	0,81 (0,04)	–1,07 (0,14)	–0,21 (0,13)	1,A* 0,62	0,46 (0,18)	0,54 (0,18)	–	0,63 (0,10)
		1,A* 0,72	0,14 (0,05)	0,86 (0,05)	–1,21 (0,20)	–0,29 (0,15)	2,A* 0,60	0,42 (0,19)	0,58 (0,19)	–	0,59 (0,09)
		1,A* 0,67	0,15 (0,04)	0,85 (0,04)	–0,46 (0,04)	–	3,A 0,72	–	1	–	0,25 (0,05)
		4,A* 0,91	0,08 (0,05)	0,92 (0,05)	–0,81 (0,03)	–	4,A* 0,61	0,44 (0,18)	0,56 (0,18)	–	0,60 (0,10)

	Start of the individual sample	Common sample (Nov 2002–May 2007)					Individual sample				
		Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1 - \alpha_2$)	α_3	α_4	Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1 - \alpha_2$)	α_3	α_4
EMU	01.1985	1,S* 0,71	0,20 (0,12)	0,80 (0,12)			1,A* 0,93	–	1	–1,01 (0,04)	–
		2,S* 0,67	0,22 (0,13)	0,78 (0,13)			2,A* 0,92	–	1	–1,01 (0,04)	–
		3,– –	–	–	–	–	3,A* 0,88	–	1	–0,76 0,05)	–
		4,S* 0,67	0,23 (0,12)	0,77 (0,12)			4,A* 0,94	–	1	–0,99 (0,04)	–
Estonia	04.2001	1,A* 0,90	–	1	–1,07 (0,06)	–	1,A* 0,90	–	1	–1,07 (0,05)	–
		2,A* 0,73	–	1	–1,09 (0,09)	–	2,A* 0,99	–	1	–0,96 (0,05)	0,09 (0,05)
		3,A* 0,64	–	1	–1,65 (0,27)	–0,50 (0,22)	3,A* 0,97	–	1	–1,01 (0,02)	–
		4,A* 0,93	–	1	–1,03 (0,04)	–	4,A* 0,99	–	1	–1,04 (0,01)	–
Finland	11.1995	1,A* 0,91	0,19 (0,02)	0,81 (0,02)	–	–	1,A* 0,93	0,12 (0,08)	0,88 (0,08)	–0,96 (0,05)	–
		2,A* 0,87	0,22 (0,03)	0,78 (0,03)	–0,83 (0,03)	–	2,A* 0,92	0,14 (0,08)	0,86 (0,08)	–0,94 (0,05)	–
		3,– –	–	–	–	–	3,A 0,46	–	1	–	0,33 (0,03)
		4,A* 0,87	0,22 (0,03)	0,78 (0,03)	–0,82 (0,03)	–	4,A* 0,91	0,21 (0,07)	0,79 (0,07)	–0,93 (0,05)	–
France	01.1985	1,S* 0,42	–	1			1,S* 0,60	0,54 (0,17)	0,46 (0,17)		
		2,A* 0,37	–	1	–0,77 (0,10)	–	2,S* 0,56	0,55 (0,18)	0,45 (0,18)		
		3,A* 0,29	–	1	–	0,37 (0,08)	3,– –	–	–	–	–
		4,A* 0,40	–	1	–0,72 (0,08)	–	4,A* 0,60	0,47 (0,24)	0,53 (0,24)	–	0,86 (0,21)
Germany	01.1985	1,A* 0,93	–	1	–0,77 (0,04)	–	1,S* 0,96	–	1		
		2,A* 0,93	–	1	–0,76 (0,04)	–	2,S* 0,95	–	1		
		3,A* 0,83	–	1	–0,73 (0,04)	–0,20 (0,06)	3,S* 0,86	–	1		
		4,A* 0,93	–	1	–0,73 (0,04)	–	4,A* 0,96	0,09 (0,03)	0,91 (0,03)	–0,95 (0,04)	–
Greece	01.1985	1,A* 0,60	–	1	–1,18 (0,09)	–	1,A 0,97	–	1	–1,00 (0,04)	–
		2,A* 0,59	–	–	–1,17 (0,10)	–	1,A 0,96	–	1	–1,01 (0,04)	–
		3,A* 0,54	–	1	–0,99 (0,14)	–	3,A* 0,90	–	1	–0,96 (0,07)	–
		4,A* 0,63	–	1	–1,15 (0,08)	–	4,A* 0,98	–	1	–0,98 (0,03)	–

	Start of the individual sample	Common sample (Nov 2002–May 2007)					Individual sample				
		Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1 - \alpha_2$)	α_3	α_4	Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1 - \alpha_2$)	α_3	α_4
Hungary	02.1993	1,A* 0,91	–	1	–1,11 (0,05)	–	1,A* 0,97	–	1	–1,19 (0,06)	–
		2,A 0,88	–	1	–1,13 (0,05)	–	2,A* 0,96	–	1	–1,21 (0,07)	–
		3,A* 0,80	–	1	–0,91 (0,05)	–	3,A 0,70	–	1	–0,70 (0,10)	–
		4,A* 0,93	–	1	–1,06 (0,04)	–	4,A* 0,99	–	1	–1,13 (0,03)	–
Ireland	01.1985	1,A* 0,92	0,23 (0,02)	0,77 (0,02)	–0,85 (0,03)	–	1,S* 0,91	0,21 (0,04)	0,79 (0,04)		
		2,A* 0,92	0,23 (0,02)	0,77 (0,02)	–0,83 (0,03)	–	2,S* 0,91	0,22 (0,04)	0,78 (0,04)		
		3,A* 0,77	0,31 (0,12)	0,69 (0,12)	–1,82 (0,52)	–0,74 (0,40)	3,S* 0,82	–	1		
		4,A* 0,93	0,23 (0,02)	0,77 (0,02)	–0,83 (0,03)	–	4,S* 0,90	0,25 (0,04)	0,75 (0,04)		
Italy	01.1985	1,S* 0,57	0,49 (0,12)	0,51 (0,12)			1,A 0,88	–	1	–	1,15 (0,07)
		2,S* 0,53	0,53 (0,12)	0,47 (0,12)			2,A 0,85	–	1	–	1,17 (0,07)
		3,A* 0,75	–	1	–0,94 (0,13)	–	3,A 0,86	–	1	–	1,19 (0,09)
		4,S* 0,49	0,57 (0,12)	0,43 (0,12)			4,A 0,91	–	1	–	1,03 (0,06)
Latvia	05.2001	1,A 0,88	0,26 (0,07)	0,74 (0,27)	–	0,98 (0,11)	1,A 0,88	0,26 (0,07)	0,74 (0,07)	–	0,98 (0,11)
		2,A 0,75	0,30 (0,10)	0,70 (0,10)	–	1,00 (0,17)	2,A 0,81	0,31 (0,09)	0,69 (0,09)	–	1,00 (0,17)
		3,A 0,61	0,23 (0,12)	0,77 (0,12)	–	0,92 (0,19)	3,A 0,65	0,27 (0,11)	0,73 (0,11)	–	0,86 (0,20)
		4,A 0,87	0,17 (0,07)	0,83 (0,07)	–	0,93 (0,07)	4,A 0,90	0,19 (0,06)	0,81 (0,06)	–	0,92 (0,07)
Lithuania	05.2001	1,A 0,98	0,08 (0,02)	0,92 (0,02)	–1,14 (0,01)	–	1,A 0,98	0,07 (0,02)	0,93 (0,02)	–1,13 (0,01)	–
		2,A* 0,92	–	1	–1,08 (0,03)	–	2,A* 0,92	–	1	–1,08 (0,03)	–
		3,S* 0,83	–	1			3,A* 0,90	–	1	–1,46 (0,15)	–0,62 (0,16)
		4,A* 0,98	–	1	–0,98 (0,02)	–	4,A* 0,98	–	1	–0,98 (0,02)	–
Luxembourg	01.2002	1,A* 0,72	–	1	–0,78 (0,12)	–					
		2,A* 0,70	–	1	–0,76 (0,12)	–					
		3,A 0,35	–	1	–0,11 (0,05)	–					
		4,A* 0,74	–	1	–0,75 (0,11)	–					

	Start of the individual sample	Common sample (Nov 2002–May 2007)					Individual sample				
		Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1 - \alpha_2$)	α_3	α_4	Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1 - \alpha_2$)	α_3	α_4
Malta	11.2002	1,A 0,71	–	1	–0,82 (0,07)	–					
		1,A 0,71	–	1	–0,84 0,08	–					
		3,A 0,50	–	1	–1,22 0,16	–0,58 0,13					
		4,A* 0,75	–	1	–0,83 0,10	–					
Netherlands	01.1985	1,A* 0,30	0,46 (0,13)	0,54 (0,13)	–1,30 (0,20)	–	1,A* 0,87	–	1	–1,29 (0,07)	–
		2,A* 0,32	0,44 (0,13)	0,56 (0,13)	–1,30 (0,18)	–	2,A* 0,81	–	1	–1,29 (0,10)	–
		3,S* 0,72	–	1			3,A* 0,84	–	1	–1,06 (0,09)	–
		4,A* 0,28	0,49 (0,07)	0,51 (0,07)	–1,34 (0,23)	–	4,A* 0,81	0,44 (0,10)	0,56 (0,10)	–1,22 (0,15)	–
Poland	05.2001	1,S* 0,92	0,19 (0,03)	0,81 (0,03)			1,S* 0,95	0,07 (0,04)	0,93 (0,04)		
		2,A 0,93	0,18 (0,07)	0,82 (0,07)	–1,17 (0,08)	–	2,S 0,94	0,08 (0,02)	0,92 (0,02)		
		3,A* 0,75	–	1	–0,73 (0,04)	–	3,S* 0,85	0,11 (0,05)	0,89 (0,05)		
		4,A* 0,93	0,14 (0,04)	0,86 (0,04)	–1,07 (0,04)	–	4,S* 0,98	0,09 (0,01)	0,91 (0,01)		
Portugal	06.1986	1,A* 0,88	–	1	–1,05 (0,05)	–	1,A 0,95	–	1	–0,20 (0,06)	0,77 (0,07)
		2,A* 0,87	–	1	–1,05 (0,05)	–	1,A* 0,95	–	1	–0,28 (0,08)	0,68 (0,09)
		3,S* 0,77	–	1			3,A 0,89	0,36 (0,18)	0,64 (0,18)	–	1,00 (0,12)
		4,A* 0,93	–	1	–1,02 (0,04)	–	4,A 0,95	0,23 (0,09)	0,77 (0,09)	–	0,92 (0,04)
Romania	05.2001	1,A 0,98	–	1	–0,92 (0,01)	–	1,A 0,97	–	1	–0,89 (0,03)	–
		2,A 0,97	–	1	–0,92 (0,01)	–	2,A 0,95	–	1	–0,88 (0,03)	–
		3,A* 0,95	–	1	–0,81 (0,01)	–	3,A 0,76	–	1	–0,71 (0,06)	–
		4,A* 0,98	–	1	–0,95 (0,02)	–	4,A* 0,98	–	1	–0,90 (0,04)	–
Slovakia	04.2000	1,A* 0,92	–	1	–1,25 (0,04)	–	1,A* 0,92	–	1	–1,25 (0,04)	–
		2,A* 0,81	–	1	–1,33 (0,07)	–	2,A* 0,81	–	1	–1,32 (0,06)	–
		3,A 0,87	–	1	–1,15 (0,06)	–	3,A 0,83	–	1	–1,09 (0,04)	–
		4,A* 0,97	0,16 (0,03)	0,84 (0,03)	–1,28 (0,04)	–	4,A* 0,95	0,09 (0,04)	0,91 (0,04)	–1,20 (0,04)	–

	Start of the individual sample	Common sample (Nov 2002–May 2007)					Individual sample				
		Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1-\alpha_2$)	α_3	α_4	Expectations' measure, equation version[2], R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness ($1-\alpha_2$)	α_3	α_4
Slovenia	03.1996	1,A 0,95	–	1	–1,00 (0,09)	0,30 (0,12)	1,S* 0,88	–	1		
		2,A 0,95	–	1	–1,01 (0,08)	0,32 (0,12)	2,S* 0,86	–	1		
		3,A* 0,92	–	1	–0,69 (0,07)	0,38 (0,17)	3,S* 0,75	–	1		
		4,A* 0,97	–	1	–1,10 (0,10)	0,21 (0,12)	4,S* 0,95	–	1		
Spain	06.1986	1,S* 0,84	–	1			1,A* 0,70	0,47 (0,24)	0,53 (0,24)	–	0,90 (0,18)
		2,S* 0,84	–	1			2,A* 0,71	0,45 (0,23)	0,55 (0,23)	–	0,87 (0,16)
		3,A* 0,44	–	1	–0,78 (0,07)	–	3,A 0,58	–	1	–	0,75 (0,08)
		4,S* 0,85	–	1			4,A* 0,71	0,46 (0,24)	0,54 (0,24)	–	0,89 (0,17)
Sweden	10.1995	1,A* 0,99	–	1	–0,96 (0,01)	–	1,A* 0,96	–	1	–0,92 (0,04)	–
		2,A* 0,99	–	1	–0,95 (0,02)	–	2,A* 0,95	–	1	–0,81 (0,04)	–
		3,– –	–	–	–	–	3,– –	–	–	–	–
		4,A* 0,99	0,09 (0,02)	0,91 (0,02)	–0,85 (0,02)	–	4,A* 0,92	0,18 (0,06)	0,82 (0,06)	–0,76 (0,04)	–
United Kingdom	01.1985	1,S* 0,71	0,27 (0,07)	0,73 (0,07)			1,A* 0,95	–	1	–1,06 (0,03)	–
		2,S* 0,68	0,27 (0,07)	0,73 (0,07)			2,A 0,89	–	1	–	1,11 (0,07)
		3,A* 0,50	0,23 (0,12)	0,77 (0,12)	–0,54 (0,09)	–	3,S* 0,91	–	1		
		4,S* 0,68	0,31 (0,06)	0,69 (0,06)			4,A* 0,96	–	1	–1,03 (0,03)	–

Notes: [1] Estimation technique: following the usual method, actual future inflation is used as a measure of rational expectations. As a consequence, the error term of the estimated equation includes the expectations error of rational expectations (see Fair (1993)). Therefore, the two-stage least squares method (2SLS) is used to estimate both versions of the test equation with constant and 12 lags of current inflation being the instruments (in line with Gerberding (2001)). [2] "A" denotes that the estimated equation is consistent with the specification in equation (21), while "S" denotes the alternative version of the test equation (22). Symbol "*" denotes the use of a constant in the estimated equation.

Source: Author's calculations.

The estimation results show the small importance of the forward-looking mechanism in the formation of consumer inflation expectations in Europe, which seems consistent with the results of other studies (eg Gerberding (2001)). The average weight of forward-looking factors is lower than 10% both in the common sample and individual sample periods. Taking into consideration the years 2002–2007, the highest fraction of consumers forming expectations rationally are in Italy (approximately 40%), the Netherlands (approximately 35%) and the United Kingdom (approximately 27%). The positive weight of forward-looking behaviour is also observed in Ireland and Latvia (approximately 25%), in the Czech Republic, the euro area, Finland and Poland (approximately 15%), as well as in Austria, Belgium,

Bulgaria, Cyprus, Denmark, Lithuania, Slovakia and Sweden. In the remaining countries, consumer inflation expectations are fully backward-looking (either adaptive or static[5]).

In the case of some economies with relatively longer samples of observations available, the weight of forward- vs backward-looking behaviour can vary with time. For example, Italian consumers, whose expectations are characterised by the highest forward-lookingness in 2002–2007, seem to be fully backward-looking when the full individual sample (1985–2007) is considered. Similar differences may be observed in other economies: Belgium, the euro area and the United Kingdom. It suggests that there was an increase in the forward-lookingness of inflation expectations formed by consumers, which confirms the results of other studies (eg Forsells and Kenny (2004)). However, there was a concurrent increase in the backward-lookingness of consumer expectations in some economies, ie in France, Portugal and Spain.

To compare the results obtained using consumer inflation expectation measures developed in this paper with Gerberding's (2001) assessment of the forward-lookingness of consumer inflation expectations in France and Italy in 1991–1999, based on an analogous methodology, equations (21) and (22) were estimated using the same sample period.[6] A fraction of backward-looking consumers in both tests is similar – according to Gerberding, it amounts to 0.30 and 1.00 respectively, while calculations using the quantified measures presented in this paper lead to estimates of 0.43 and 1.00.

4.2 Impact of subjective opinions about past price changes on predicted price changes

The impact of survey opinions about past price changes on the survey views about future price changes may be treated as another proxy for the degree of backward-lookingness of the inflation expectations. Such an approach avoids the problems caused by quantification methods, which automatically impose a certain degree of backward-lookingness on the resulting series of inflation expectations.

To assess the impact of subjective opinions about past price changes on predicted price changes, correlations of respective balance statistics of perceived and expected inflation (BS_1^p-BS_1^e, BS_2^p-BS_2^e, BS_3^p-BS_3^e and BS_4^p-BS_4^e) were calculated both in full individual samples and in the common sample. Figure 6 presents the correlation coefficients for all the pairs of balance statistics of perceived and expected inflation, while Table 8 provides the detailed results of the calculations.

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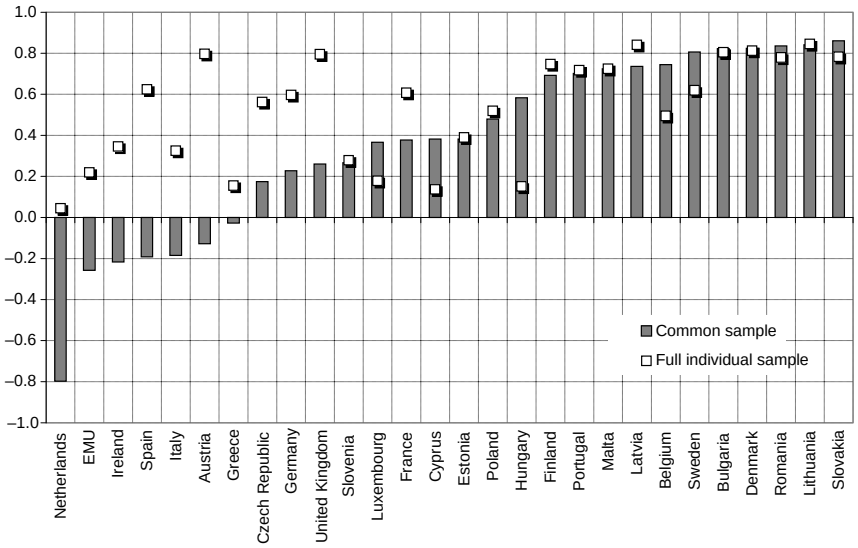
5 As far as the backward-looking component of inflation expectations is concerned, its adaptive form is more frequent than its static one. In a number of cases in which the static version of the test equation was finally chosen, its adaptive version's estimation results were also satisfactory, but were characterised by a slightly smaller degree of fit. However, the assessment of the degree of forward- and backward-lookingness in both types of equations was similar.

6 Germany was not taken into account due to the fact that the quantified measures of inflation expectations used in this study start in 1992.

Figure 6

Correlation of balance statistics of perceived and expected inflation (average for all pairs of balance statistics)



Source: Author's calculations.

Taking into account the average correlations, in a vast majority of countries under consideration the correlation of consumer opinions about past and future inflation is positive. Contrary to the assessment based on quantified measures of inflation expectations, being approximately the same in the common sample period (2002–2007) and in the individual sample period, the average correlation of balance statistics is significantly higher in the former period (0.53) than in the latter (0.37). The difference in correlation coefficients is particularly large (0.86 on average) in Austria, the Netherlands and Spain (individual sample periods: 1985–2007 in the case of Austria and the Netherlands; 1986–2007 in the case of Spain). When comparing the results for the common and individual samples there is another interesting observation concerning the signs of the correlation coefficient. Individual sample period correlation coefficients in all the economies are positive, while in the years 2002–2007 consumer opinions concerning past and future price movements are correlated negatively in the Netherlands, the euro area as a whole, Austria, Greece, Italy, Ireland and Spain (although only in the case of the Netherlands and the euro area are they statistically lower than zero, with a 10% significance level).

Individual pairs of balance statistics display different degrees of correlation: it is relatively lower in the case of disaggregated balance statistics BS_3 and BS_4, while relatively larger in the case of balance statistics BS_1 and BS_2, treating respondents declaring a price increase as a homogenous group independently of the fact that the size of the increase in prices they declare differs. With regard to the balance statistics BS_3 and BS_4, it may be observed that in both the common and individual sample periods the correlation of consumer subjective opinions on price changes perceived and expected reaches its lowest (negative) levels in the Netherlands, while the highest are in Bulgaria. Moreover, in many of the old EU member states and the euro area as a whole, the impact of changes in the perception of past price movements on consumer foresights is significantly weaker in 2002–2007 than in individual sample periods.

Table 8

Correlation of balance statistics of perceived and expected inflation

	Start of the individual sample	Common sample (Nov 2002–May 2007)				Full individual sample			
		BS_1	BS_2	BS_3	BS_4	BS_1	BS_2	BS_3	BS_4
Austria	01.1985	-0.04[n]	–0.09[n]	–0.19[n]	–0.19[n]	0.90	0.85	0.71	0.73
Belgium	01.1985	0.65	0.71	0.81	0.81	0.53	0.54	0.46	0.45
Bulgaria	05.2001	0.79	0.84	0.84	0.82	0.73	0.78	0.86	0.85
Cyprus	05.2001	0.43	0.35	0.28	0.47	0.31	0.12[n]	–0.06[n]	0.18[n]
Czech Republic	01.2001	0.26	0.23	0.09[n]	0.12[n]	0.68	0.66	0.44	0.47
Denmark	01.1985	0.89	0.84	0.78	0.79	0.90	0.92	0.73	0.70
EMU	01.1985	–0.10[n]	–0.14[n]	–0.40	–0.39	0.38	0.36	0.07[n]	0.07[n]
Estonia	04.2001	0.53	0.52	0.23	0.25	0.55	0.54	0.24	0.23
Finland	11.1995	0.70	0.70	0.68	0.69	0.83	0.80	0.67	0.69
France	01.1985	0.59	0.59	0.15[n]	0.18[n]	0.78	0.76	0.44	0.45
Germany	01.1985	0.49	0.53	–0.07[n]	–0.04[n]	0.77	0.82	0.40	0.40
Greece	01.1985	0.05[n]	0.05[n]	–0.08[n]	–0.13[n]	0.40	0.38	–0.06[n]	–0.09[n]
Hungary	02.1993	0.53	0.58	0.61	0.61	0.17	0.19	0.12[n]	0.12[n]
Ireland	01.1985	0.09[n]	0.00[n]	–0.49	–0.46	0.34	0.48	0.32	0.25
Italy	01.1985	–0.11[n]	–0.21[n]	–0.24	–0.17[n]	0.53	0.51	0.13	0.13
Latvia	05.2001	0.89	0.91	0.55	0.60	0.92	0.93	0.75	0.77
Lithuania	05.2001	0.93	0.92	0.75	0.77	0.93	0.91	0.76	0.78
Luxembourg	01.2002	0.40	0.42	0.32	0.33	0.14[n]	0.18[n]	0.19[n]	0.20[n]
Malta	11.2002	0.67	0.73	0.76	0.74	0.67	0.73	0.76	0.74
Netherlands	01.1985	–0.71	–0.78	–0.85	–0.85	0.30	0.19	–0.19	–0.12
Poland	05.2001	0.76	0.74	0.19[n]	0.23	0.74	0.71	0.29	0.33
Portugal	06.1986	0.78	0.81	0.63	0.59	0.80	0.87	0.63	0.57
Romania	05.2001	0.88	0.90	0.78	0.78	0.70	0.79	0.81	0.81
Slovakia	04.2000	0.91	0.91	0.81	0.81	0.89	0.89	0.67	0.68
Slovenia	03.1996	0.41	0.47	0.09[n]	0.10[n]	0.07[n]	0.41	0.44	0.19
Spain	06.1986	–0.16[n]	–0.11[n]	–0.24	–0.26	0.55	0.57	0.71	0.67
Sweden	10.1995	0.88	0.81	0.77	0.77	0.69	0.70	0.52	0.56
United Kingdom	01.1985	0.61	0.16[n]	0.15[n]	0.12[n]	0.87	0.82	0.74	0.75
Average		***0.46***	***0.44***	***0.28***	***0.29***	***0.61***	***0.62***	***0.45***	***0.45***
Minimum		*–0.71*	*–0.78*	*–0.85*	*–0.85*	*0.07*	*0.12*	*–0.19*	*–0.12*
Maximum		*0.93*	*0.92*	*0.84*	*0.82*	*0.93*	*0.93*	*0.86*	*0.85*

Notes: Symbol [n] denotes correlation coefficients not significant with a 10% significance level.

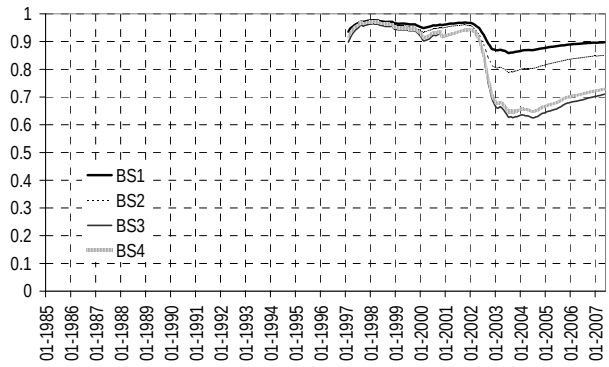
Source: Author's calculations based on EC survey data.

An analysis of dynamic correlation indices calculated with a gradually widened sample (Figure 7) indicates a significant change in the relationship between the opinions about past and future price changes after the launch of the euro in January 2002. In the economies forming the EMU, there was a fall in the correlation coefficients between survey responses to the question on inflation perception and expectations. In the remaining economies of the European Union, such an effect did not appear.

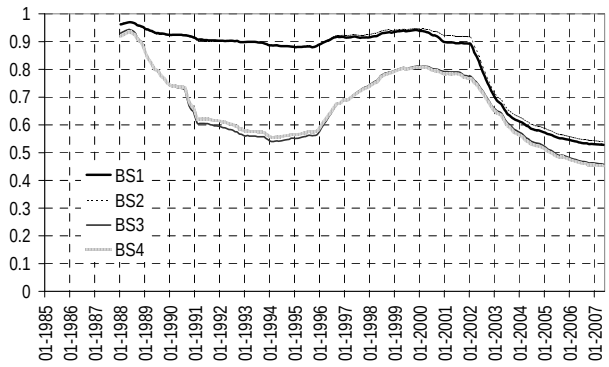
Figure 7

Dynamic correlations of balance statistics of perceived and expected inflation

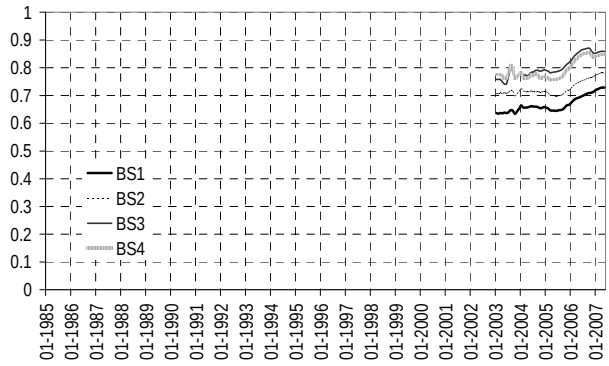
Austria



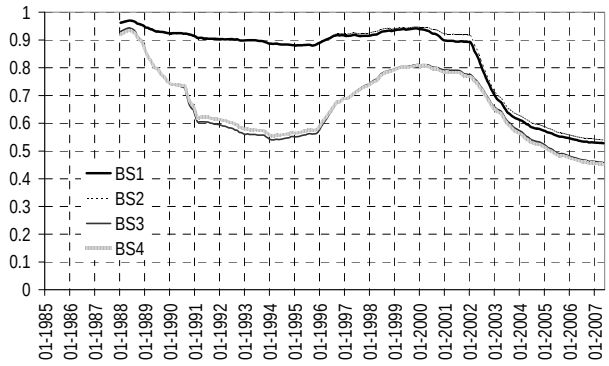
Belgium



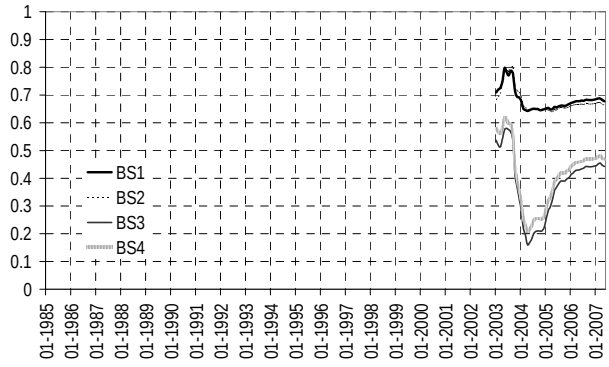
Bulgaria



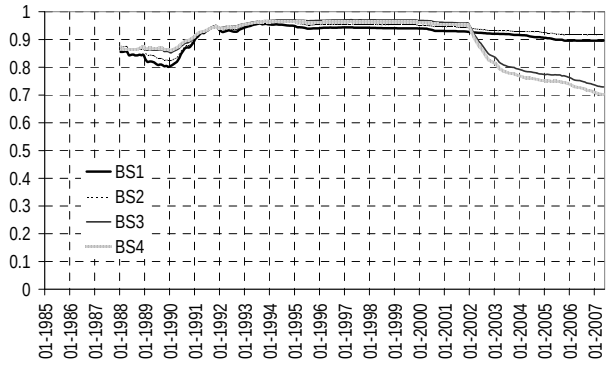
Cyprus



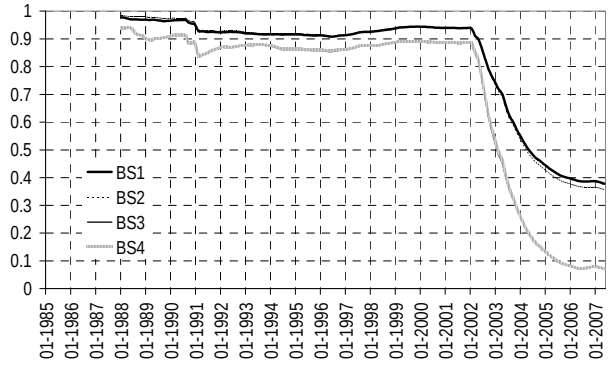
Czech Republic



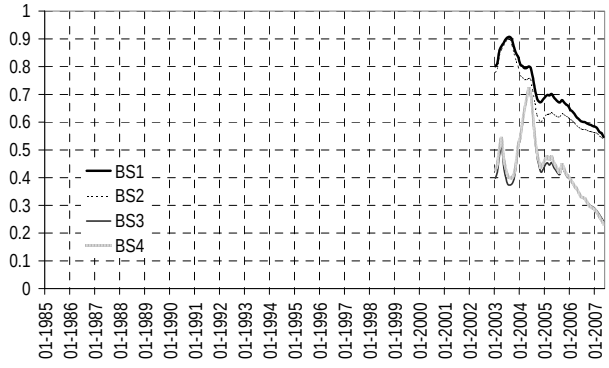
Denmark



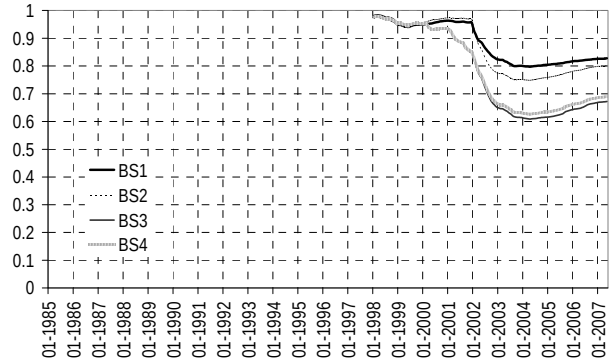
EMU



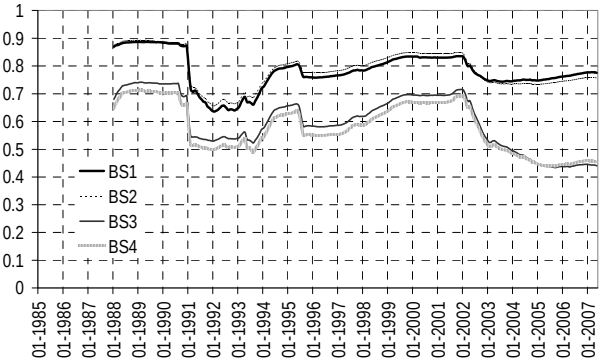
Estonia



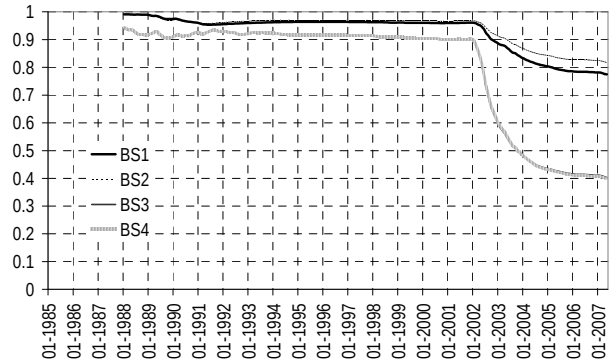
Finland



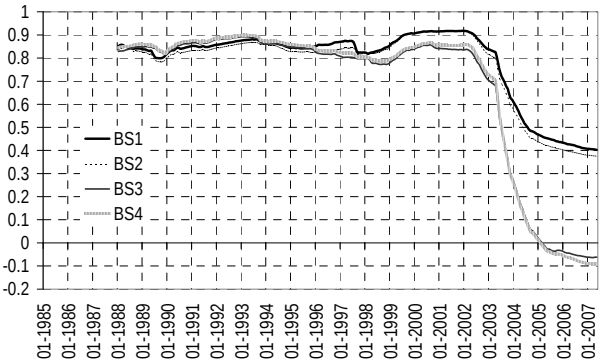
France



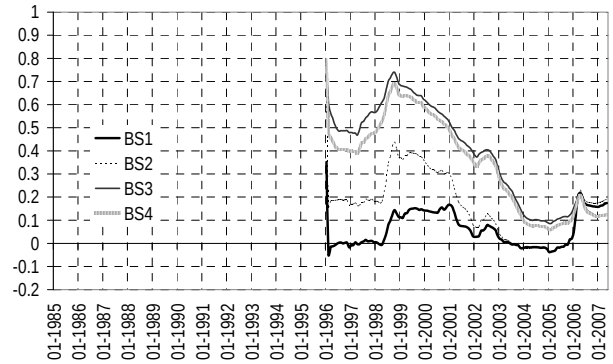
Germany



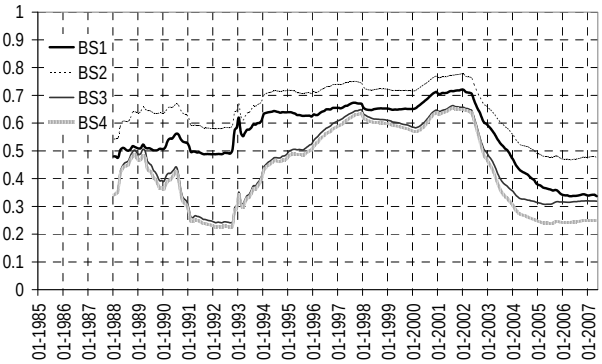
Greece



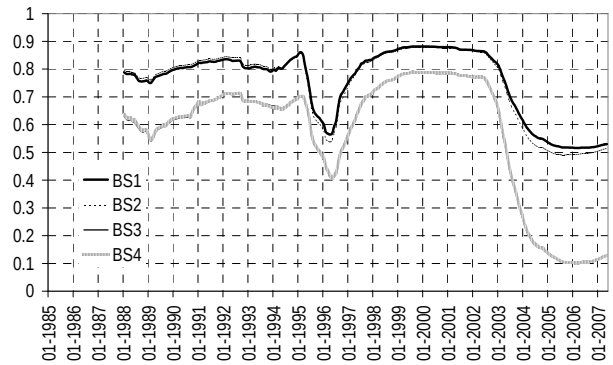
Hungary



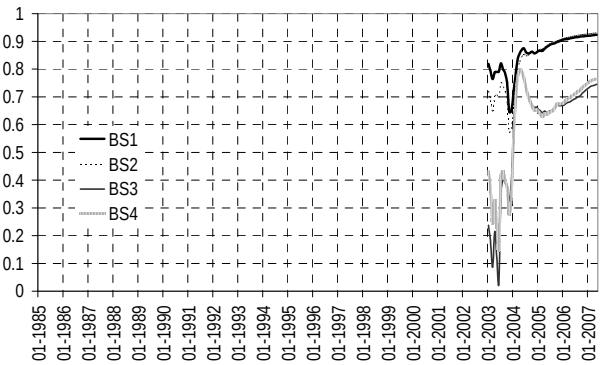
Ireland



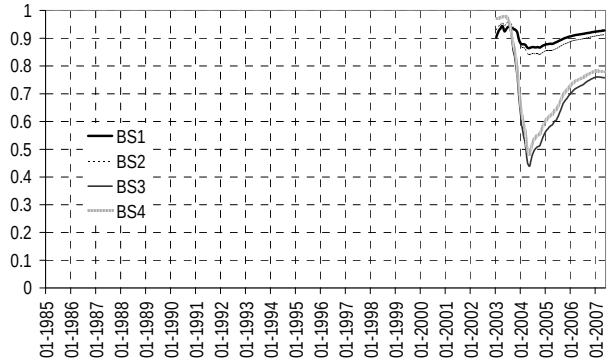
Italy



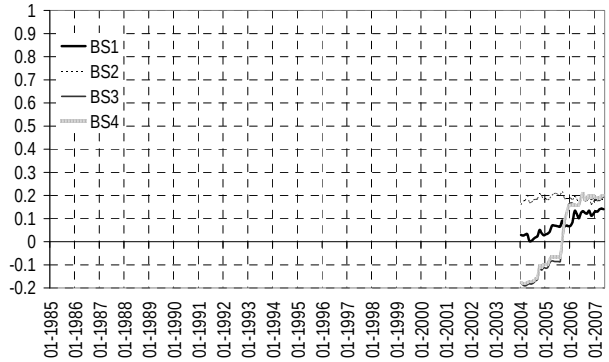
Latvia



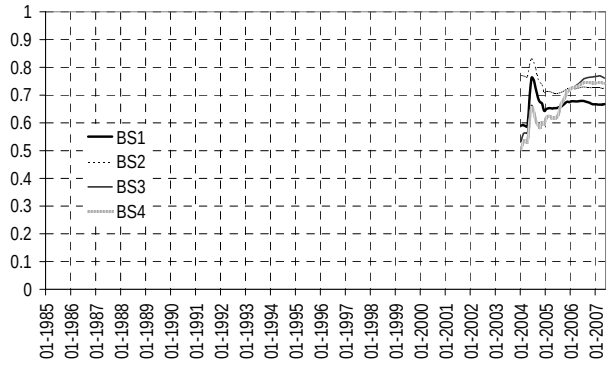
Lithuania



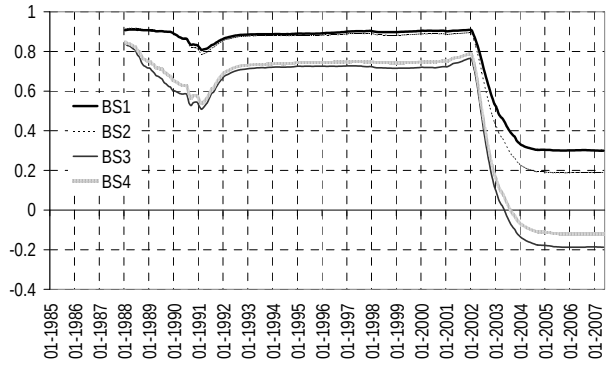
Luxembourg



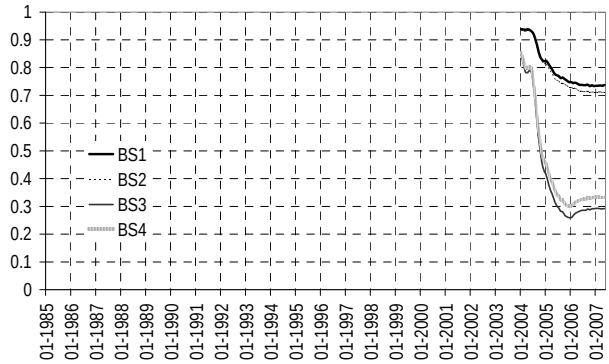
Malta



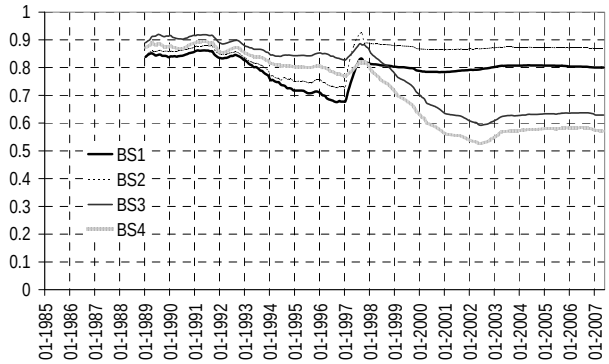
Netherlands



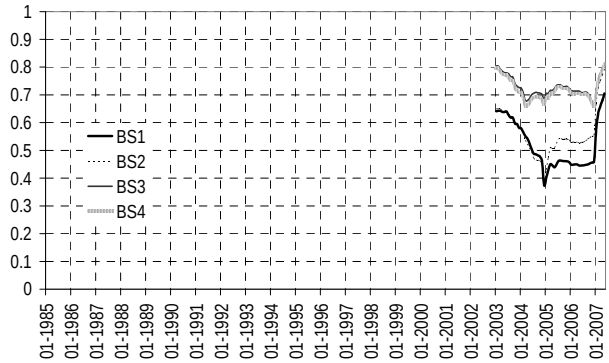
Poland



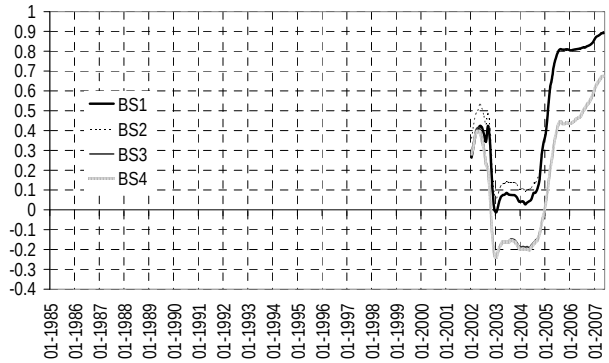
Portugal



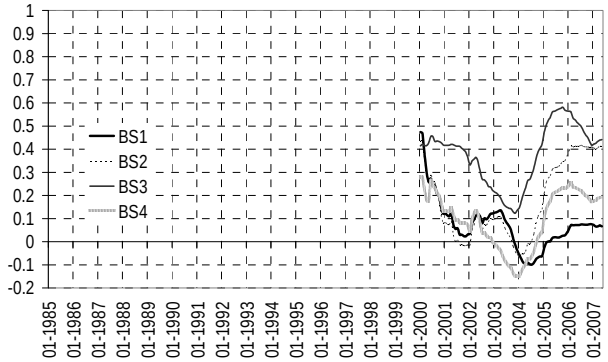
Romania



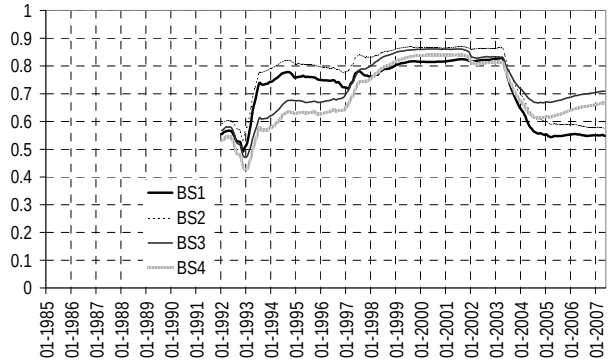
Slovakia



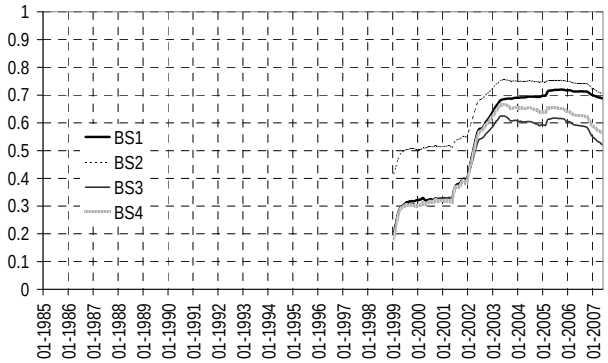
Slovenia



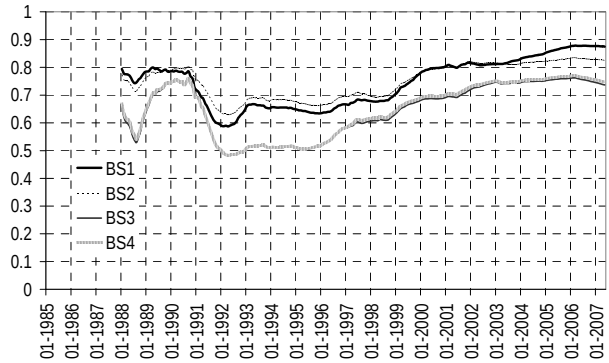
Spain



Sweden



United Kingdom



Source: Author's calculations on the basis of EC survey data.

The introduction of euro banknotes and coins was an important factor affecting consumer views on both past and future price changes. On the one hand, there was an increase of subjectively perceived price dynamics, with statistical inflation measures relatively stable;[7] on the other hand, there was an improvement in consumer expectations of future price movements (Figure 8).

The highest impact of the euro's introduction on consumer inflation perception was noted in Germany and the Netherlands, whereas the lowest was seen in Belgium. The persistence of the euro effect on perceived price changes, measured with changes in balance statistics in 2002–2006,[8] seems to be highest in Austria, France and Greece and lowest in the Netherlands, Germany and Ireland, where the distribution of responses to the survey question on inflation perception in 2006 was even better than in 2001, ie prior to the launch of the euro. It should be noted, however, that the persistence of the inflation perception gap seems sizeably smaller while using quantified measures of inflation perception instead of balance statistics (Figure 9).[9]

[7] See: Łyziak (2009), pp 101–2.

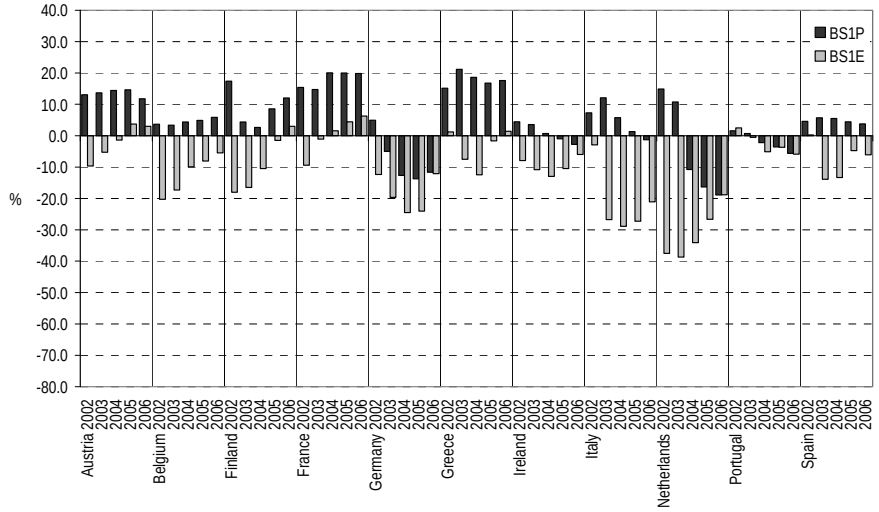
[8] Balance statistics BS_3 and BS_4 have a relatively higher weight due to their richer information content. An assessment of the persistence of the euro effect on consumer perception of price changes relies on two indicators, ie a difference between the average level of a given balance statistic in the years 2002–2006 and 2001, and a difference between the average level of a given balance statistic in 2006 and 2001.

[9] For example, Dias et al (2007).

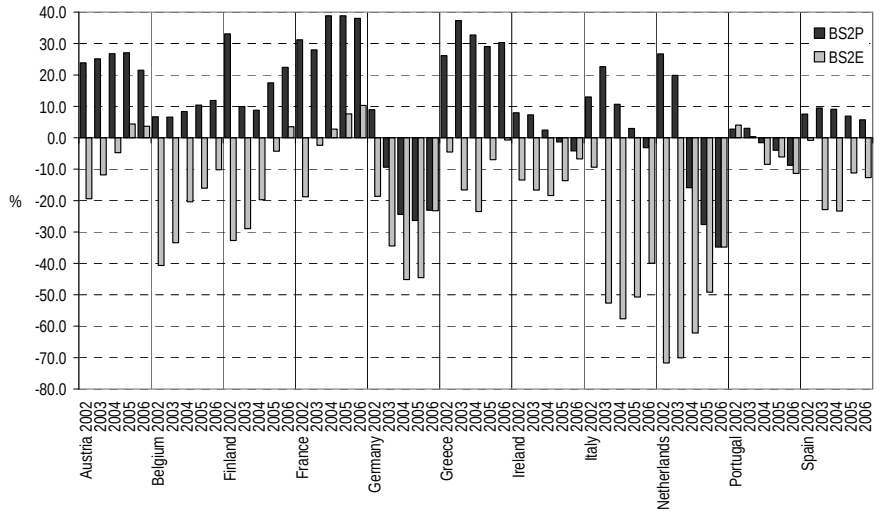
Figure 8

Changes in balance statistics of perceived and expected inflation relative to 2001 average in countries launching the euro in 2002†

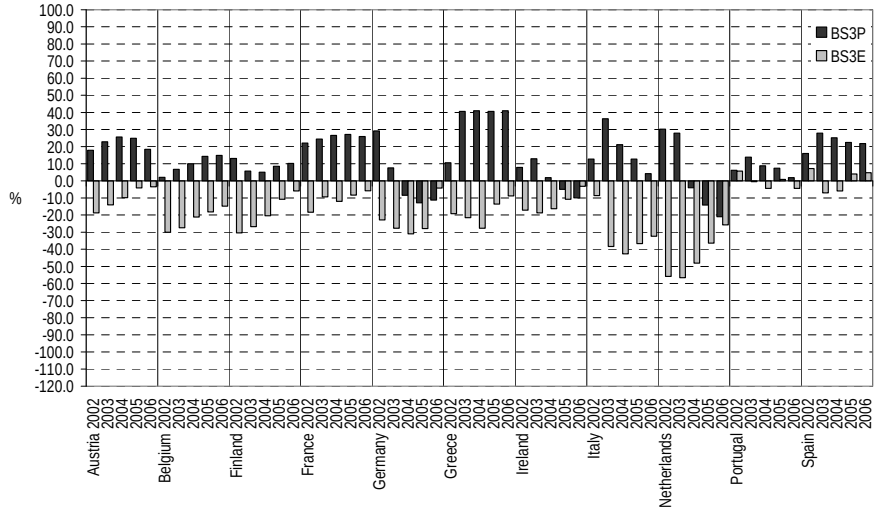
Balance statistics BS_1^p and BS_1^e



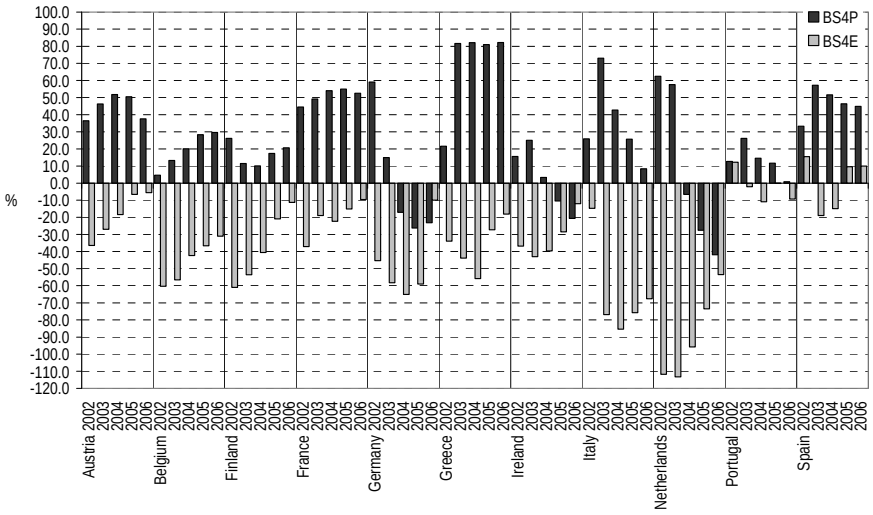
Balance statistics BS_2^p and BS_2^e



Balance statistics BS_3^p and BS_3^e



Balance statistics BS_4^p and BS_4^e

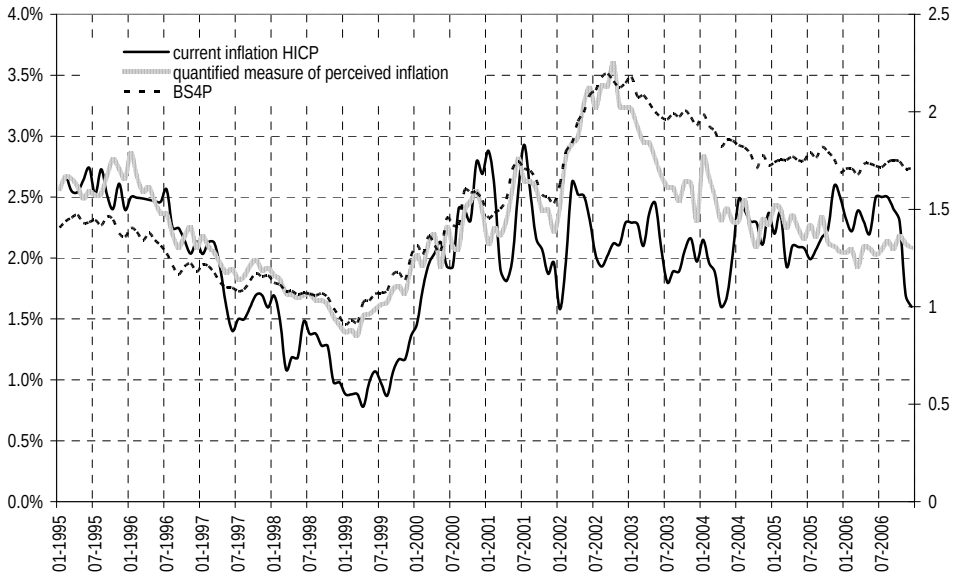


† Luxembourg not considered due to a lack of survey data for 2001.

Source: Author's calculations on the basis of EC survey data.

Figure 9

Inflation perception gap – two survey measures of perceived inflation vs HICP inflation



Source: Author's calculations on the basis of EC survey data and IFS data.

The impact of the euro's introduction on consumer inflation perception is widely discussed in the literature,[10] while there is almost no discussion of its impact on inflation expectations.

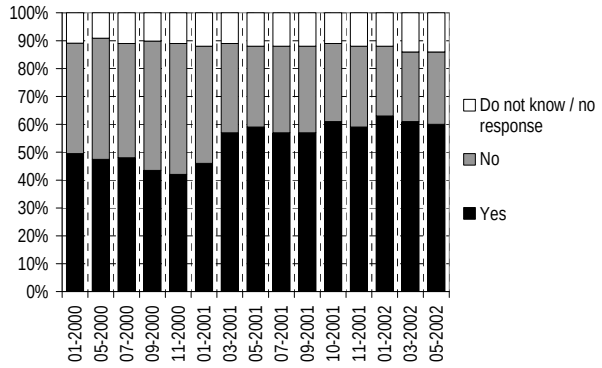
[10] There are different explanations for the inflation perception gap after the euro's introduction. Many studies point out the sizeable increase in prices of frequently bought products and services (eg Dziuda and Mastrobuoni (2006), Álvarez González et al (2004), Fluch and Stix (2006), ECB (2003)) and the discussion on that effect in the mass media (Del Giovane and Sabbatini (2004, 2005)). There are also some psychological factors to be considered, such as: recalculating the prices to former domestic currencies and rounding effects;

Despite increased inflation perception, expectations that the euro would contribute to price stability were very strong even before the euro's introduction. The EOS Gallup Europe survey data (Eurobarometer) show that in 2000–2002 the percentage of individuals in the euro area sharing that opinion was high and rising – from approximately 46% in 2000 to more than 60% in 2002 (Figure 10). In November 2001, ie two months before the introduction of the euro banknotes and coins, consumers in Belgium and Ireland were the most convinced that the euro would contribute to price stability, while relatively low percentages of individuals shared this view in Finland, Germany and the Netherlands. After the launch of the euro, consumers in many of the EMU economies became more optimistic about future price changes. For example, the balance statistics of price expectations by Dutch consumers – whose perception of price changes was most affected by the launch of the common currency – decreased in 2002 to the highest extent among euro area economies. An improvement in price change predictions in 2002 was similarly strong in Belgium and Finland. On the other hand, there was a worsening of survey responses to the question on inflation expectations in Portugal and Spain. As far as long-term effects are concerned, a decrease in the balance statistics of inflation expectations in the years 2002–2006 was greatest in Italy and the Netherlands.

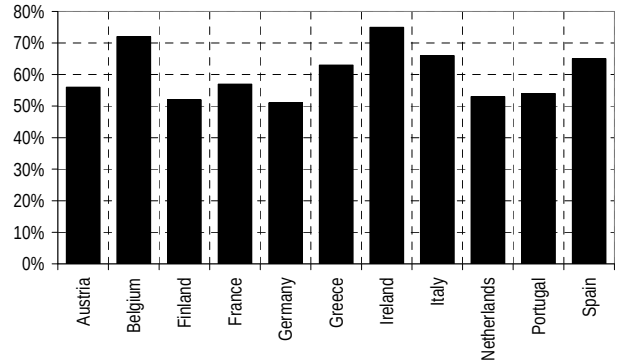
Figure 10

Opinions of the public on the impact of the euro's introduction on price stability

Survey responses in the euro area, 2000–2002



Fraction of respondents declaring that the euro will contribute to price stability, November 2001



Notes: Survey question: "Do you think that the euro will contribute to price stability in the euro zone countries?"

Sources: EOS Gallup Europe (2001), Table 15; EOS Gallup Europe (2002), Table 18, see: http://ec.europa.eu/public_opinion/flash

5. Conclusions

This paper develops the different measures of European consumer inflation expectations quantified on the basis of qualitative survey data with different quantification schemes, ie with the probability method, the regression method and the logistic (and linear) function method. It then assesses the differences between those measures and tests the formation process of consumer expectations.

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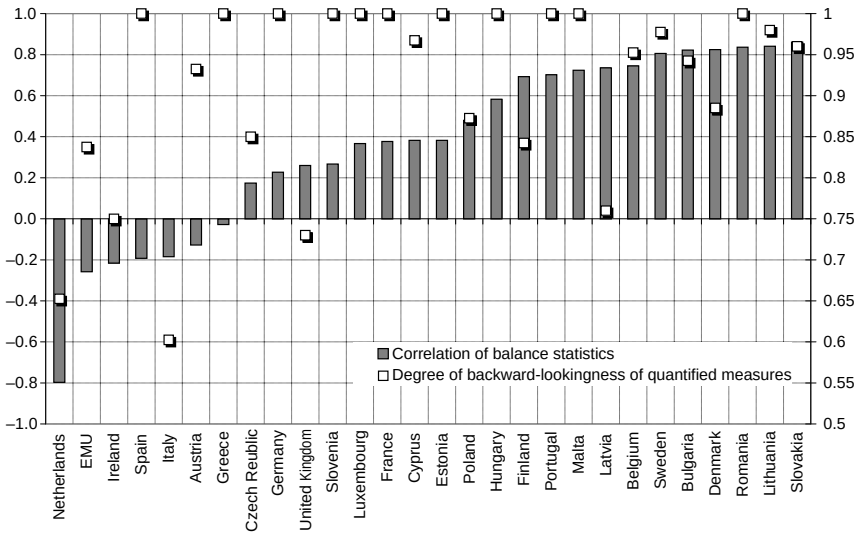
price increases being perceived by consumers more strongly than price reductions (Fluch and Stix (2005), Kurri (2006)); or the effect of expectancy confirmation in spite of the disconfirming evidence (Stix (2006)).

All the quantified measures of consumer inflation expectations seem highly correlated with each other; therefore, even in economies where uncertainty concerning the exact level of inflation expected by consumers is elevated, all the proxies follow similar trends.

As far as the formation of consumer inflation expectations is concerned, the results of empirical tests – conducted both with quantified measures of inflation expectations and balance statistics – show that, in general, the weight of the forward-looking mechanism is rather small, although in some euro area economies and the euro area as a whole an increase in the forward-lookingness of expectations may be observed following the introduction of the common currency. An analysis of the detailed results is, to some extent, dependent on the method chosen. From the perspective of individual countries, the results based on an estimation of the weight of a backward- vs forward-looking mechanism in the formation of expectations does not fully correspond to the assessment based on a correlation of the balance statistics (Figure 11). However, after dividing the economies under consideration into groups, in which the correlation of balance statistics of perceived and expected inflation is negative, statistically insignificant, positive (statistically higher than zero, but lower than 0.75) and strongly positive (higher than 0.75), it occurs that those groups display a simultaneous increase in the weight of the backward-looking mechanism in inflation expectation formation estimated on the basis of the probability measures of expectations (Table 9).

Figure 11

Correlation of balance statistics of perceived and expected inflation vs a degree of backward-lookingness of quantified measures of inflation expectations, common sample



Source: Author's calculations.

Therefore, by combining the results of both empirical approaches, consumers in the Netherlands and the euro area as a whole seem to be the least backward-looking, whereas consumers in Austria, the Czech Republic, Greece, Ireland, Italy and Spain form inflation expectations in a slightly more backward-looking manner. There is a medium level of backward-lookingness of inflation expectations in Belgium, Cyprus, Estonia, Finland, France, Germany, Hungary, Latvia, Luxembourg, Malta, Poland, Portugal, Slovenia and the United Kingdom, and a high level of backward-lookingness in consumer inflation expectations in Bulgaria, Denmark, Lithuania, Romania, Slovakia and Sweden.

Table 9

Correlation of balance statistics of perceived and expected inflation vs a degree of backward-lookingness of quantified measures of inflation expectations in selected groups of EU economies, common sample

Economies in which the correlation of balance statistics of perceived and expected inflation is:	Average correlation of balance statistics	Average weight of backward-looking expectations
▪ Negative (Netherlands, EMU)	–0.53	0.75
▪ Insignificantly different from zero (Austria, Czech Republic, Germany, Greece, Ireland, Italy, Spain)	–0.10	0.86
▪ Positive (Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Hungary, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, United Kingdom)	0.60	0.94
· *Lower than 0.75 (Belgium, Cyprus, Estonia, Finland, France, Hungary, Latvia, Luxembourg, Malta, Poland, Portugal, Slovenia, United Kingdom)*	*0.49*	*0.94*
· *Higher than 0.75 (Bulgaria, Denmark, Lithuania, Romania, Slovakia, Sweden)*	*0.83*	*0.96*

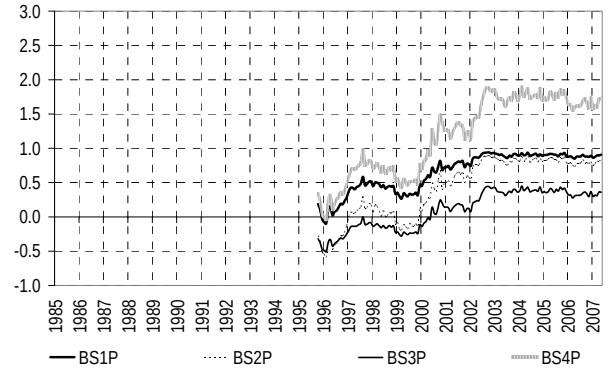
Source: Author's calculations.

Annex A

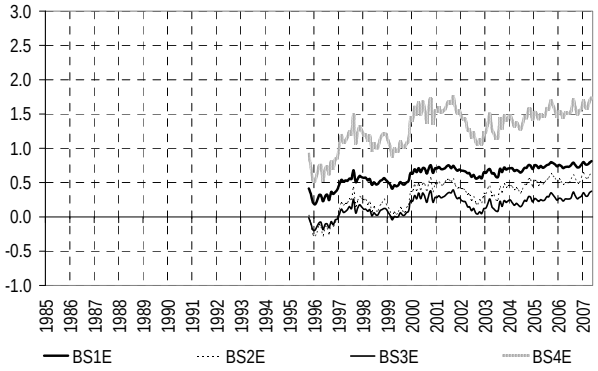
Figure A1

Balance statistics of inflation perception and expectations

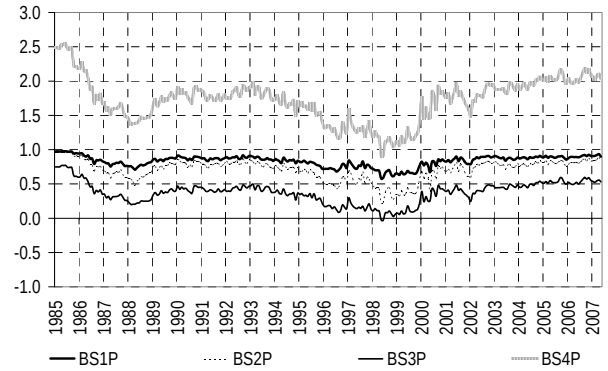
Austria – perception



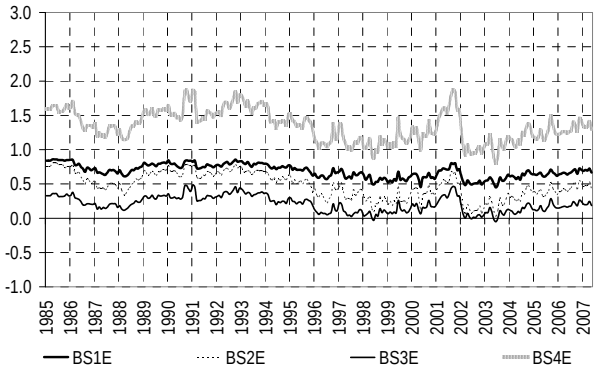
Austria – expectations



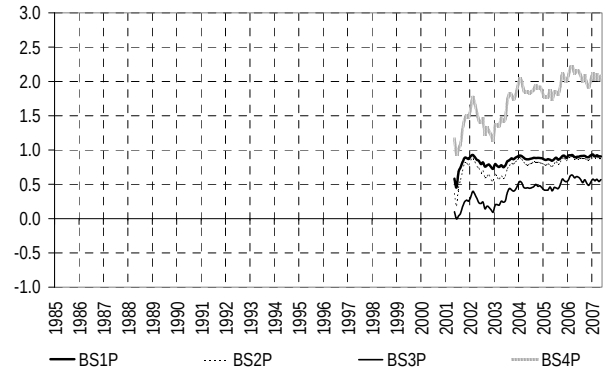
Belgium – perception



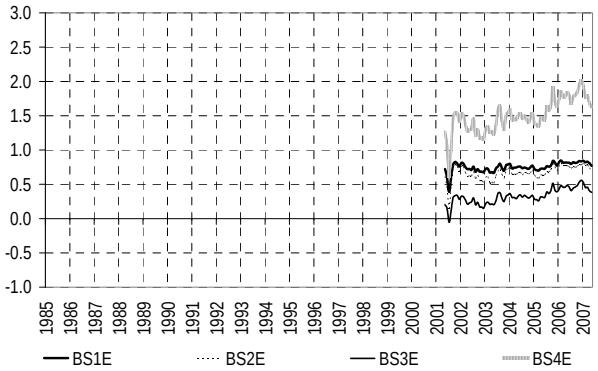
Belgium – expectations



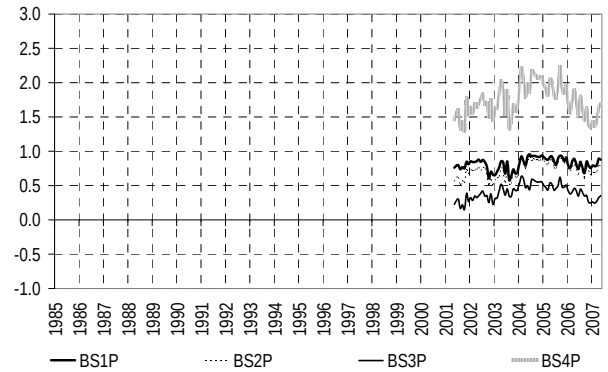
Bulgaria – perception



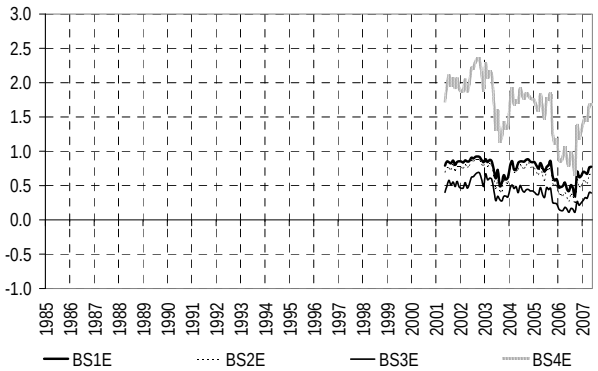
Bulgaria – expectations



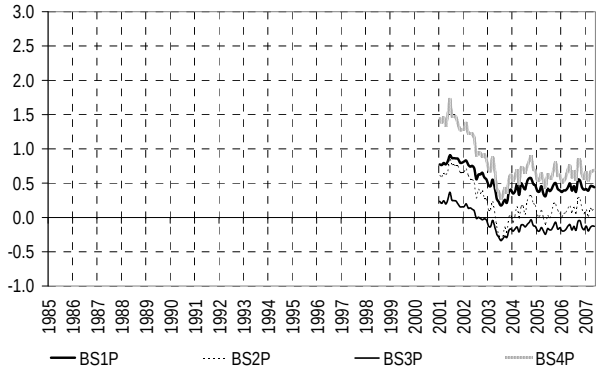
Cyprus – perception



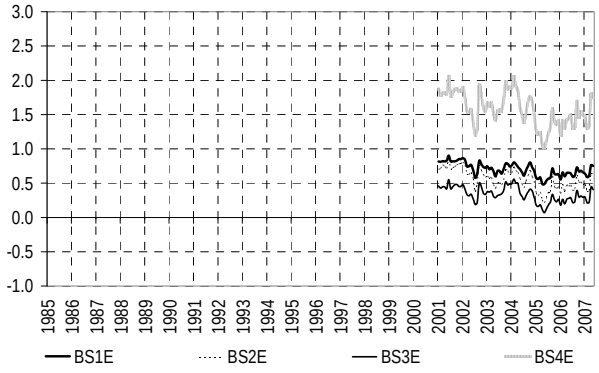
Cyprus – expectations



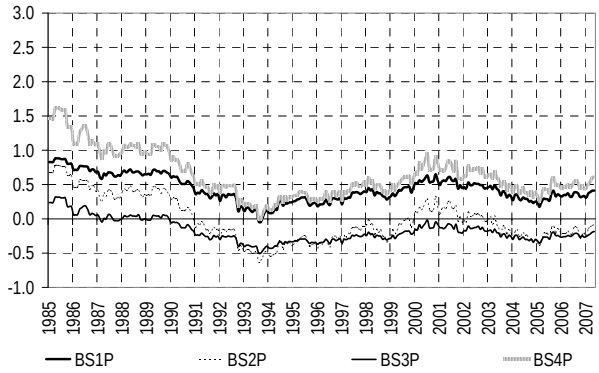
Czech Republic – perception



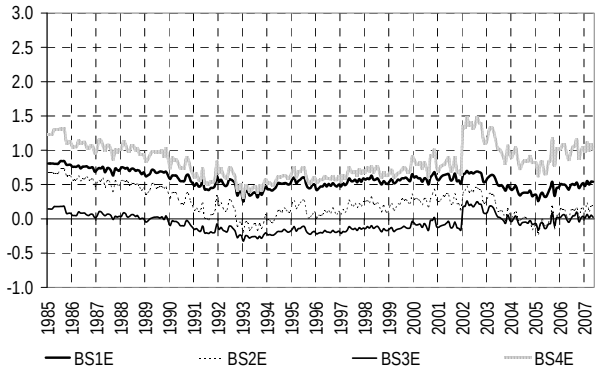
Czech Republic – expectations



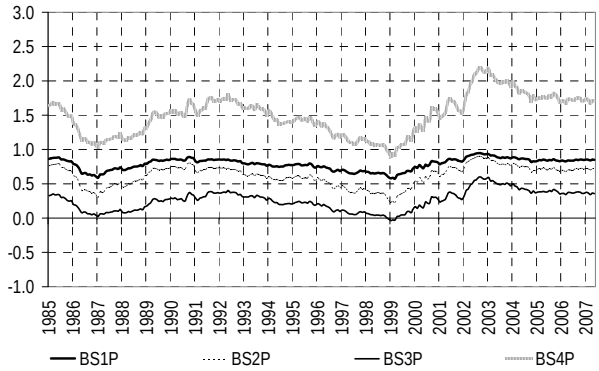
Denmark – perception



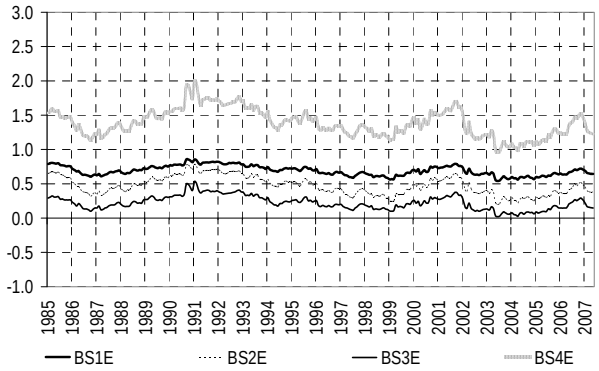
Denmark – expectations



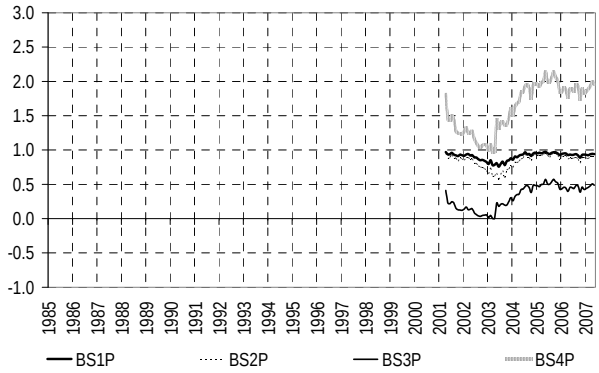
EMU – perception



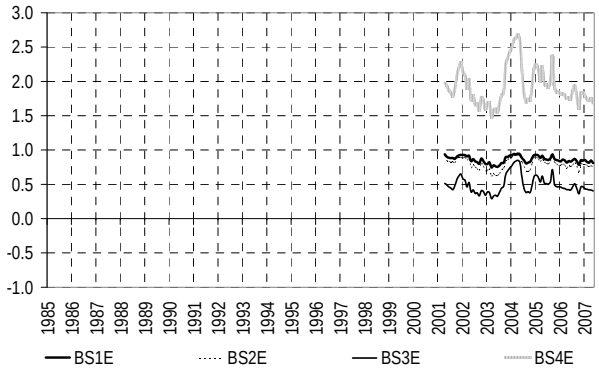
EMU – expectations



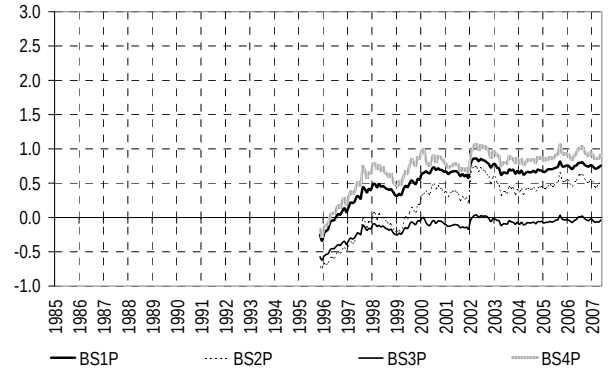
Estonia – perception



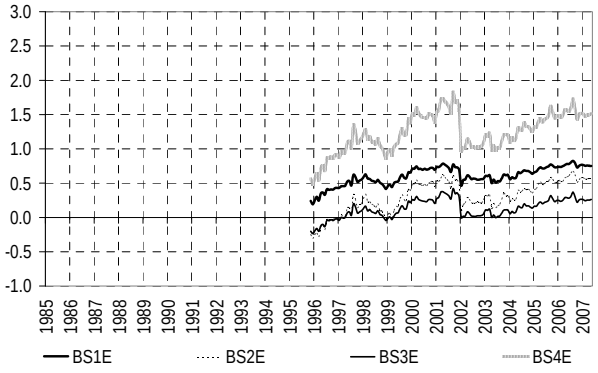
Estonia – expectations



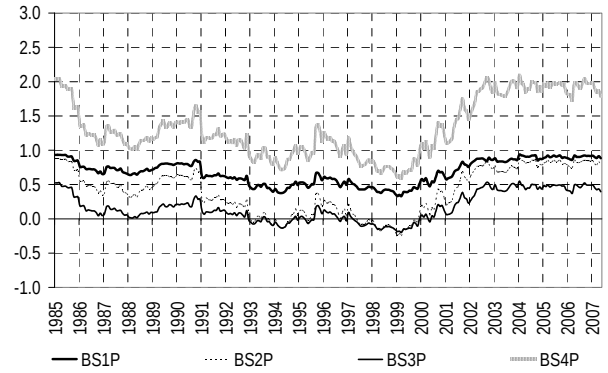
Finland – perception



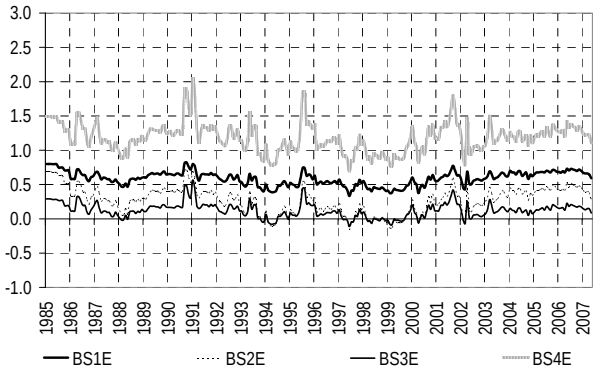
Finland – expectations



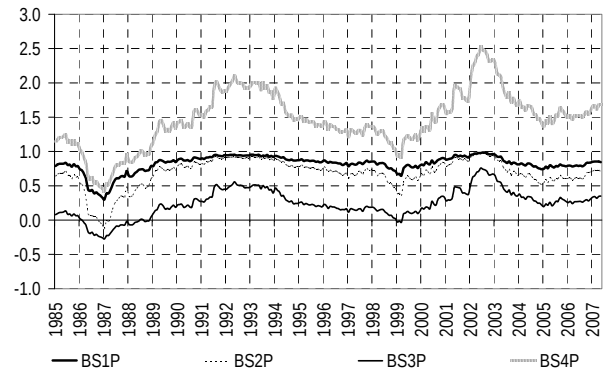
France – perception



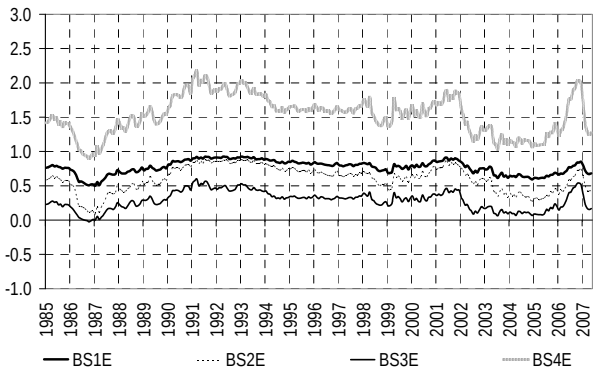
France – expectations



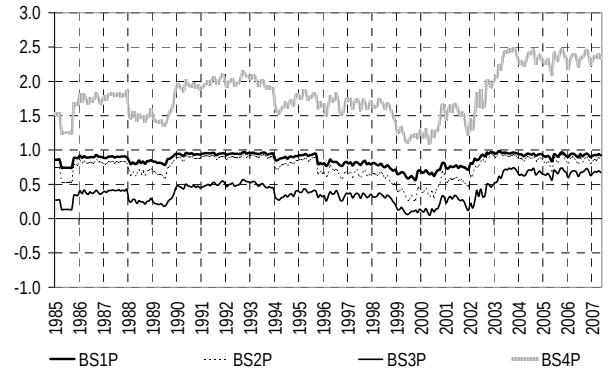
Germany – perception



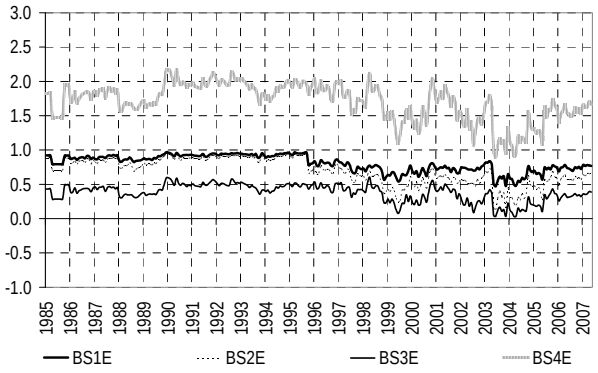
Germany – expectations



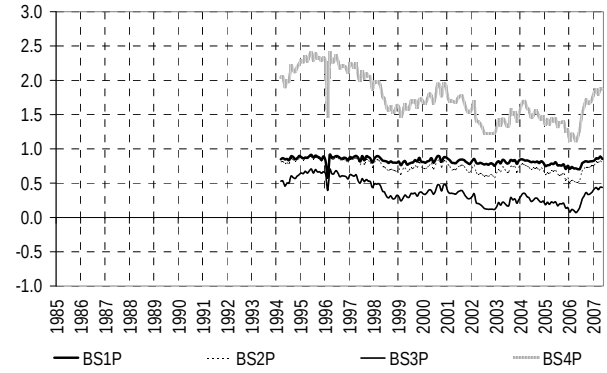
Greece – perception



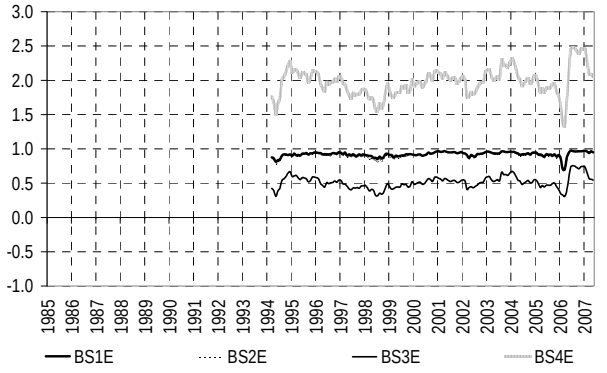
Greece – expectations



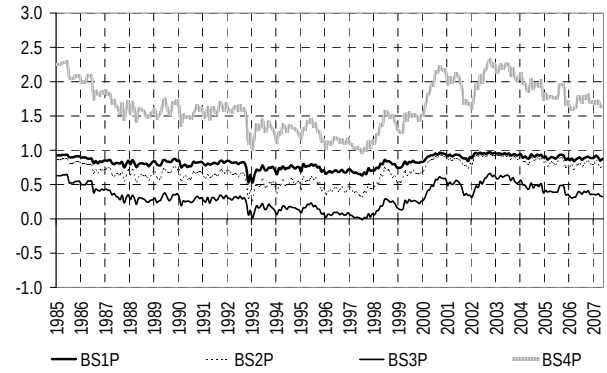
Hungary – perception



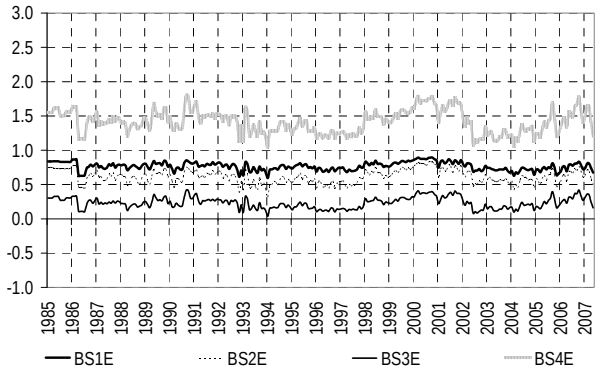
Hungary – expectations



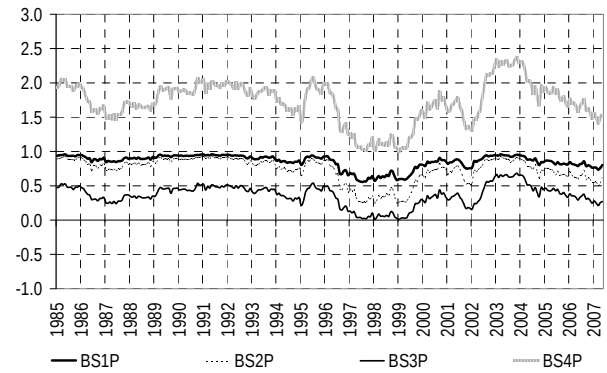
Ireland – perception



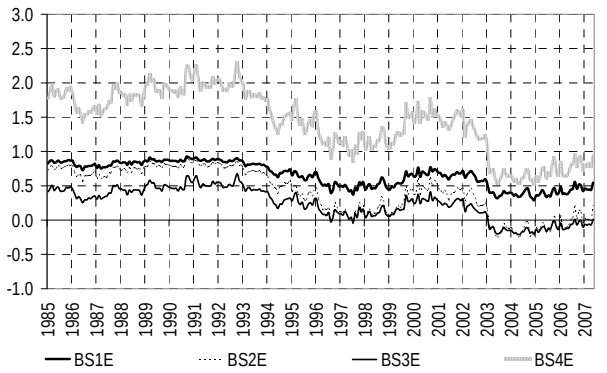
Ireland – expectations



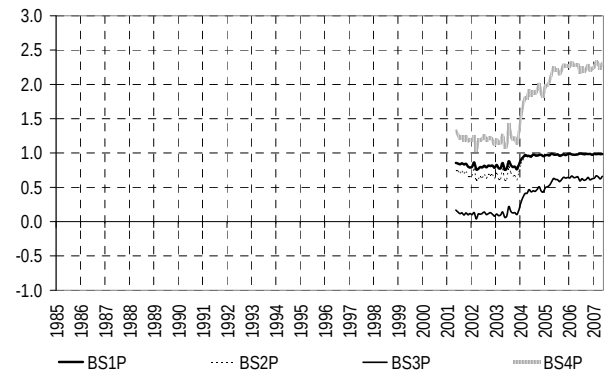
Italy – perception



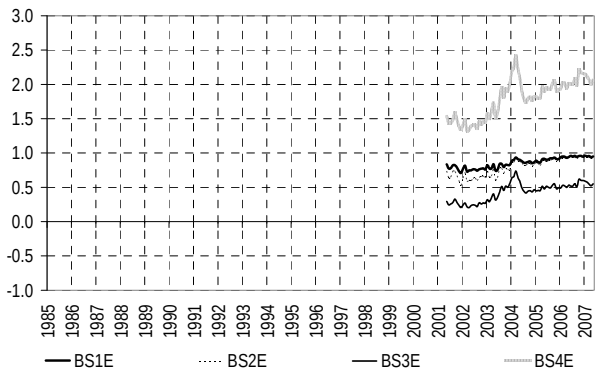
Italy – expectations



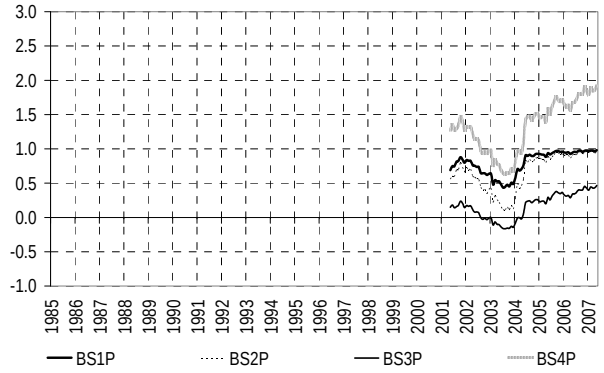
Latvia – perception



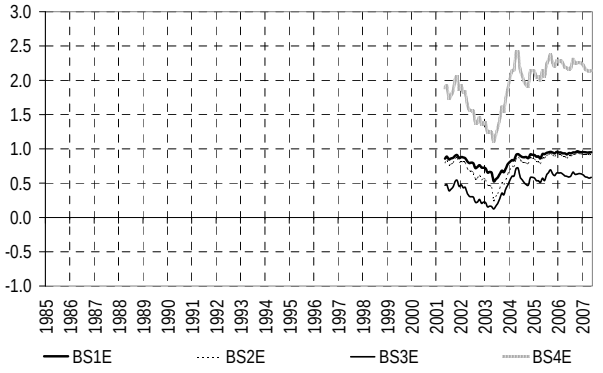
Latvia – expectations



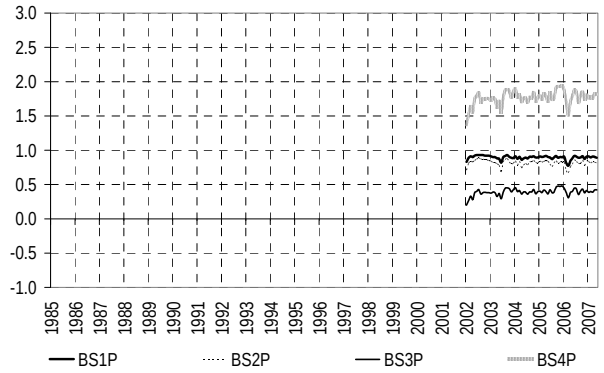
Lithuania – perception



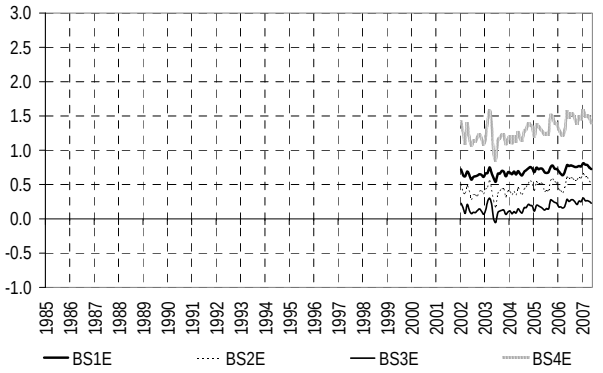
Lithuania – expectations



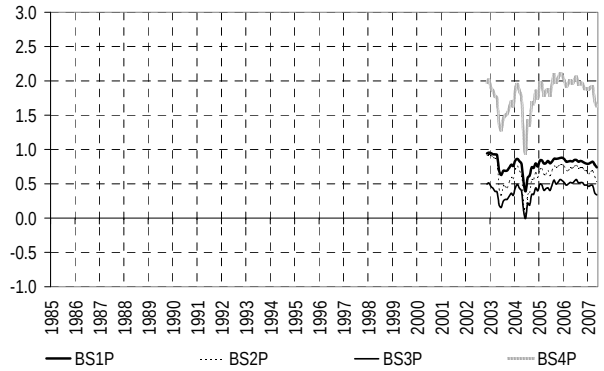
Luxembourg – perception



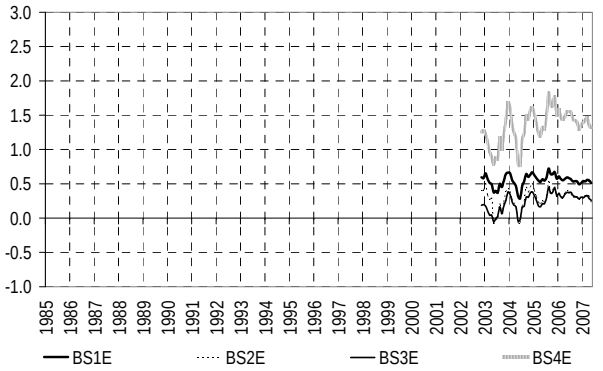
Luxembourg – expectations



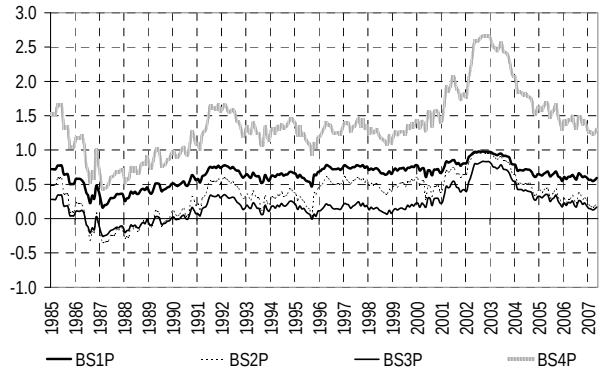
Malta – perception



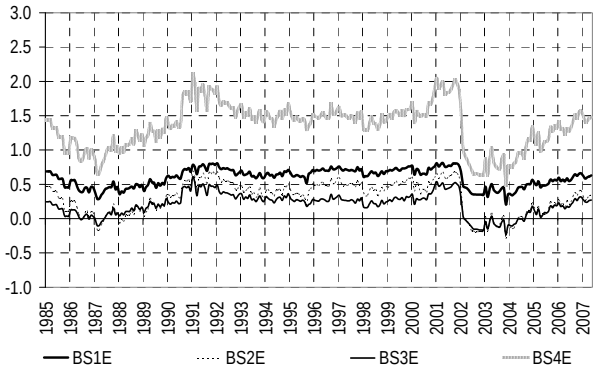
Malta – expectations



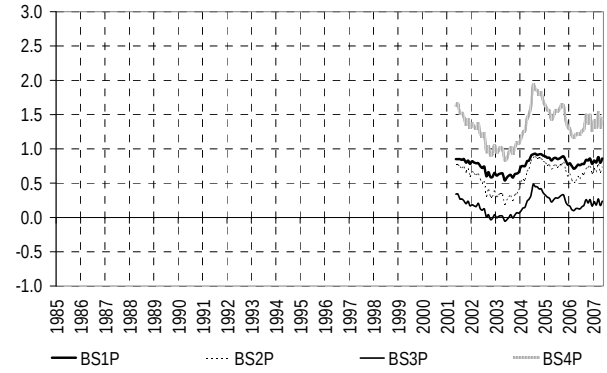
Netherlands – perception



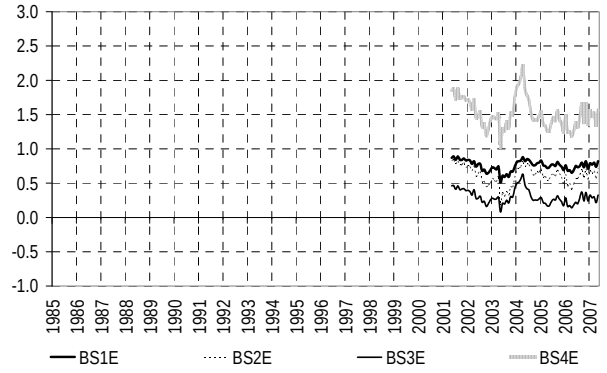
Netherlands – expectations



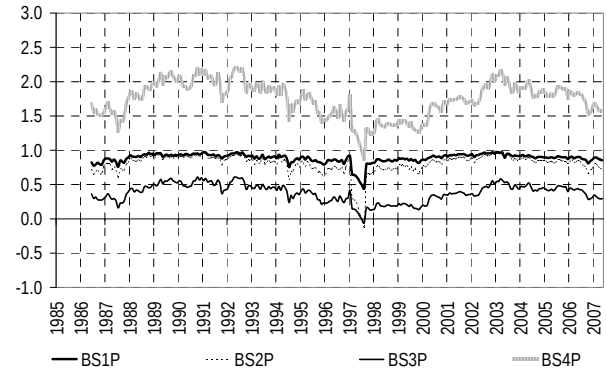
Poland – perception (GfK Polonia)



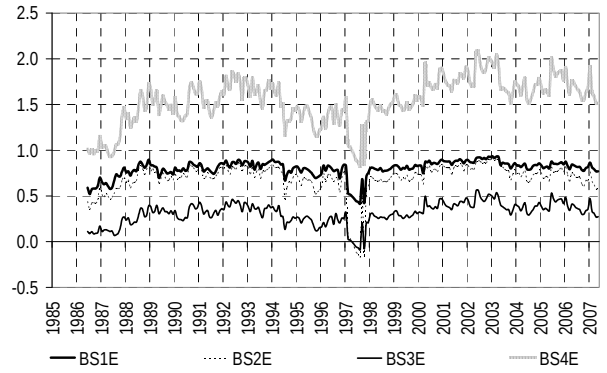
Poland – expectations (GfK Polonia)



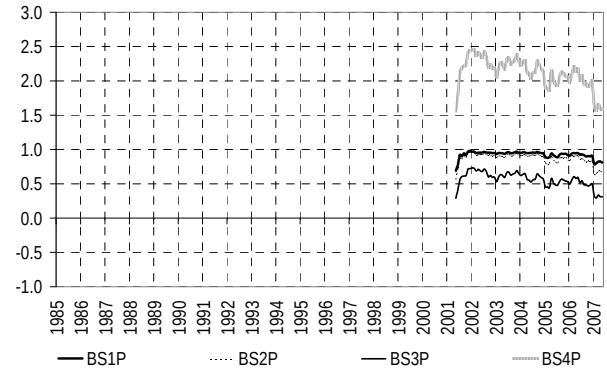
Portugal – perception



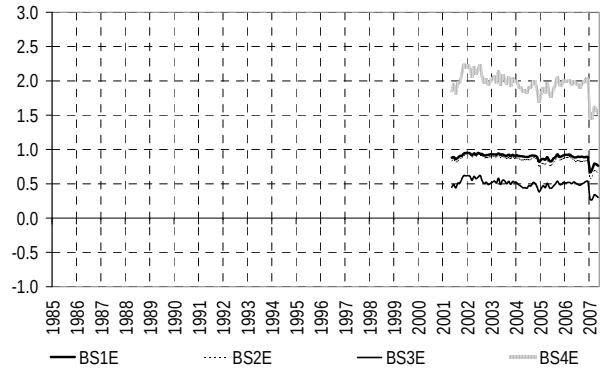
Portugal – expectations



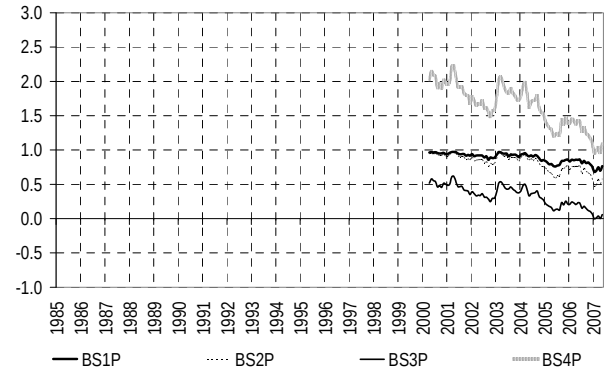
Romania – perception



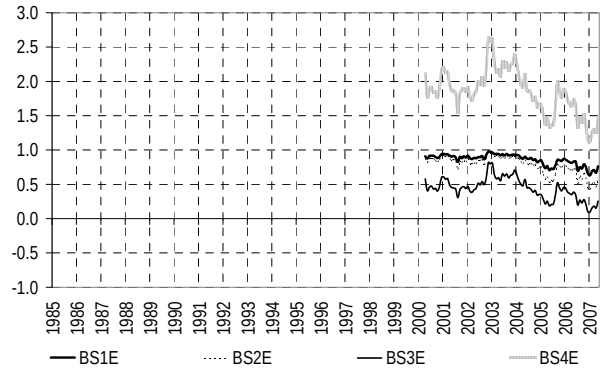
Romania – expectations



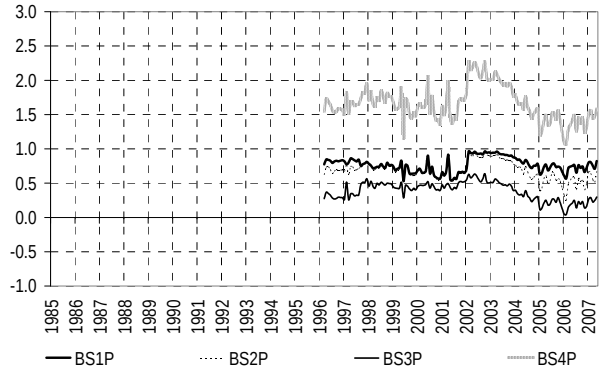
Slovakia – perception



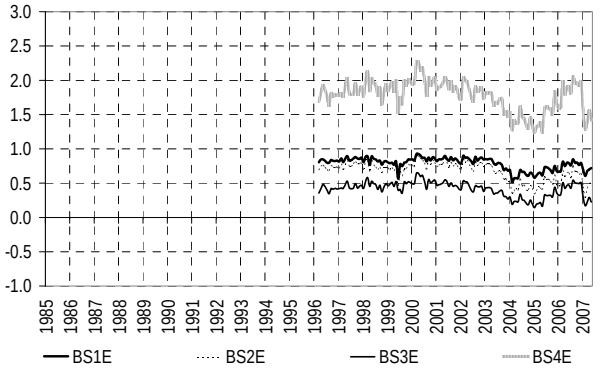
Slovakia – expectations



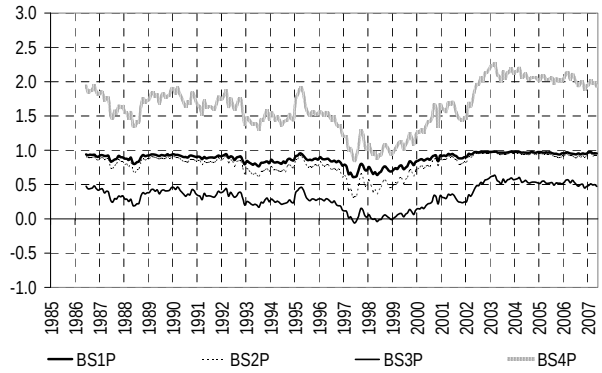
Slovenia – perception



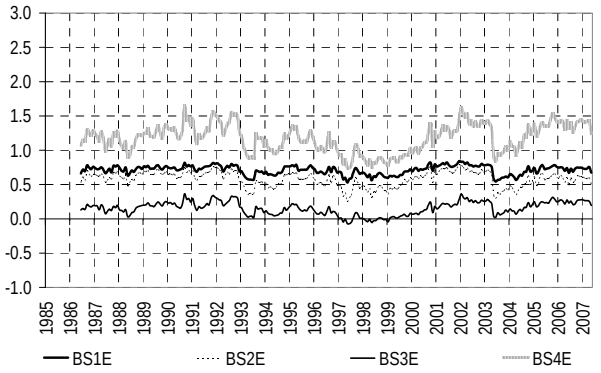
Slovenia – expectations



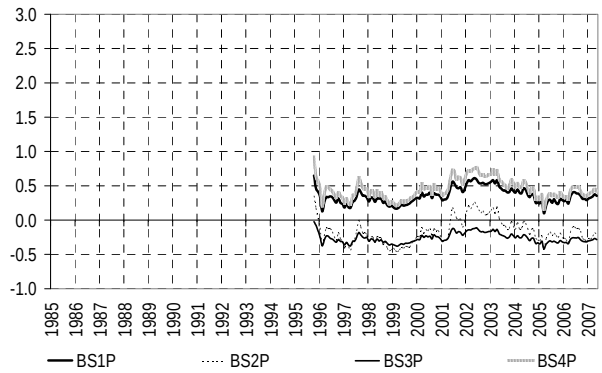
Spain – perception



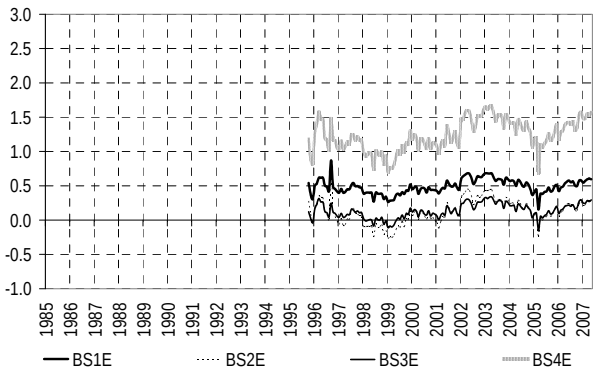
Spain – expectations



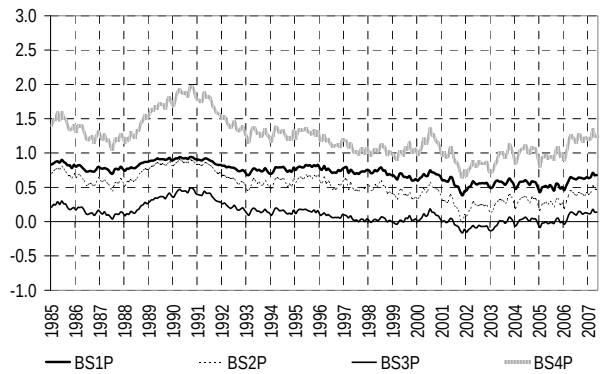
Sweden – perception



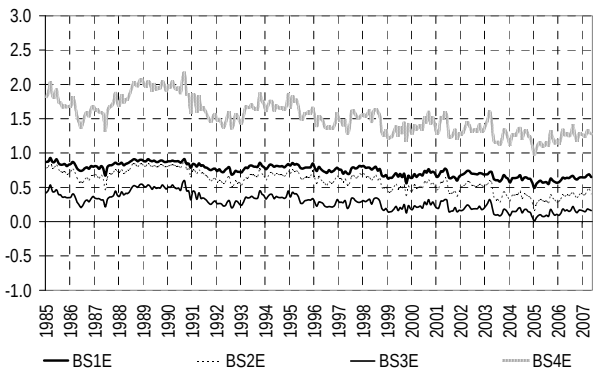
Sweden – expectations



United Kingdom – perception



United Kingdom – expectations



Source: Author's calculations on the basis of EC data.

Annex B

Denmark – Cunningham (1997) regression model

Equation A: (weight: 0.25)		$\log\left(\frac{\sum_{i=1}^{3} A_{it}^{p}}{1-\sum_{i=1}^{3} A_{it}^{p}}\right) = \underset{(0.108)}{-1.482} + \underset{(3.942)}{54.041}\cdot \pi_{0t} + \varepsilon_t$
Equation B: (weight: 0.75)		$\log\left(\frac{C_t^p}{1-C_t^p}\right) = \underset{(0.233)}{-1.456} - \underset{(9.018)}{73.366}\cdot \pi_{0t} + u_t$
Sample:	Mar 1985–May 2007	Standard errors in parentheses
R^2 adj:	0.73 (A) 0.55 (B)	

France – Smith and McAleer (1995) regression model

$\pi_{0t} = \frac{\sum_{i=1}^{3} A_{it}^{p} \cdot \left(\underset{(0.032)}{0.051} + \underset{(0.169)}{0.318} \cdot \sum_{j=1}^{12} \pi_{0,t-j} \right) - \underset{(0.426)}{0.574} \cdot C_t^p}{1 + \underset{(3.265)}{4.919} \cdot \sum_{i=1}^{3} A_{it}^{p} - \underset{(19.919)}{30.604} \cdot C_t^p} + \varepsilon_t$		
Sample:	Mar 1986–May 2007	Standard errors in parentheses
R^2 adj:	0.68	

Netherlands – Anderson (1952) regression model

$\pi_{0t} = \underset{(0.002)}{0.039} \cdot \sum_{i=1}^{3} A_{it}^{p} - \underset{(0.044)}{0.288} \cdot C_t^p + \varepsilon_t$		
Sample:	Mar 1985–May 2007	Standard errors in parentheses
R^2 adj:	0.64	

Ireland – Smith and McAleer (1995) regression model

$\pi_{0t} = \frac{\sum_{i=1}^{3} A_{it}^{p} \cdot \left(\underset{(0.002)}{0.010} + \underset{(1.057)}{3.463} \cdot \pi_{0,t-1} - \underset{(0.258)}{0.497} \cdot \pi_{0,t-2} \right)}{1 + \underset{(0.923)}{2.109} \cdot \sum_{i=1}^{3} A_{it}^{p}} + \varepsilon_t$		
Sample:	May 1985–May 2007	Standard errors in parentheses
R^2 adj:	0.94	

Italy – Smith and McAleer (1995) regression model

$$\pi_{0t} = \frac{\sum_{i=1}^{3} A_{it}^{p} \cdot \left(\underset{(0.001)}{0.007} + \underset{(0.009)}{0.043} \cdot \sum_{i=1}^{12} \pi_{0,t-i} \right)}{1 - \underset{(0.109)}{0.419} \cdot \sum_{k=1}^{3} A_{kt}^{p}} + \varepsilon_t$$

Sample:	Mar 1986–May 2007	Standard errors in parentheses
R^2 adj:	0.91	

Latvia – regression model based on the balance statistic BS_4

$$\pi_{0t} = -\underset{(0.007)}{0.025} + \underset{(0.003)}{0.042} \cdot BS_{4t}^{p} + \varepsilon_t$$

Sample:	May 2001–May 2007	Standard errors in parentheses
R^2 adj:	0.82	

Lithuania – regression model based on the balance statistic BS_4

$$\pi_{0t} = -\underset{(0.005)}{0.045} + \underset{(0.003)}{0.046} \cdot BS_{4t}^{p} + \varepsilon_t$$

Sample:	May 2001–May 2007	Standard errors in parentheses
R^2 adj:	0.81	

Malta – Smith and McAleer (1995) regression model

$$\pi_{0t} = \frac{\sum_{i=1}^{3} A_{it}^{p} \cdot \sum_{j=2}^{12}{}_{(\Phi_j^{SD})} \Phi_j \cdot \pi_{0,t-j} - C_t^{p} \cdot \left(\underset{(0.545)}{1.122} + \sum_{k=1}^{12}{}_{(\Gamma_k^{SD})} \Gamma_k \cdot \pi_{0,t-k} \right)}{1 - \underset{(0.011)}{0.970} \cdot \sum_{i=1}^{3} A_{it}^{p} + \underset{(36.613)}{57.514} \cdot C_t^{p}} + \varepsilon_t$$

$$\Phi = \begin{bmatrix} 0.332 \\ -0.387 \\ 0.549 \\ -0.422 \\ 0.773 \\ -0.559 \\ 0 \\ 0.540 \\ -0.464 \\ 0.116 \\ -0.252 \end{bmatrix}, \quad \Phi^{SD} = \begin{bmatrix} 0.025 \\ 0.054 \\ 0.065 \\ 0.066 \\ 0.059 \\ 0.035 \\ 0 \\ 0.044 \\ 0.051 \\ 0.014 \\ 0.032 \end{bmatrix}, \quad \Gamma = \begin{bmatrix} 55.753 \\ -33.433 \\ 35.842 \\ -67.570 \\ 51.640 \\ -50.148 \\ 45.183 \\ -36.613 \\ 0 \\ 42.139 \\ -54.682 \\ 26.852 \end{bmatrix}, \quad \Gamma^{SD} = \begin{bmatrix} 27.028 \\ 17.075 \\ 18.908 \\ 18.223 \\ 12.782 \\ 17.244 \\ 15.942 \\ 10.737 \\ 0 \\ 15.913 \\ 12.093 \\ 9.0273 \end{bmatrix}$$

Sample:	Nov 2003–May 2007	Standard errors in parentheses
R^2 adj:	0.82	

Poland – Smith and McAleer (1995) regression model

$$\pi_{0t} = \frac{\underset{(0.001)}{0.004} \cdot \sum_{i=1}^{3} A_{it}^{p} - \underset{(0.082)}{0.216} \cdot C_t^{p} \cdot \sum_{j=1}^{12} \pi_{0,t-j}}{1 - \underset{(0.058)}{0.933} \cdot \sum_{i=1}^{3} A_{it}^{p}} + \varepsilon_t$$

Sample:	May 2002–May 2007	Standard errors in parentheses
R^2 adj:	0.74	

United Kingdom – Smith and McAleer (1995) regression model

$$\pi_{0t} = \frac{\sum_{i=1}^{3} A_{it}^{p} \cdot \left(\underset{(0.001)}{0.012} + \underset{(0.006)}{0.010} \cdot \sum_{i=1}^{12} \pi_{0,t-i} \right)}{1 - \underset{(0.066)}{0.825} \cdot \sum_{k=1}^{3} A_{kt}^{p}} + \varepsilon_t$$

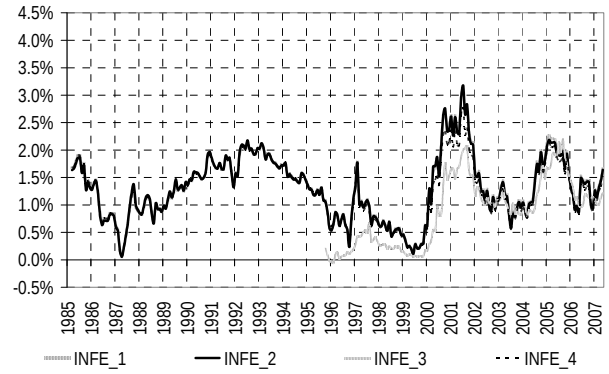
Sample:	Mar 1986–May 2007	Standard errors in parentheses
R^2 adj:	0.80	

Annex C

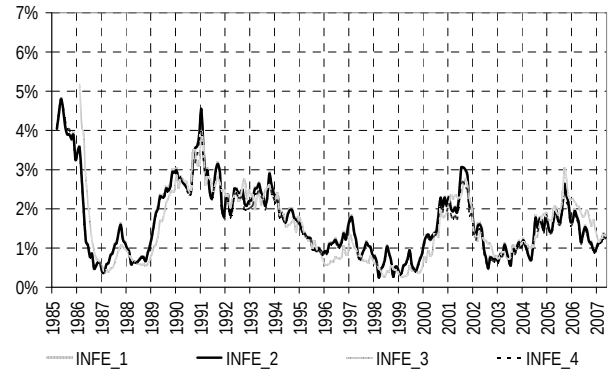
Figure 12

Quantified measures of inflation expectations

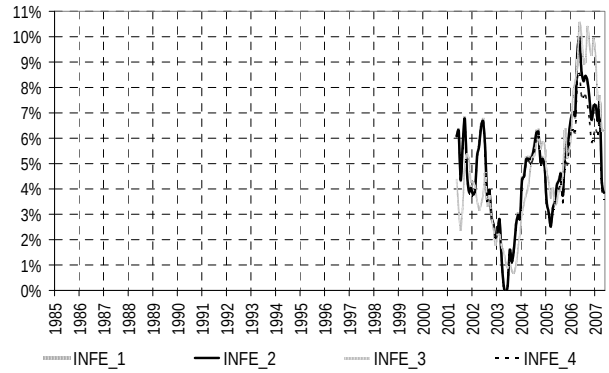
Austria



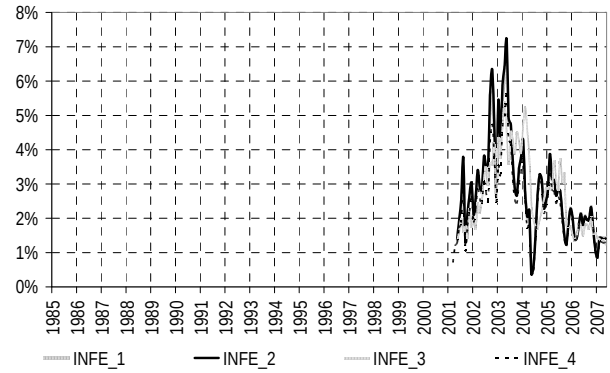
Belgium



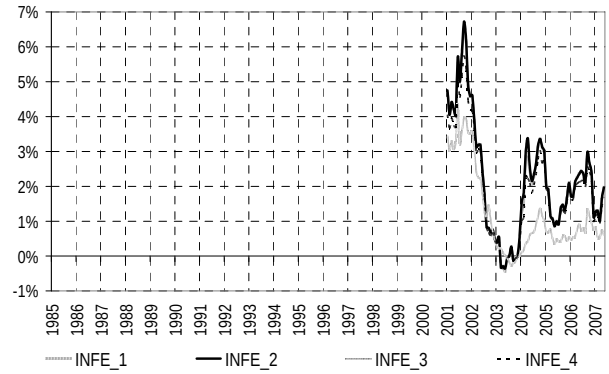
Bulgaria



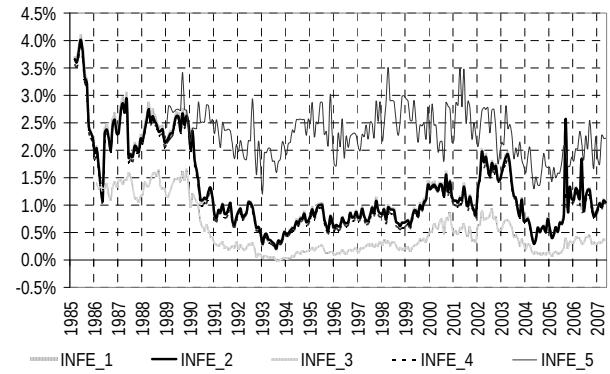
Cyprus



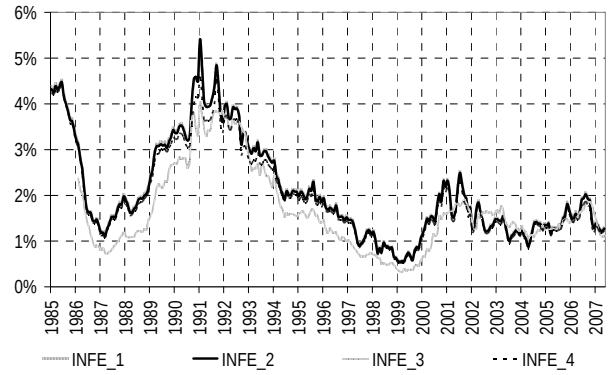
Czech Republic



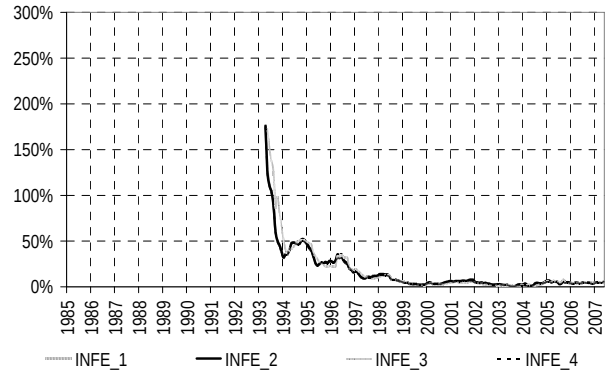
Denmark



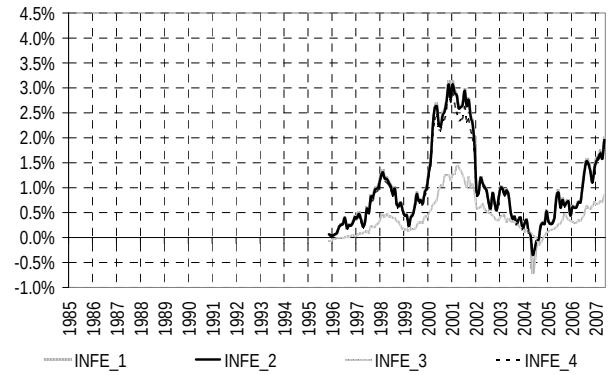
EMU



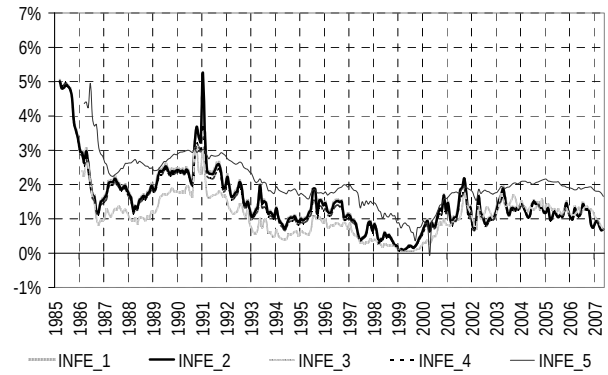
Estonia



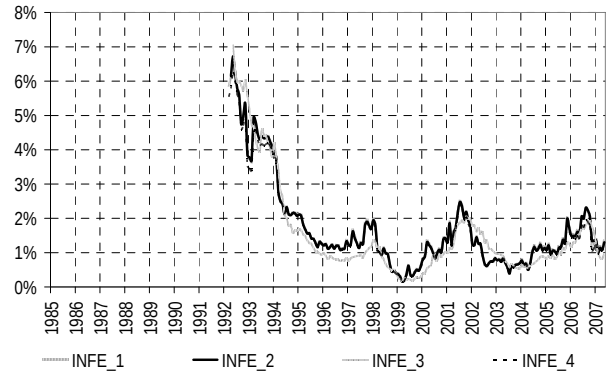
Finland



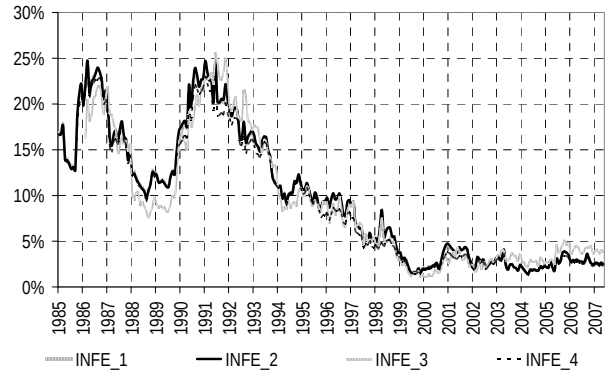
France



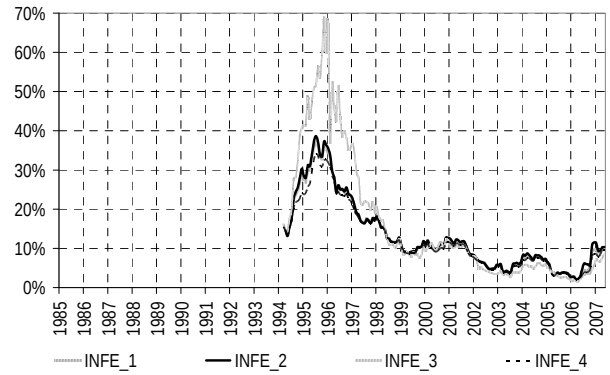
Germany



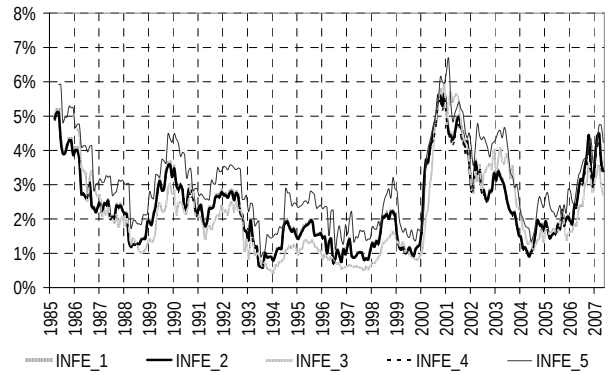
Greece



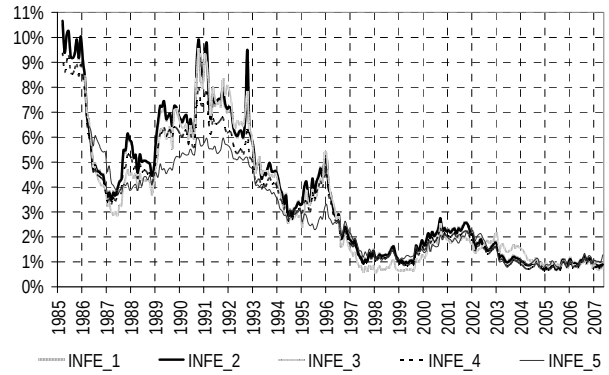
Hungary



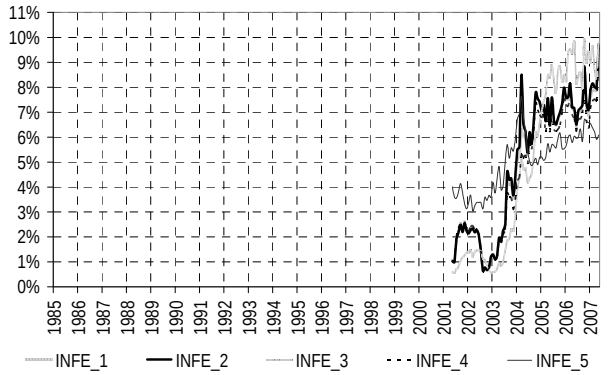
Ireland



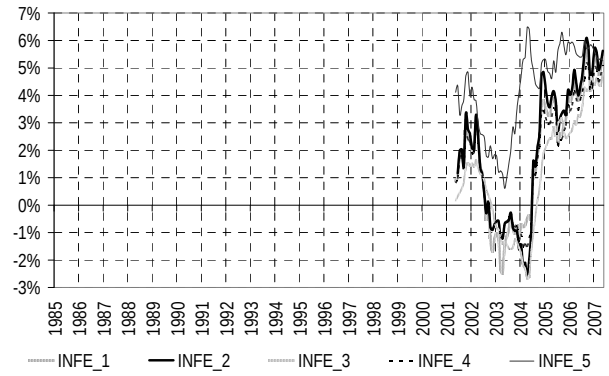
Italy



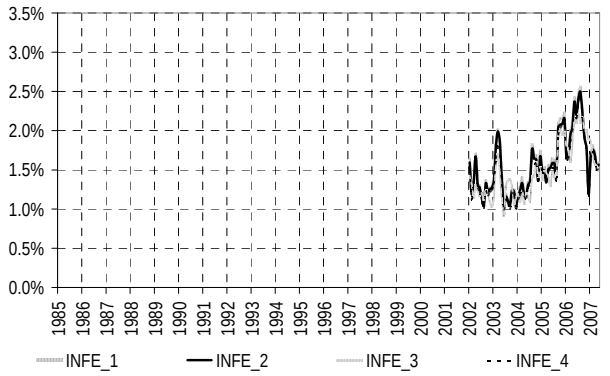
Latvia



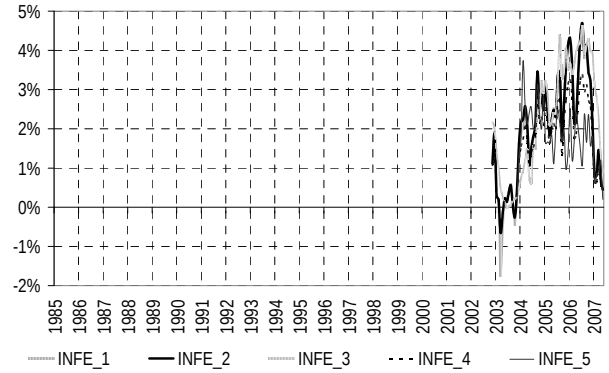
Lithuania



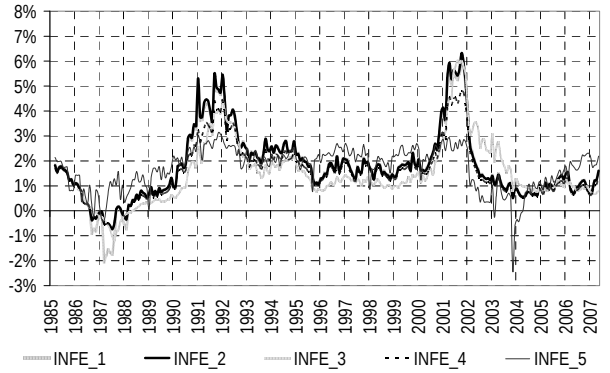
Luxembourg



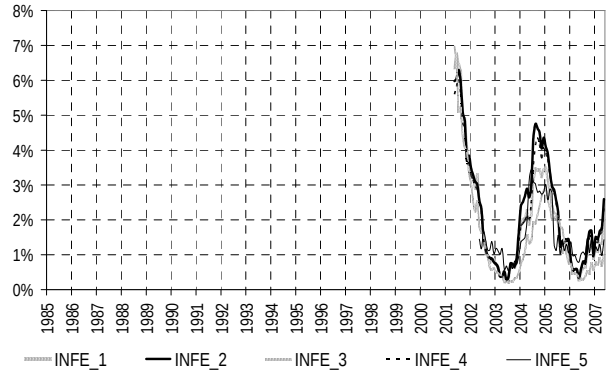
Malta



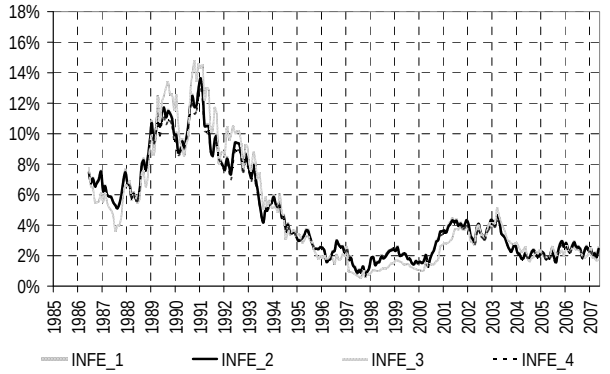
Netherlands



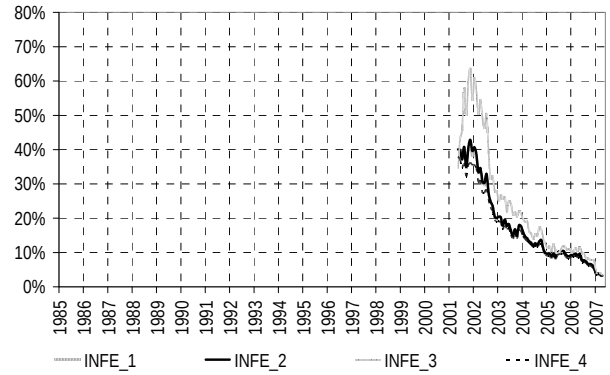
Poland



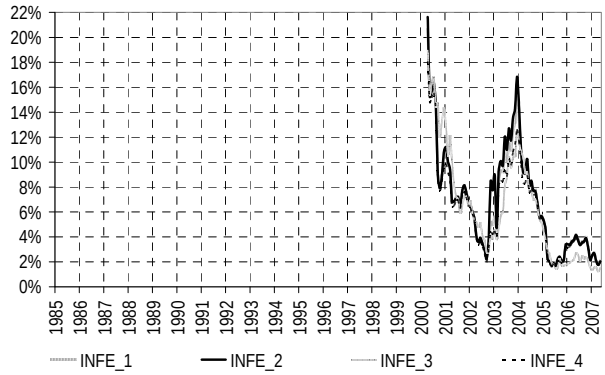
Portugal



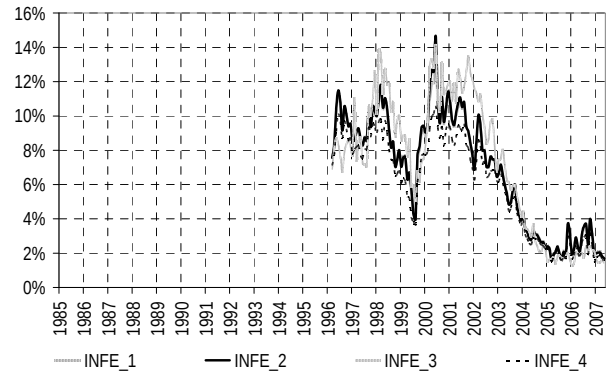
Romania



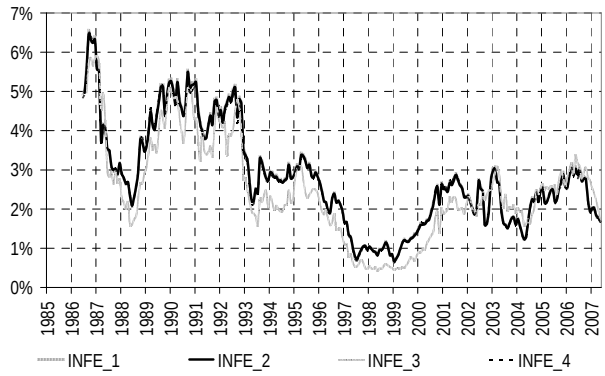
Slovakia



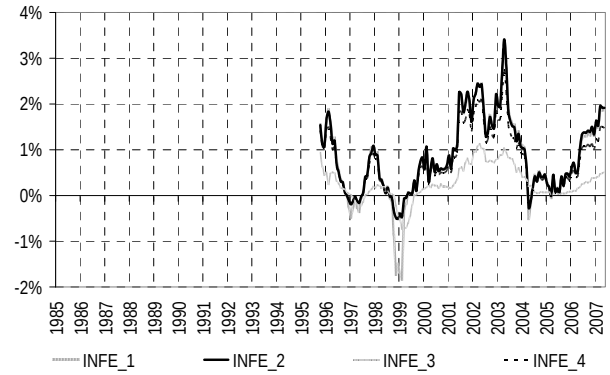
Slovenia



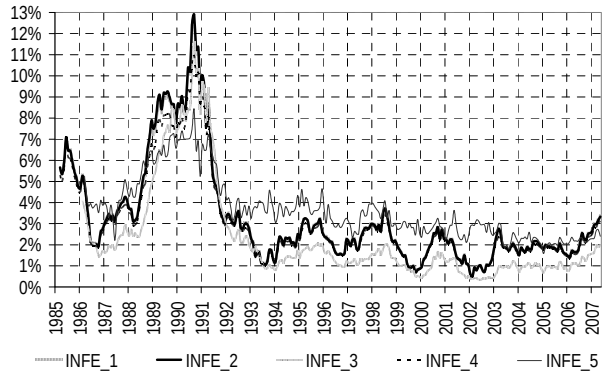
Spain



Sweden



United Kingdom



Source: Author's calculations on the basis of EC and IFS data.

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